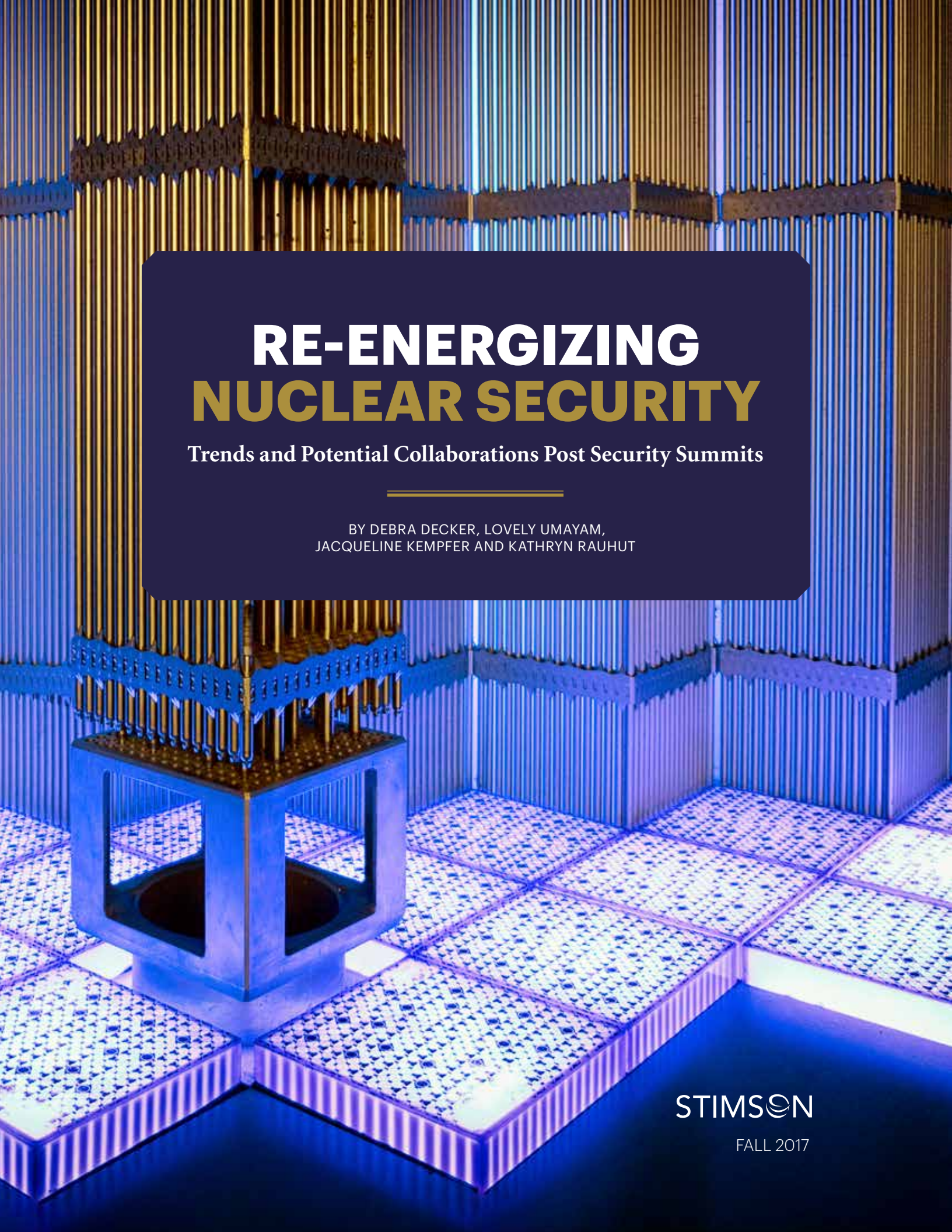

RE-ENERGIZING NUCLEAR SECURITY

Trends and Potential Collaborations Post Security Summits

BY DEBRA DECKER, LOVELY UMAYAM,
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STIMSON

