Nuclear Safety and Security at the 2012 Seoul Nuclear Security Summit

Sharon Squassoni

March 2012

US-KOREA INSTITUTE AT SAIS

ABOUT THE AUTHOR

Sharon Squassoni directs the Proliferation Prevention Program at the Center for Strategic and International Studies (CSIS) where she is a senior fellow. She joined CSIS from the Carnegie Endowment for International Peace. From 2002-2007, she advised Congress as a senior specialist in weapons of mass destruction at the Congressional Research Service. Ms. Squassoni also served in the executive branch of government from 1992 to 2001 in the State Department and the Arms Control and Disarmament Agency. She is the recipient of various service awards and has published widely. She is a frequent commentator for US and international media outlets. She holds a B.A. in political science from the State University of New York at Albany, a Masters in Public Management from the University of Maryland, and a Masters in National Security Strategy from the National War College.

Printed in the United States of America
www.uskoreainstitute.org

This USKI Working Paper Series was made possible by support from the John D. and Catherine T. MacArthur Foundation.

The US-Korea Institute (USKI) at the Paul H. Nitze School of Advanced International Studies, Johns Hopkins University, works to increase information and understanding of Korea and Korean affairs. USKI's efforts combine innovative research with a repertoire of outreach activities and events that encourage the broadest possible debate and dialogue among scholars, policymakers, students, NGO and business leaders, and all those with an interest in the Korean peninsula. USKI also sponsors the Korea Studies Program at SAIS, a growing policy studies program preparing the next generation of leaders in the field of Korean affairs. For more information, visit www.uskoreainstitute.org.

Nuclear Safety and Security at the 2012 Seoul Nuclear Security Summit

Sharon Squassoni
Center for Strategic and International Studies

INTRODUCTION

In April 2009, US President Barack Obama introduced a comprehensive nuclear agenda in a speech in Prague that featured a commitment to a world without nuclear weapons. President Obama supported reductions of strategic arms, a comprehensive test ban treaty, and a treaty to end fissile material production for weapons; strengthening the Nuclear Non-Proliferation Treaty (NPT), including building a new framework for civil nuclear cooperation; and strengthening nuclear security, including a commitment to "secure all vulnerable nuclear material around the world in four years." President Obama suggested "we will set new standards, expand our cooperation with Russia, and pursue new partnerships to lock down these sensitive materials."

So was born the 2010 Nuclear Security Summit, held in April of that year in Washington, DC. A year after the Prague speech, most of President Obama's nuclear agenda still remained to be accomplished, but expectations remained high. Nuclear security, in particular, was one area in which progress could be made, unfettered by the kinds of political and legal obstacles facing other elements of his agenda. The uniqueness of the 2010 Washington Summit contributed to its success in gathering more than 47 national leaders together to make practical progress in securing nuclear materials around the world.

As Seoul prepares to host the 2012 Nuclear Security Summit, the meeting will probably resemble its predecessor in many ways. Three years after the Prague speech, nuclear security still offers some of the "lowest hanging fruit" in terms of progress on the nuclear agenda. The context for the 2012 summit, however, is quite different. There is less optimism about progress toward nuclear disarmament, no resolution in sight for the challenges posed by the North Korean and Iranian nuclear weapons programs, and less optimism about peaceful nuclear energy following the devastating accident in March 2011 at the Fukushima Daiichi nuclear power plant in Japan.

Since the earthquake and tsunami that struck Japan, leading to the meltdown of three of the six nuclear power plants at Fukushima Daiichi, nuclear safety has captured the public's imagination in ways that nuclear security has not. What's more, public views on nuclear security span a range of issues, particularly in South Korea, that have little to do with the objectives of the summit. Therefore, it could be useful to harness public attention to nuclear safety in a way that can galvanize action on nuclear security.

In December 2011, a group of eminent persons released a Joint Statement for the 2012 Seoul Summit. In this statement, they declared their expectation that leaders at that meeting will "enhance public confidence

in the peaceful uses of nuclear energy." In addition to urging leaders to reduce the threats to nuclear facilities and their operating systems, such as sabotage or cyber attacks, the group of eminent persons called on them to discuss "in a responsible manner the ways in which nuclear security and nuclear safety can be mutually reinforced, bearing in mind the implications and lessons learned from the Fukushima nuclear accident."[1] One of the six recommendations the group made concerned the intersection of nuclear safety and nuclear security:

> Fourth, the Seoul Summit should take into account the new international security circumstances that have taken shape since the Washington Summit. In particular, in considering the lessons of the Fukushima accident that releases of radioactivity into the environment have grave consequences, the Seoul Summit should recognize that just as insufficient nuclear safety may put nuclear security at risk, insufficient nuclear security may put nuclear safety at risk. In conjunction, it should develop measures for cooperation to reduce the threat of radiological terrorism. The Seoul Summit should also promote the strengthening of international and regional cooperation mechanisms in nuclear safety and security.

South Korea has a keen interest in restoring the confidence in nuclear energy that existed before the catastrophic accident in March 2011. Other countries committed to nuclear power are also likely to support this. That said, the diversity of views on nuclear power within the ranks of the countries that will attend the Seoul Summit is likely to ensure that discussion of nuclear safety during the meeting is limited to areas where it overlaps with nuclear security.

NUCLEAR SAFETY: THE KEY TO SUSTAINABLE NUCLEAR ENERGY

Before the accident at Fukushima Daiichi, the world seemed set on a trajectory of unparalleled nuclear energy growth. Concerns about climate change, energy security, and meeting skyrocketing electricity demands lent an optimism to nuclear energy that had not been seen in almost forty years. South Korea, with 21 nuclear power plants and another seven planned or under construction, has been in the vanguard of the so-called nuclear renaissance. It is a stellar example of how a country with few domestic resources can use nuclear energy to its advantage in developing its economy and moving toward increased technical sophistication. Moreover, it has also invested significant resources in developing its nuclear power industry, moving from foreign-run projects with little indigenous input in the 1970s to reactors that now are nearly entirely ROK-designed-and-built.

South Korea's interest in nuclear power is more than purely domestic, it is also an emerging exporter of nuclear power reactors overseas. In December 2009, Korea Electric Power Company (KEPCO) won a $20 billion contract to build four ROK-developed APR1400 reactors in the United Arab Emirates, with KEPCO providing a full scope of services. The first of these reactors is expected to be operational by 2017. According to the ROK Ministry of Knowledge Economy, South Korea aims to export 80 nuclear power reactors by 2030, which would make it the world's third largest power reactor vendor with a 20 percent share of the global market.

Enthusiasm for nuclear power has undoubtedly dimmed in the wake of Fukushima, but it is impossible to judge the long-term impact on nuclear power worldwide. One immediate effect has been a significant

erosion of public confidence. Several countries have backed off nuclear energy, including Germany, Switzerland, and Taiwan; some have decided to reduce their reliance on nuclear energy, like Japan. Others will proceed more slowly, like China. Although the nuclear resurgence may not be as strong as forecasted five or ten years ago, some countries will still build nuclear power plants, with newcomers located most likely in the Middle East and Southeast Asia. Given its high dependence on trade, South Korea's desire to capture a portion of the nuclear reactor export market takes on special significance. There is little doubt that ROK government officials will take opportunities around the Seoul Nuclear Security Summit to promote safe nuclear energy.

A common response to Fukushima by countries operating nuclear power plants has been to conduct safety reviews. In South Korea, the Ministry of Education, Science and Technology's review of safety at existing plants was completed at the end of May 2011. Although the review reportedly did not identify any outstanding problems, at least $1 billion has been set aside for safety upgrades. This compares with a French review at the end of 2011 that reportedly will result in about $13 billion in upgrades.[2] France operates almost three times as many nuclear power reactors as South Korea.

Among the many lessons taken away from Fukushima is the need for greater transparency and international collaboration. In June 2011, the International Atomic Energy Agency (IAEA) hosted a ministerial-level meeting in Vienna. In September 2011, the United Nations (UN) hosted a high-level summit on nuclear safety and security in New York, during which the UN Secretary General noted, "the effects of nuclear accidents respect no borders. To adequately safeguard our people, we must have strong international consensus and action." Later that month, the IAEA Board of Governors adopted a Nuclear Safety Action Plan.[3] The Action Plan contained twelve items, many of which called for strengthening implementation and effectiveness of existing practices, standards, and approaches. Parties to the Convention on Nuclear Safety (CNS) agreed to hold an extraordinary review focused on Fukushima in 2012.

THE INTERPLAY OF NUCLEAR SAFETY AND NUCLEAR SECURITY

The IAEA defines nuclear safety as, "the achievement of proper operating conditions, prevention of accidents and mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards."

Nuclear security, on the other hand, is defined by the IAEA as, "the prevention and detection of and response to theft, sabotage, unauthorized access, illegal transfer, or other malicious acts involving nuclear material, other radioactive substances, or their associated facilities.[4]

Fundamentally, nuclear safety and nuclear security serve the same objective: to protect the public and the environment from unintended releases of radiation. Whether for nuclear safety or security reasons, protection starts with good design (of equipment, facilities, and sites), follows through with good operational practices, including transportation, and ends with good design and operation of waste disposal sites. This is necessary not just for nuclear material and facilities but also for radiological materials, which are used at medical, agricultural, and industrial sites.

The IAEA describes these practices in its *Fundamental Safety Principles*:

> The safety principles concern the security of facilities and activities to the extent that they apply to measures that contribute to both safety and security, such as:
>
> —Appropriate provisions in the design and construction of nuclear installations and other facilities;
>
> —Controls on access to nuclear installations and other facilities to prevent the loss of, and the unauthorized removal, possession, transfer, and use of, radioactive material;
>
> —Arrangements for mitigating the consequences of accidents and failures, which also facilitate measures for dealing with breaches in security that give rise to radiation risks;
>
> —Measures for the security of the management of radioactive sources and radioactive material.[5]

Although a popular conception is that nuclear safety is primarily concerned with facilities while security focuses on material, the operational intersection has always been extensive. The original IAEA recommendations for a state's physical protection system (INFCIRC/225 Physical Protection of Nuclear Material) issued in 1972 noted that the objective of such protection should be "to establish conditions which will minimize the possibilities for unauthorized removal of nuclear material or sabotage and to provide information and technical assistance in support of rapid and comprehensive measures by the State to locate and recover missing nuclear material." The document also notes that the physical protection system should take into account a state's system of accounting and control of nuclear material (commonly known as "safeguards") and that all measures are in addition to, and not a substitute for, other measures established for safety purposes for material in use, transit, and storage.