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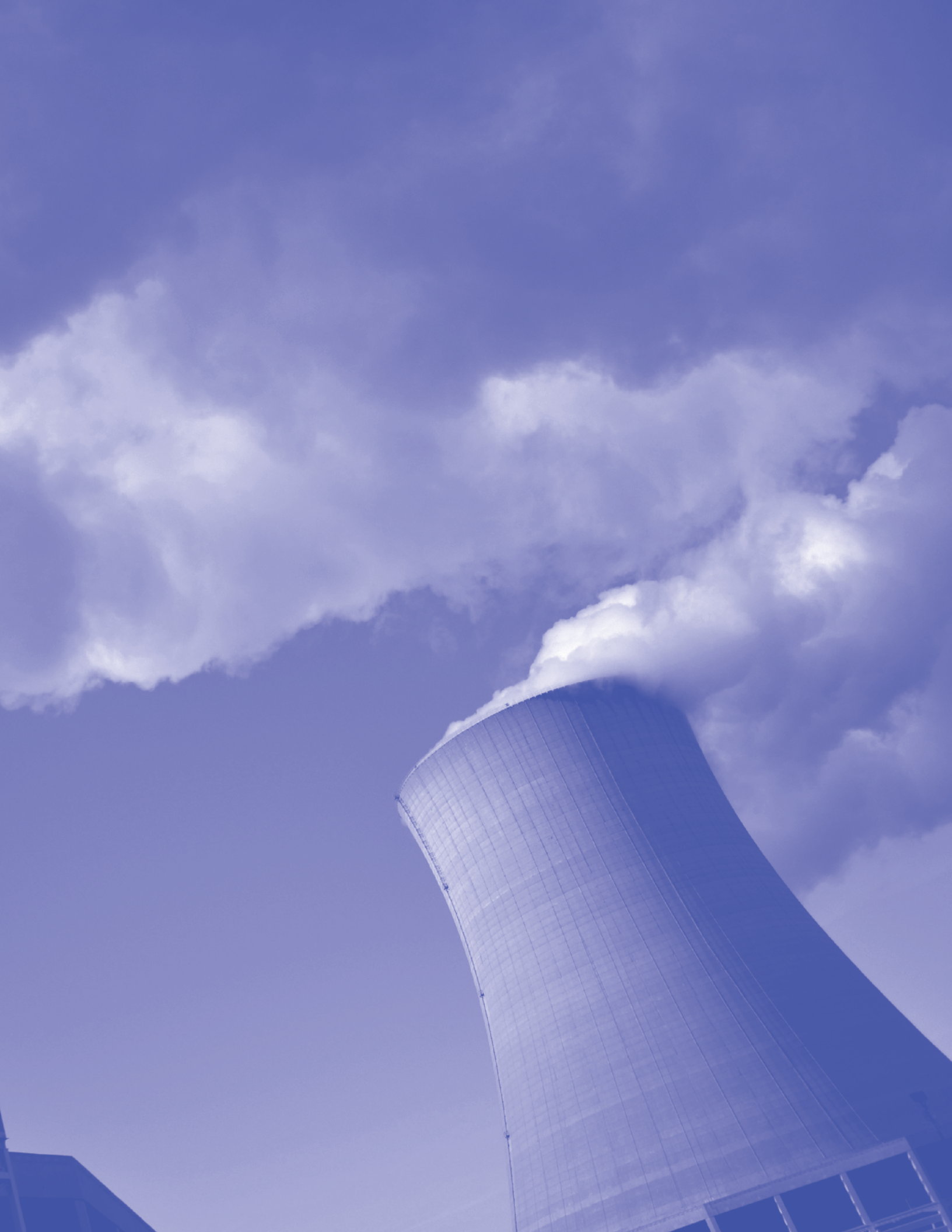

Foreword

As governments around the globe confront an increasingly complex set of threats — from terrorism, cyber attacks, and environmental degradation to illicit technology diffusion and regional energy poverty — it has become clear that the public sector alone can no longer shoulder the burden of our common security and economic prosperity. Private industry is called upon in new and uncharted ways to partner with government to meet common goals. Over the last decade, the Stimson Center has worked to better align governments' nonproliferation objectives with the nuclear industry's imperative to build market value. By better defining "shared value" to include both nuclear security and economic interests, complementary and sustainable new approaches to proliferation prevention can and have been engendered.

I am pleased to present our latest contribution to this effort: *"Re-energizing Nuclear Security: Trends and Potential Collaborations Post Security Summits,"* by Debra Decker, Lovely Umayam, Jacqueline Kempfer, and Kathryn Rauhut. This study surveys the international security landscape and the architecture surrounding the nuclear enterprise, and develops an array of options and recommendations for how private industry can enhance its contribution to global nuclear security. The report proceeds from the realization that the progress made toward enhanced security from the Nuclear Security Summits (NSS) — and the companion industry and civil society summit meetings — must continue. The active participation of private industry and other stakeholders is no longer a luxury, but a requirement. The authors of this report ably demonstrate the practical steps and long-term benefits of such an approach as they evaluate the critical and constructive role of private industry in nuclear security.