Likewise, nuclear safety is much broader than just the safety of facilities—it also covers radiation, waste, and transportation safety. IAEA standards date back to the earliest years of the agency.

The IAEA has identified nuclear security as a "cross-cutting activity."[6] Nuclear security benefits from synergies and collaboration with activities undertaken for safety and safeguards purposes. For example, joint safety and security missions help evaluate national laws and regulations for the control of radiological sources; engineering safety design reduces the vulnerability of vital areas in nuclear facilities to sabotage; and systems for accounting and control of nuclear material deter and/or allow early discovery of theft.

In 2010, the IAEA's International Nuclear Safety Group (INSAG) produced a report entitled, "The Interface Between Safety and Security at Nuclear Power Plants."[7] With the backdrop of increased interest in nuclear power, the report aimed to "highlight the importance of a coordinated approach to nuclear safety and security," and the need to "approach safety and security in a fashion that they complement each other." The report compared the responsibilities of the state, regulatory authorities and operators for safety and for security, discussed common basic principles between safety and security, and addressed how safety and security should be handled over the lifetime of nuclear power plants. INSAG recommended greater coordination at all levels, while noting the specific need to take into account differences where they existed.

Although safety and security are considered complementary, INSAG-24 pointed out where they diverge. One key difference is in risk assessment. For nuclear safety experts, an unintended release is the result of an unintentional incident. This can happen as a result of a natural occurrence (like the earthquake and tsunami in Japan), hardware failures, internal events or disruptions, or human error. Nuclear security

experts, on the other hand, are most concerned with releases of radiation that result from intentionally destructive acts, including those designed to circumvent protective measures.

There are certainly similarities in the approaches to protection under safety and under security: both rely on in-depth defenses; both place priority on prevention, early detection, and prompt action; and both require extensive emergency planning.

However, the different starting points of safety and security at times have implications for how measures are implemented and who implements them. For example, before Fukushima, probabilistic risk assessments for safety did not consider more than one "beyond design basis" event occurring (such as an earthquake and tsunami). On the other hand, nuclear security assessments must contend with the attacker's intention to defeat the system, potentially including a multi-pronged approach.

Another key difference is the approach to information sharing and transparency. In nuclear safety, information sharing is critical to the safe operation of plants, and the general inclination is to share information to avoid mistakes being repeated, including at other plants. For nuclear security, information is generally shared among a restricted group in order to maximize information security. Moreover, there may be kinds of information, for example, intelligence reports, which can be crucial to preventing sabotage, which lie outside the operators' control. In fact, the role of the state in defining rules for confidentiality is much greater in the case of nuclear security than it is in nuclear safety.

Moreover, nuclear security often is implemented by law enforcement personnel, while nuclear safety is the purview primarily of engineers and radiation health experts. These experts approach problems in different ways and may work in different organizational structures with different incentives. Safety and security can also sometimes have contradictory imperatives. For example, a security incident could require a lock-down of the facility, whereas an accident would require easy access for operators and emergency personnel. Ensuring that measures are complementary rather than contradictory is important in the design, regulation, and operation of the facility.

INTERNATIONAL CONVENTIONS, GUIDANCE, AND ASSISTANCE

For nuclear safety and security, the state and operators have primary responsibility for protection. Over time, however, recognition has grown of the need for global cooperation. In terms of international instruments for setting standards and norms, the regime for nuclear safety is much more developed than that of nuclear security. Prior to the accident at Chernobyl in 1986, nuclear safety was largely considered a national, sovereign issue. With recognition of the significant cross-border effects of Chernobyl, countries acted quickly to implement two conventions: one on early notification of accidents and the other on provision of assistance. The Convention on Nuclear Safety took many more years, brought into force in 1996. Despite this, the CNS, while legally binding, is not a regulatory regime that entails inspections or sanctions. Rather, it is what is known in international law circles as an "incentive convention."[8] The CNS outlines fundamental safety principles, not specific requirements. Rather than requiring enforcement, it encourages compliance through periodic peer reviews. States submit national reports for peer review but requirements for national reports are not detailed. In general, states must adopt national laws to implement their obligations under the CNS to "achieve and maintain a high level of nuclear safety worldwide; establish and maintain effective defenses…against potential radiological hazards; protect individuals

society and the environment from harmful effects of ionizing radiation; and prevent . . . and mitigate radiological consequences of accidents." Articles of the Convention cover establishing national safety requirements, licensing and regulatory authorities and procedures, and so forth.

As in nuclear safety, nuclear security is still very much the purview of the state. Two major international agreements have been reached thus far: the Convention on the Physical Protection of Nuclear Material (CPPNM) and the International Convention on the Suppression of Acts of Nuclear Terrorism (ICSANT). Other agreements include the Code of Conduct on the Safety and Security of Radioactive Sources, and the supplementary Guidance on the Import and Export of Radioactive Sources. The CPPNM, brought into force in 1987, was designed primarily to cover nuclear material in transit. The amendment to the CPPNM, introduced in 2005, seeks a much broader scope for the convention: "to achieve and maintain worldwide effective physical protection of nuclear material used for peaceful purposes and of nuclear facilities used for peaceful purposes; to prevent and combat offences relating to such material and facilities worldwide; as well as to facilitate co-operation among States Parties to those ends (Article IA)." The amended version, however, will not enter into force until two-thirds of the parties (96 states) have ratified the amendment. At this writing, only 52 states have ratified the amendment.

The International Convention on the Suppression of Acts of Nuclear Terrorism, or ICSANT, was adopted by the UN General Assembly on April 13, 2005 (A/Res/59/290) and entered into force in 2007. ICSANT requires states to criminalize the unlawful possession, manufacture, or use of radiological and nuclear material or devices or damage to nuclear facilities to release radioactive material by persons. At this writing, 115 states have signed, with 77 of them having ratified the convention. Several of the key states at the 2012 summit have not yet ratified the treaty, including the United States, South Korea, and France. Figure 1 illustrates the intersection of international agreements and instruments regarding the two.

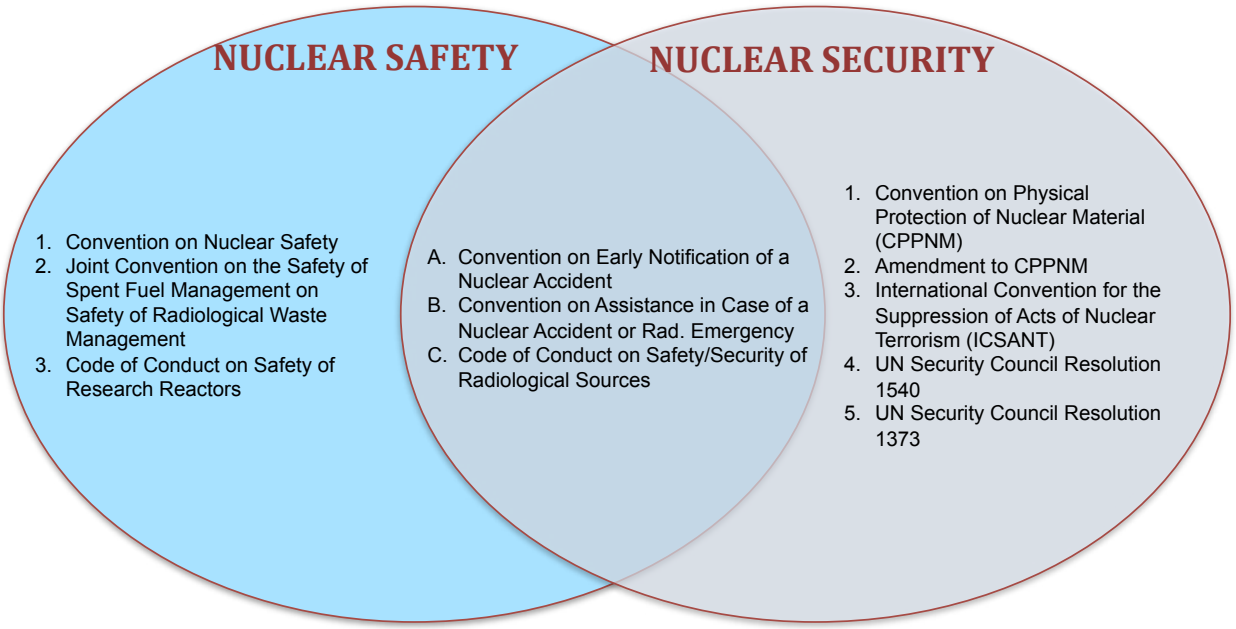
Nuclear safety, like nuclear security, relies on guidance promulgated by the IAEA and published in a series of guidance documents. These include fundamental safety principles and objectives, general safety requirements and guides, and general and specific safety guides for particular types of facilities and activities.[10] The safety standards help guide national requirements and serve as the basis for peer reviews. Guidance documents for nuclear security are less comprehensive but include *Nuclear Security Fundamentals* (including Physical Protection Fundamentals and Objectives which was adopted in September 2001 and forms the basis for the amendment to the CPPNM); *Recommendations*, presenting best practices that should be adopted by Member States in the application of the Nuclear Security Fundamentals; *Implementing Guides*; and *Technical Guidance*, comprising reference manuals as well as training and service guides. Of a planned 19 documents in the series, five have been completed. One of the most important is the fifth revision of INFCIRC 225, which is categorized as a recommendations document, first published in 1972.

Finally, the IAEA provides a range of assistance measures in nuclear safety and security. Many of these are specific to one area, but some, like the Integrated Regulatory Review Service (IRRS), cover all national regulatory authorities, and services related both to the safety and security of radiological sources. In nuclear safety, there are about 25 advisory services, across the board. In nuclear security, there are just a handful of assistance missions: International Physical Protection Advisory Service (IPPAS), International Nuclear Security Advisory Service (INSServ), IAEA State System of Accounting & Control Advisory Service (ISSAS), International Team of Experts (ITE) advisory missions, and the Integrated Nuclear Security Support Plan (INSSP).