Brian Finlay
President and CEO
The Stimson Center

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Finally, the authors would like to dedicate the report to those in industry, government, and international and nongovernmental institutions who work tirelessly to improve the security of the nuclear enterprise and make the world a safer place for us all.

Glossary

CPPNM/A	(Amended) Convention on the Physical Protection of Nuclear Materials
FMWG	Fissile Materials Working Group
GICNT	Global Initiative to Combat Nuclear Terrorism
Global Partnership	Global Partnership Against the Spread of Weapons and Materials of Mass Destruction
HEU	Highly Enriched Uranium
IAEA	International Atomic Energy Agency
INFCIRC	International Atomic Energy Agency Information Circular
INTERPOL	International Police Organization
ISSPA	International Source Suppliers and Producers Association
LEU	Low Enriched Uranium
NEI	Nuclear Energy Institute
NGO	Non-Governmental Organization
NIS	Nuclear Industry Summit
NISGS	Nuclear Industry Steering Group for Security
NSS	Nuclear Security Summit
SMR	Small Modular Reactor
UNSCR 1540	United Nations Security Council Resolution 1540
WANO	World Association of Nuclear Operators
WCO	World Customs Organization
WINS	World Institute for Nuclear Security
WNA	World Nuclear Association
WNTI	World Nuclear Transport Institute

Summary

Market competition, along with a trifecta of major nuclear incidents — Three Mile Island, Chernobyl, and Fukushima — have posed barriers to the growth and public acceptance of nuclear power. Liberalization of electricity energy markets has made nuclear energy less cost-effective than other energy sources, including gas and renewables.

The staggering initial capital cost requirements of nuclear new build have led to new financing models. China and Russia are now offering package deals, which are attractive in emerging countries that do not have the financing or expertise for nuclear power. The build-own-operate model allows for unique opportunities and strange bedfellows. These complex financing and ownership arrangements are beyond the scope of this paper, but they introduce troubling arrangements where Russia, for example, could be responsible for nuclear security in Turkey. These factors have had consequences for nuclear industry around the world, with some countries faring better than others. China has negotiated nuclear deals with various countries, including the United Kingdom, Iran, Argentina, and Saudi Arabia, and is planning to build 20 new reactors at home.[1] The U.S. nuclear industry, in comparison, is struggling to continue as a competitive supplier, while domestically trying to stay afloat: About 10 nuclear power plants are scheduled to close prematurely as of 2017.[2]

But nuclear energy is entering a new chapter that could change the game for all industry players. With concerns about a warming planet, many countries are beginning to reconsider nuclear as a "clean" energy source.[3] In addition, the promise of small modular reactors (SMRs) and other next-generation reactor designs could be an entry point for potential suppliers. The prospect of new builds on the horizon also translates into job creation for many communities. These factors could engender a renewed public response that could potentially reverse decades of negative attitudes towards nuclear energy, and advance countries' strategic engagement through new nuclear deals.

While there are exciting new opportunities, there are also unique challenges: The security landscape continues to change in unprecedented ways as the public grows wary of cyber vulnerabilities and the potential for insider threats against critical infrastructures, including nuclear. Recent attempts to wage cyber-attacks on nuclear facilities could be, as the International Atomic Energy Agency (IAEA) Director General Yukiya Amano stated last year, the "tip of the iceberg" — the world could potentially see more devious hacks as state and non-state actors hone their abilities to develop more sophisticated attack vectors.[4] Thus, *nuclear security* as a concept must be recognized and addressed just as *nuclear safety* has been for the industry to ensure a favorable future.

Governments, civil society, and nuclear industry leaders all expressed commitments to nuclear security during four Nuclear Security Summits (NSSs) (2010–2016) amid much international press. But now that the Summits are over and the world is no longer watching, attention to nuclear security has waned. While the last Summit in April 2016 tasked five international organizations — the United Nations, the IAEA, International Police Organization (INTERPOL), the Global Initiative to Combat Nuclear Terrorism (GICNT), and the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction (Global Partnership) — to maintain the integrity of the "nuclear

security architecture," it is not clear how outstanding commitments will translate to measurable and impactful actions.