Since 2003, security has been paired bureaucratically with safety at the IAEA. In 2005, the IAEA

established an Incident and Emergency Response Center to integrate its preparedness and responses to all kinds of nuclear and radiological emergencies, regardless of their cause. However, it is not entirely clear how much integration has been accomplished on the ground or how much is desired by states, or by the IAEA itself.

Figure I: Intersection of Nuclear Safety and Nuclear Security Regime Elements[9]



LEARNING FROM NUCLEAR SAFETY CRISES

The pace and scope of development of the nuclear security and nuclear safety regimes is in many ways tied to international attention to the "problem." Crises focus energy and attention on "fixing" deficiencies in systems and regimes. To date, there has not been a nuclear security crisis on the order of those in nuclear safety: Three Mile Island, Chernobyl, and Fukushima. In many respects, agreement by world leaders to hold nuclear security summits is an acknowledgement of the need to act now to avert potential crises. In the meantime, the development of a strong nuclear security regime has lagged in comparison to that of nuclear safety.

Given the complementary nature of safety and security, a key question is whether one regime can learn lessons from the other. Given that nuclear safety crises have spawned new organizations, international legal instruments, and new approaches, does it make sense to move forward in a similar fashion for nuclear security even in the absence of a crisis? If so, what existing barriers to new organizations, instruments, and approaches would need to be overcome?

IMPACT ON APPROACHES AND REGIMES

The first and immediate impact of a significant nuclear accident is on national safety implementation. In the wake of Three Mile Island, significant improvements were implemented in the US nuclear regulatory system as well as within nuclear industry. As the Nuclear Regulatory Commission (NRC) describes it,

> There is no doubt that the accident at Three Mile Island permanently changed both the nuclear industry and the NRC… NRC's regulations and oversight became broader and more robust, and management of the plants was scrutinized more carefully. The problems identified from careful analysis of the events during those days have led to permanent and sweeping changes in how NRC regulates its licensees—which, in turn, has reduced the risk to public health and safety.[11]

Among the major changes identified by the NRC were expansion of the resident inspector program and performance-oriented inspections; upgrades to plant design and equipment requirements; upgrades to operator training and staffing requirements; enhancement of emergency preparedness, including drills and response plan testing; and expansion of the NRC's international activities to share nuclear safety information with other countries. In industry, the Institute for Nuclear Power Operations (INPO) was created, which established a voluntary system of peer safety reviews. Although these reviews are voluntary, they reportedly are taken very seriously by reactor operators.

The impact of Chernobyl on nuclear safety was far-reaching. The magnitude of the accident and its effects galvanized world attention and led to a global effort to improve nuclear safety. The notification and assistance conventions were swiftly adopted, followed by the Convention on Nuclear Safety some years later. Peer reviews were implemented and an international coordinated emergency response system was put in place.

With respect to Fukushima, it is still too early to assess the full implications since additional information may come to light as time passes. In Japan, significant changes are likely to be implemented in nuclear safety regulations. The first step, in April 2012, will be to create more independence for Japanese regulators under the Nuclear Industry and Safety Agency (NISA) by separating it from the Ministry of Economy, Trade, and Industry. Reportedly, NISA is to be merged with the Nuclear Safety Commission, creating a more independent Nuclear Safety Agency.

It is unlikely that the Fukushima accident will result in any new conventions or mandatory safety inspections, but it could prompt the creation of an international emergency response team. The Fukushima accident, however, is likely to result in a strengthening of existing approaches. As a result of the June ministerial IAEA conference, the IAEA Director General made five recommendations: to strengthen IAEA Safety Standards; to systematically review the safety of all nuclear power plants, including by expanding the IAEA's program of expert peer reviews; to enhance the effectiveness of national nuclear regulatory bodies and ensure their independence; to strengthen the global emergency preparedness and response system; and to expand the Agency's role in receiving and disseminating information. In 2011, the World Association of Nuclear Operators (WANO), an international industry association formed after Chernobyl to share best safety practices, recommended the following actions in the wake of Fukushima: "expanding the scope of WANO activities; developing a worldwide integrated event response strategy; improving WANO's credibility including changes to WANO's peer reviews and corporate peer reviews; improving visibility; and improving the quality and consistency of WANO's products and services worldwide."[12] WANO Chairman Laurent Stricker noted in April 2011 that the organization had focused on lessons from reactor operations rather than from reactor designs. This could potentially comprise a new

area for WANO.

With respect to nuclear security, several lessons might be applied. One key question is whether it is necessary and/or desirable to revise emergency response planning, including evacuation zone standards. The Japanese government initially recommended a 3 km evacuation zone, then quickly expanded it to a 20 km evacuation zone. Days later, the US government recommended a 50 mile evacuation zone for its citizens near Fukushima, based on an assessment by the Nuclear Regulatory Commission. The difference in these recommendations raised concerns about what standards were being applied and what assumptions had been made. Emergency response planning is a particular concern for nuclear security because of the potential intention of terrorists to provoke social disruption by an act of sabotage at a nuclear facility.

Another question Fukushima raised is whether the design basis of existing and future reactors should cover more severe accident triggers such as those experienced at Fukushima. Furthermore, the implications of siting nuclear plants near large population centers, along seacoasts, and in areas at risk of powerful earthquakes, tornadoes, fires, or terrorist attacks potentially capable of producing a prolonged "station blackout" as what occurred at Fukushima, need to be assessed. At a minimum, extending the capabilities of back-up power, including diesel generators and batteries, is warranted. In addition, the use of passive systems in reactors that do not require human intervention in the event of shutdown would improve robustness against both safety and security incidents.

Unlike other major accidents, the Fukushima crisis also highlighted the vulnerability of spent fuel pools. A re-evaluation of their design and permissible loading limits is likely. This could also prompt more support for moving spent nuclear fuel out of wet storage and into dry cask storage away from the reactor more quickly. Such improvements would benefit both safety and security.

More broadly, the Fukushima crisis highlighted the vulnerability of the infrastructure needed to support nuclear power by demonstrating just how disruptive a major accident can be. Efforts to strengthen that infrastructure will have both safety and security benefits.

BROAD LESSONS FOR NUCLEAR SECURITY[13]

From the discussion above, it is clear that there are several steps that could be taken to strengthen both nuclear safety and nuclear security. The first step is strengthening the independence of national nuclear regulatory authorities. Operators primarily look to their national regulators for safety and security guidance and requirements. Regulators must be strong, independent, and technically competent to ensure that rules are instituted and enforced. Japanese regulators will not be the only ones to come under scrutiny; steps are also being taken in South Korea to increase regulatory independence. In late 2011, South Korea established a presidential Commission on Nuclear Safety and Security.

Harmonizing accident/incident reporting parameters and expanding information sharing and transparency in a crisis is another important requirement. The first duty of operators is to manage the crisis, rather than provide information to the public. But, public concerns are important and are influenced heavily by the quality of information provided as well as the transparency of authorities. During the Fukushima accident, governments and media reported complex data that was difficult to translate properly to the lay public and often was inconsistent. Effective analysis and response to nuclear crisis can benefit from clear

communications that utilize standardized evaluation metrics and reporting requirements. There is little international consensus on incident reporting beyond the IAEA's international nuclear and radiological event scale that conveys only the most basic details.

Incorporating security as a fundamental element in new reactor designs and in reactor operations is another important option to pursue. Safety has become a core value of the nuclear industry, and is reflected in its efforts to retrofit old reactors with new safety features and incorporate passive safety features into new reactors. Fortunately, many of the new safety designs also contribute to improved security. But safety and security objectives can also be in conflict. It is important that security not be treated as a subset of safety, but rather promoted as a fundamental priority alongside it. Regulators have an important role to play in ensuring that both safety and security culture are robust.

Several elements of the nuclear safety regime that developed as a result of crises have direct applicability to the nuclear security regime. These include: regularized assessments of performance; information sharing; peer reviews; reviews of the implementation of relevant international conventions; and strong trade organizations.

Four of these elements are embodied in the CNS and have been critical to the improvement of nuclear safety over time. The fifth—strong trade organizations—is embodied in the World Institute for Nuclear Security (WINS), which was launched in 2008 to provide a forum for sharing and promoting nuclear security best practices. WINS has focused attention on integrating security into nuclear facility operations on par with nuclear safety. But, it is not as institutionally robust yet as INPO and WANO, either in terms of funding or capacity to provide services.

Neither of the nuclear security regime's key international conventions—the CPPNM and its amendment nor the ICSANT—includes provisions for assessment, information sharing, or peer review. A single CPPNM review conference was held in October 1992, five years after it entered into force as required by Article 16, during which unanimous support for the CPPNM was expressed by the 35 states in attendance. CPPNM parties came together again in the late 1990s and early 2000s to strengthen and expand the scope of the convention by amending it to better address threats of nuclear terrorism, smuggling, and sabotage. An amendment was adopted in 2005, but will not come into effect until two-thirds of the state parties ratify the changes. The ICSANT has a provision for an amendment conference but not a review conference.

MOVING BEYOND THE CURRENT PARADIGM

The nuclear safety and security regimes rely principally on national decision-making, laws, and regulations, supplemented by international agreements and organizations that largely offer voluntary guidance. In general, the implementation of the regimes is incentive-based and many believe that this is preferable to mandatory requirements. However, the voluntary, national nature of the implementation of nuclear safety and security is in conflict with the fact that nuclear crises do not respect borders.

Introducing more binding international standards could address concerns about weak links in national nuclear safety and security regulation and implementation. They could supplement the current regimes without dismantling the incentives in place. The objective would be greater uniformity of safety and

security standards as well as encouraging countries and operators that are lagging to improve so that they can meet the highest standards. One option for international standards could include negotiating a baseline for nuclear security, or states could provide advance consent to the IAEA for periodic evaluations of their nuclear safety and security measures, similar to safeguards inspections. Another would be to increase the number of requests and funding for IAEA IPPAS assessments or establishing bilateral or regional exchanges of information.

BARRIERS TO ADOPTING ELEMENTS OF THE NUCLEAR SAFETY REGIME

Although adopting (and adapting) certain elements of the nuclear safety regime could significantly strengthen the nuclear security regime, at least four challenges are likely to surface: national sovereignty, information transparency, lack of policy consensus, and problems of regime harmonization. International conventions, IAEA guidance, and the 2010 Washington Nuclear Security Summit documents emphasize national responsibility for nuclear material security. In nuclear safety, accidents like Chernobyl and Fukushima have demonstrated that nuclear crises do not respect borders and that there is a need to think beyond national approaches and regulations for sufficient protection of the global community.