While the Summit process yielded concrete commitments from participating countries, there are still various political and bureaucratic hurdles to improved security. As it stands, little agreement or understanding exists as to how the five organizations will coordinate and implement the Summit commitments within a reasonable timeframe. And while industry participants expressed support towards the Summit process by hosting their own side meetings and proclaiming their own security commitments, it is unclear how this will be reflected in their practices. Although much was accomplished during the Summits, international institutions, governments, industry, and civil society must continue to work together to address outstanding Summit commitments, and preserve gains already achieved.

This paper proposes several recommendations to bring all relevant stakeholders together to revitalize attention around nuclear security:[5]

- To continue the public focus on nuclear security, states party to the amended Convention on the Physical Protection of Nuclear Materials (CPPNM/A) should call for regular reviews to ensure all parties to the Convention are implementing it, including the newly added fundamental principles.
- To facilitate assistance efforts and ease states' reporting processes, countries willing to take leadership roles should consider new ways of streamlining reporting, starting off with a trial process to include the CPPNM/A's fundamental principles as part of the United Nations Security Council Resolution (UNSCR) 1540 voluntary reporting.
- The Fissile Materials Working Group (FMWG) and other nongovernmental organizations (NGOs) should consider how they can better complement the work being done by governments and industry, potentially by promoting transparency and accountability and by identifying and evaluating new avenues to increase nuclear security.
- Nuclear industry representatives involved in the Summit process, possibly through industry groups such as the newly-formed Nuclear Industry Steering Group for Security (NISGS), should explore specific ways they can help implement the NSS action plans for the five international institutions. For instance, industry groups could:
    - Serve as the official hub for international information sharing and collaboration with industry on security issues,
    - Develop an industry framework for strong governance on nuclear security, and
    - Promote industry discussions with the five organizations on emerging nuclear technologies/approaches.

Pursuing some of these actions can help continue the post-Summit dialogue without having to rely on the next incarnation of ministerial-level meetings to take stock of progress. Governments need to spearhead these efforts, as meaningful changes in policy and regulation must be driven from the top. NGOs can advocate for more meaningful industry input into the process, so that perspectives from the operational-level can be taken into consideration. Industry, perhaps with the help of

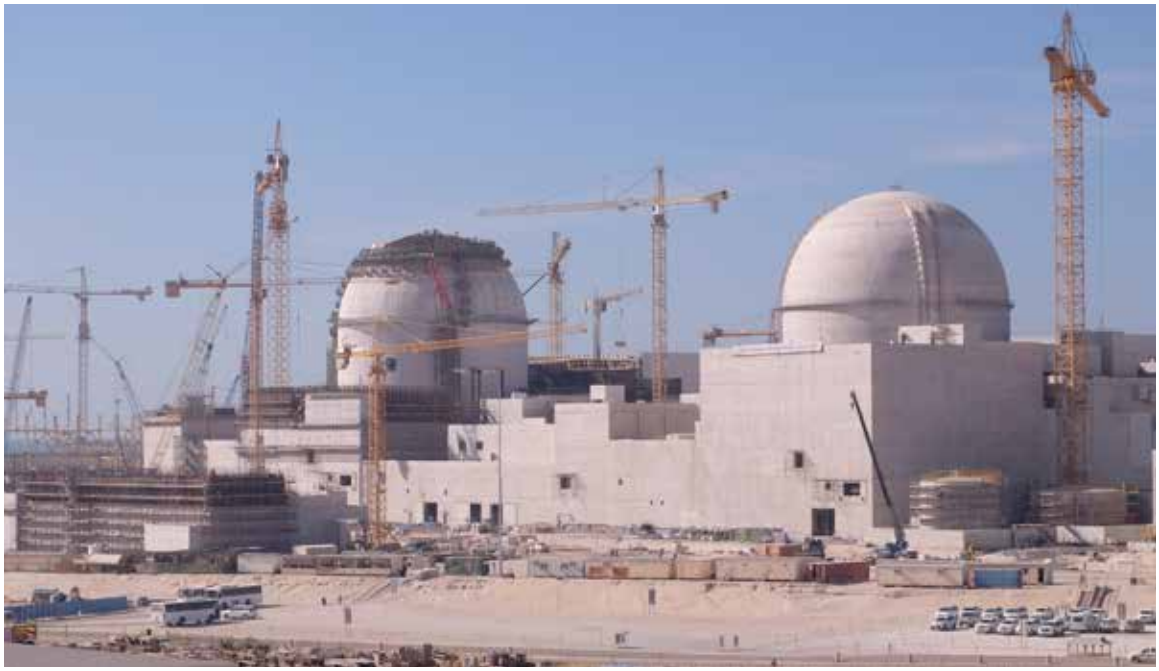
civil society, can also push forward with voluntary commitments — by subscribing to a corporate governance framework, peer reviews, and other transparency measures — to demonstrate that it is willing to do its share in upholding nuclear security.

Overall, new mechanisms outside an official high-level convening must be developed to take pragmatic steps to ensure a strong and stable nuclear future as prospects for the nuclear industry expand over the long term.

Current and Emerging Nuclear Trends

Despite multiple promises of a "nuclear renaissance" around the world, not all nuclear industry actors have seen this come to fruition. For most countries, industry had to weather various political and economic barriers to expansion. In the United States, costs have risen with aging plant maintenance and with newly imposed security and safety requirements since 9/11 and the 2011 Fukushima incident. Variations in supplies of competing electric energy sources such as gas and government-subsidized renewables have made energy prices drastically fluctuate in the United States.[6] Although nuclear operators have become more efficient at production with improved capacity, profits in deregulated electricity markets are continually unpredictable.[7] In addition, persistent public doubts about nuclear safety have derailed the industry in countries such as Germany and Switzerland and led others, such as South Korea, to cut back their nuclear power plans.[8]

High construction costs and scheduling uncertainties also have plagued some new builds, with some of these issues brought upon by regulatory uncertainty surrounding acceptability of construction plans. Issues with construction of new reactors in the United States and Finland helped push Westinghouse into bankruptcy, Toshiba into massive write-offs, and the French government to help bail out Areva.[9] Even with a plant built and properly operating, the nagging question for many countries of how to handle radioactive spent fuel continues to worry the public and politicians.[10]



The construction site of the Barakah nuclear power plant in the United Arab Emirates in 2016.
IAEA IMAGEBANK VIA FLICKR

Changing Minds Post Fukushima

UNITED STATES

While construction of two new reactors in the United States halted cost and schedule overruns, U.S. policy under the Trump administration is encouraging a revival of the nuclear energy industry; the 99 operating reactors in the United States' provide 20 percent of U.S. electricity and represent the world's largest fleet of operating reactors.[i]

FRANCE

A leader in the nuclear energy field, France currently gets 75 percent of its electricity from nuclear power but laid plans to reduce that dependence to 50 percent by 2025 — primarily by retiring aging reactors and increasing the overall amount of energy produced. However, French dependence on the industry and the country's greenhouse gas emissions targets cause some to wonder if new French President Emmanuel Macron may decide to amend this target.[ii]

GERMANY

After winning elections in 2010, German Chancellor Angela Merkel's government reversed a previous decision to phase out nuclear power. However, after the 2011 Fukushima disaster, tens of thousands of protesters demanded a rollback on nuclear energy. With wide support in the German Parliament, Merkel reversed her decision and laid out a timeline to phase out nuclear power by 2022.[iii] Some still doubt that Germany will execute its plan in full, in part due to the ongoing tensions in Europe's energy relationship with Russia.

SOUTH KOREA

Newly-elected South Korean President Moon Jae-in announced in June 2017 that South Korea would phase out nuclear power in favor of renewable power options. The country would terminate existing construction plans for nuclear power plants and would also close coal-fired power plants, demonstrating the president's commitment to transition South Korea toward renewable energy sources. President Moon cited Fukushima, South Korea's earthquake risks, and the need to protect public safety as reasons for his decision.[iv] Nuclear power currently accounts for one-third of South Korea's energy production, and nuclear exports are important to South Korea's economy.