The focus on sovereignty with respect to nuclear security is especially highlighted in the area of information security. As noted by the INSAG, "the general rule in the nuclear safety area…is to pursue transparency…[while] in the security field, the sharing of information should typically be restricted to…prevent[ing] sensitive information…from falling into the hands of adversaries." Not surprisingly, information exchanges and peer reviews have not played a large role in the nuclear security regime. Nonetheless, some countries, most notably the United States and Russia, have found ways to work together on improving the security of the most sensitive nuclear materials and facilities without compromising security information. Increasing transparency does not mean making sensitive information public. Confidentiality among parties can be maintained, as is the case when countries collaborate with the IAEA on nuclear safety. But information sharing can also promote international confidence. For example, country reports submitted as part of the CNS review process were originally kept confidential, but for the last few years, most have been posted online because countries determined that their interests were better served by openness than secrecy. Also, general knowledge about US-Russia cooperation has increased international confidence in the security of nuclear materials in Russia.

It will ultimately fall to national leaders to decide the policy evolution of the nuclear security regime. Although consensus on policy improvements may be preferable, that process could be difficult and result in inadequate solutions. As a complement to this process, countries could begin to evaluate and harmonize the existing elements of the nuclear security regime, especially in the nuclear material security area. The current regime is bulky and bureaucratically taxing. A streamlining process could be helpful in garnering policy consensus and adapting the security regime to address 21st century challenges.

GOAL OF CONTINUAL IMPROVEMENT

The priority of continually improving nuclear safety and security must remain high in all nations whether the summit process continues or not.

It is unclear what path the international dialogue on nuclear security will take after the 2014 summit in the Netherlands. If future summits are scheduled, the high-level attention, consultation process, and spillover activities in the nongovernmental and industry communities will likely continue to shine a spotlight on advancing global nuclear security. This could help further the integration of nuclear safety and security. However, if they do not continue, other means to drive the agenda must be found. Policymakers should begin to build on the foundation of the Nuclear Security Summit process now so that continually improving nuclear safety and security remains high on the international agenda.

Encouraging civilian nuclear operators to engage with their foreign counterparts on nuclear security best practices is one positive step. Such dialogues would require that sensitive data be protected; however, the US government's engagements with countries like Russia, Pakistan, and China on nuclear security demonstrate that space exists to share best practices without compromising security. Regulators from different countries also should be encouraged to meet and exchange views and information. WINS can play a useful role in these dialogues.

Another step would be to regularize dialogue and interaction among all stakeholders—nuclear operators, regulators, international organizations, and policy experts. Creating a forum to bring all relevant and responsible stakeholders together for periodic, candid discussions would provide vital information input to advance nuclear governance as well as safe and secure plant operations. This dialogue, for example, could be sponsored and facilitated by the past or future summit host countries.

APPROACHING THE 2012 SUMMIT AND BEYOND

Just as the Washington Summit did in 2010, the Seoul Summit in March 2012 will focus heavily on securing the most vulnerable fissile material—highly enriched uranium and separated plutonium. However, the Seoul Summit will also address security, broadly, in four other areas: radiological sources, nuclear facilities (with respect to CPPNM and its amendment), sensitive information, and security between states (e.g., border controls and illicit trafficking).

There are several steps that states should consider taking, either individually or collectively, that would strengthen nuclear safety and nuclear security:

1. Agree to assess how to incorporate elements of the nuclear safety regime (e.g. regularized assessments, information sharing, peer review, reviews of the implementation of relevant international conventions, and strong trade organizations) into the nuclear security regime over time.

2. Acknowledge that barriers such as national sovereignty, lack of information transparency, lack of policy consensus, and regime harmonization are significant challenges and need to be addressed.

3. Seek an optimal balance between mandatory international standards and voluntary actions and/

or endorse consideration of additional binding and non-binding international safety and security requirements.

4. Support strengthened independence of nuclear regulatory authorities in all nations, harmonization of accident/incident reporting parameters and expansion of information sharing and transparency in a crisis, incorporation of security as a fundamental element in new reactor designs, and robust protection of nuclear facilities, including against cyber attack.

5. Encourage civilian nuclear operators and regulators to engage with their foreign counterparts on nuclear security best practices while protecting sensitive information, particularly through WINS, and encourage regularized dialogue and interaction among nuclear operators, regulators, international organizations, and policy experts.

South Korea has a special interest in encouraging the sustainable growth of civilian nuclear energy as a country that intends to increase its reliance on nuclear energy as well as export nuclear power plants. Nuclear safety and security are seen as a *sine qua non* of sustainable growth. At the September 2011 High-Level Meeting on Nuclear Safety and Nuclear Security at the United Nations, ROK President Lee Myung-bak stated, "We are also keen to contribute to the peaceful use of nuclear energy by leading the 2012 Seoul Nuclear Security Summit to a success. Nuclear security, which aims to secure nuclear material from terrorists, is a prerequisite for all nuclear activities."[14]

As stated on the Seoul Nuclear Security Summit's official website, one of the expected outcomes of the summit is that it "will serve as a forum for discussion not only of the issue of nuclear security, but also of its interface with nuclear safety which became the focus of renewed attention following the Fukushima nuclear accident."[15]

Of the 50 states that will attend the summit, 30 countries operate nuclear power plants, although a few of those will be phasing them out. Of the remaining 17, a few have contracts or plans for constructing nuclear power plants. No matter what, however, all states have an interest in the safe operation of nuclear power.

The question is to what extent the Summit will wind up addressing nuclear safety and with what impact. The real work of nuclear safety and security lies in the capacity of national regulatory authorities, operators of nuclear facilities and users of nuclear and radiological material and rigorous implementation of safety and security requirements. Summit-level meetings can encourage states to apply resources toward design and implementation and encourage cooperation between states on a bilateral and regional basis. They can provide an opportunity to showcase innovations or new initiatives. One new regional initiative in emergency response that could be extended beyond safety to nuclear security is the agreement signed by China, Japan, and South Korea in May 2011 on strengthening trilateral cooperation in nuclear safety and disaster management.

Beyond the planned 2014 summit, some experts urge continued high-level attention to nuclear security, whether or not it includes summits.[16] This may either reflect a pessimism that the four-year goal of securing the most vulnerable materials will be reached or the conviction that not enough is being done overall for nuclear security. In order to sustain such high-level attention, however, it may be necessary to broaden the scope of the agenda in ways that appeal to participating states. The synergies between nuclear security and nuclear safety, and the potential lessons that the nuclear security regime can learn from the nuclear safety regime could be part of that appeal.

(Endnotes)

1 "The Eminent Persons Group Adopts the Joint Statement." The 2012 Seoul Nuclear Security Summit press release, December 1, 2011, http://www.thenuclearsecuritysummit.org/eng_media/press/press_view.jsp?oCmd=6&b_code=1&idx=94&rnum=13&f_gubun=0.

2 "EDF Pegs Nuclear Upgrade Cost at $13 Billion," *Wall Street Journal*, January 3, 2012, http://online.wsj.com/article/SB10001424052970203550304577138392366526910.html.

3 Report by the Director General, Board of Governors, IAEA, GOV/2011/59-GC(55)/14, "Draft IAEA Action Plan on Nuclear Safety," September 5, 2011, http://www.iaea.org/About/Policy/GC/GC55/Documents/gc55-14.pdf.

4 "IAEA Safety Glossary Concepts and Terms," International Atomic Energy Agency, last modified January 17, 2012, http://www-ns.iaea.org/standards/concepts-terms.asp?s=11&l=90#3.

5 "Fundamental Safety Principles," International Atomic Energy Agency, 2006, http://www-pub.iaea.org/MTCD/publications/PDF/Pub1273_web.pdf.

6 Report by the Director General, Board of Governors, IAEA, GOV/2006/46-GC(50)/13, "Nuclear Security—Measures to Protect Against Nuclear Terrorism," August 16, 2006, http://www.iaea.org/About/Policy/GC/GC50/GC50Documents/English/gc50-13_en.pdf.

7 Report by the International Nuclear Safety Group, INSAG-24, "The Interface Between Safety & Security at Nuclear Power Plants," Vienna, 2010, http://www-pub.iaea.org/MTCD/publications/PDF/Pub1472_web.pdf.

8 Gunther Handl, "The IAEA Nuclear Safety Conventions: An Example of Successful 'Treaty Management'?" *Nuclear Law Bulletin* (2001): 72, http://www.oecd-nea.org/law/nlb/nlb-72/007_027.pdf.

9 The Proliferation Prevention Program, the Center for Strategic and International Studies.

10 "Long-Term Structure of IAEA Safety Standards and Current Status," International Atomic Energy Agency, February 10, 2012, http://www-ns.iaea.org/committees/files/CSS/205/status.pdf.

11 "Backgrounder on Three Mile Island Accident," Nuclear Regulatory Commission, last modified March 15, 2011, http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html.

12 "History: WANO," World Association of Nuclear Operators, http://www.wano.info/about-us/history/.

13 The discussion that follows is drawn from Ken Luongo, Sharon Squassoni, and Joel Wit, "Integrating Nuclear Safety and Nuclear Security: Policy Recommendations," CSIS Policy Perspectives Paper, Center for Strategic and International Studies, December 13, 2011, http://csis.org/files/publication/111214_Integrating_Nuclear_Safety_and_Security_Memo_2.pdf.

14 President Lee Myung-Bak, speech given at the High-Level Meeting on Nuclear Safety, United Nations, New York, NY, September 22, 2011, http://arirang.co.kr/News/News_View.asp?nseq=120705&code=Ne8&category=1.

15 "Overview: 2012 Nuclear Security Summit," 2012 Seoul Nuclear Security Summit, http://www.thenuclearsecuritysummit.org/eng_info/overview.jsp.

16 "Policy Memo: Nuclear and WMD Security and Summit Diplomacy—Leveraging Top-Level Engagement," The Stanley Foundation, October 19, 2011, http://www.stanleyfoundation.org/spc2011/Nuclear__WMD_Policy_Memo.pdf.

US-Korea Institute at SAIS
Johns Hopkins University
1717 Massachusetts Avenue NW, 6th Fl
Washington, DC 20036

www.uskoreainstitute.org