SWEDEN

Prior to 2016, Sweden had been on track to phase out nuclear energy and shift entirely to renewable energy by 2040. In 2016, Sweden's government chose to move in another direction and agreed to construct 10 more nuclear plants and cut an energy tax levied on nuclear power. It is unclear how many of the 10 new approved power plants will actually be constructed.[v]

VIETNAM

In November 2016, Vietnam's legislature voted to abandon plans to construct two nuclear power plants. Vietnam, which did not choose to shift away from nuclear power following the Fukushima disaster, repeatedly delayed construction in 2014 and 2015. The legislature cited decreasing electricity demand, increasing construction costs, and safety concerns. The estimated cost for the project had doubled since 2009, and Vietnam's government has struggled with rising debt.[vi]

i. "US nuclear construction project to be abandoned." World Nuclear News, August 1, 2017. Accessed August 3, 2017. http://www.world-nuclear-news.org/NN-US-nuclear-construction-project-to-be-abandoned-0108177.html; Decker, Debra. "Rethinking U.S. Nuclear Policy: Stable Energy vs. Security Risks." The Cipher Brief, July 2, 2017. Accessed August 3, 2017.

ii. Silverstein, Ken. "France May Cut Its Nuclear Energy Fleet, Which Is Core to Its Economy." Forbes, July 12, 2017. Accessed August 3, 2017. https://www.forbes.com/sites/kensilverstein/2017/07/12/france-may-cut-its-nuclear-energy-fleet-which-is-core-to-its-economy/#50cc021a1d27; Conca, James. "French President Macron's Nuclear Dilemma." Forbes, July 16, 2017. Accessed August 3, 2017. https://www.forbes.com/sites/jamesconca/2017/07/16/french-president-macrons-nuclear-dilemma/#6f1d786824b9.

iii. Staudenmaier, Rebecca. "Germany's nuclear phase-out explained." Deutsche Welle, June 15, 2017. Accessed August 3, 2017. http://www.dw.com/en/germanys-nuclear-phase-out-explained/a-39171204.

iv. McCurry, Justin. "New South Korean president vows to end use of nuclear power." The Guardian, June 19, 2017. Accessed August 3, 2017. https://www.theguardian.com/world/2017/jun/19/new-south-korean-president-vows-to-end-use-of-nuclear-power.

v. Plumer, Brad. "Sweden decides it's not so easy to give up nuclear power." Vox, June 17, 2016. Accessed August 3, 2017. https://www.vox.com/2016/6/17/11950440/sweden-nuclear-power; "Sweden abolishes nuclear tax." World Nuclear News, June 10, 2016. Accessed August 3, 2017. http://www.world-nuclear-news.org/NP-Sweden-abolishes-nuclear-tax-1006169.html.

vi. Minh, Ho Binh and Mai Nguyen. "Vietnam abandons plan for first nuclear power plants." Reuters, November 22, 2016. Accessed August 3, 2017. http://www.reuters.com/article/us-vietnam-politics-nuclearpower/vietnam-abandons-plan-for-first-nuclear-power-plants-idUSKBN13H0VO; Nguyen, Viet Phuong. "The fate of nuclear power in Vietnam." Bulletin of the Atomic Scientists, December 5, 2016. Accessed August 3, 2017.

However, there are prospects for a new beginning. Concerns about climate change and the need for a stable source of electricity have caused increased interest in nuclear as a base load source of clean energy. Fraught with high levels of air pollution combined with increasing energy requirements, China has committed to building dozens of new nuclear plants domestically.[11] Other countries — from India to the United Arab Emirates to Turkey — are also looking to nuclear power for a secure domestic power supply to satisfy growing energy needs, including for desalination to provide needed supplies of fresh water.[12]

Nuclear power has become a strategic investment not only for those investing in new nuclear plants, but also for those selling them. China, Russia, and South Korea have been dominating the export markets, with attractive financing plans, turnkey plants and spent fuel take back being offered by countries' majority-state-owned enterprises.[13] The relationships forged through these types of nuclear deals could last close to a century, from nuclear power planning to project development to operation and ultimately plant decommissioning. As it stands, new agreements are for large power reactors, but SMRs — and even floating power plants — may well be the wave of the future and an important export.[14] If this comes to fruition, it could open new opportunities for the United States to reassert its leadership in nuclear energy globally.

But as it stands, the United States is not a top nuclear player, given that the Russian and Chinese nuclear industries continue to receive substantial subsidies from their respective governments that have allowed them to dominate the production and export of traditional large nuclear power reactors worldwide. Without status as a significant supplier, the United States does not have the same leverage to shape norms, standards, and best practices within industry like it did fifty years ago.[15] It is unclear what the current U.S. administration is prepared to do, especially now that it withdrew from the Paris Climate Agreement.[16] More recently, the U.S. administration promised an "energy

Small Modular Reactors: Wave of the Future?

Unlike large reactors that can produce over 1000 MWe, SMRs typically will generate up to 300 MWe, feeding into local or microgrids. They are expected to be built off-site and delivered, with a reduction in construction time and cost, as well as reduced reliance on long transmission lines. Companies developing SMR designs draw attention to their potential for increased safety, security, and nonproliferation benefits. Most are designed to be sited underground with passive safety systems, which companies claim require no operator action in the event of an accident. Designers also highlight the construction below ground will provide increased protection from terrorist threats. Some are expected to be conveniently sited near users, with floating power plants being directly delivered to serve port cities. Some believe the potential benefits are overstated. Currently, no prototype appears able to produce power economically. However, with mass production of a design, kilowatt-hour production costs could become competitive. Internationally, interest in developing and deploying new designs is high. For new nuclear initiatives struggling to be commercially viable, old regulatory approaches to security can be a costly added burden that deters innovation, while regulatory delays in reviews can prove stifling. Strong state support for SMR development in various countries will give the first successful, regulator-approved SMRs a competitive edge *(See Appendix A)*.

dominant" America, and a full review of U.S. nuclear energy policy.[17] Concrete actions behind this promise remain to be seen, but U.S. nuclear industry representatives do appear to have made some progress in promoting U.S. nuclear energy as part of an overall energy strategy.[18]

Still, several other factors threaten to curtail this potential growth. The U.S. Department of Homeland Security and the Federal Bureau of Investigation issued a report providing details on the recent cyber attempt to penetrate the computer systems of the utility company managing the Wolf Creek nuclear power plant in Kansas, possibly to map the facility network for a potential future attack.[19] While the nuclear facility was not compromised, this attempt at sabotage is indicative of the increasingly sophisticated security challenges that the energy sector, including nuclear industry, now faces. And as many industry stakeholders forebodingly note, a nuclear incident anywhere — either safety or security-related — is a nuclear incident everywhere. If a nuclear facility is significantly damaged by a cyber attack, the impact could be deleterious for governments and industries alike. And there is no way of guessing how long it would take to bounce back from such a political and economic blow.

Power reactors are only one aspect of the nuclear fuel cycle; industry actors involved in other processes within the cycle will undoubtedly feel the same opportunities or pressures, depending on whether a favorable view on nuclear energy continues to gain traction. The nuclear industry also involves other activities, such as the operation of research and test reactors — which number 250 now operating in 55 countries, with 11 planned builds — and other applications of nuclear energy and radioactive materials to medical, agricultural, and industrial uses.[20] These different activities that comprise nuclear industry come with their own unique security considerations, but also with the common need to recognize an all-hazard management approach to existing and emerging nuclear risks.

Heightened Security Concerns and the Origins of the NSS

The IAEA has legal authority under safeguard agreements to verify that states are not diverting technologies and materials to purposes inconsistent with their commitments. This is a critical step toward ensuring that countries are not using their nuclear programs for military means. The safety and security of nuclear sites and their materials, however, are the responsibility of the states in which they reside. The IAEA provides guidelines and roadmaps for states to follow to build adequate safety and security measures into regulations and at facilities. For example, states are encouraged to develop Design Basis Threats for each facility, which operators implement and regulators evaluate to ensure compliance. Otherwise, states oversee their own safety and security requirements.

While it is understandable that nuclear programs around the world differ based on state capacity and capability for oversight, some experts consider this a flaw in the multilateral framework governing the responsible use of nuclear materials and technologies.[21] Aside from the aforementioned guidelines and roadmaps, the IAEA offers its member states a broad range of services, including review missions on safety and security, if requested.[22] Even well-developed and experienced states have had incidents where management deficiencies and the lack of a strong safety culture were among the primary reasons that incidents occurred.[23]

The 21st century introduced a jarring and seemingly unmanageable security landscape; since 9/11, terrorism has become a major point of concern, particularly the potential for sophisticated terrorist organizations to attack critical infrastructures to reinforce their political message. Terrorists continue in their efforts to obtain nuclear and radiological materials and to target nuclear facilities.[24]

Fourth Nuclear Security Summit in Washington, D.C. (2016). NARENDRA MODI VIA WIKIMEDIA

Boko Haram and ISIL operate in or near countries that have, or are considering nuclear power.[25] Although most civilian nuclear facilities do not possess materials that can be made directly into improvised nuclear devices, some still do.[26] Furthermore, North Korea's possible diversion or sale of nuclear material is worrisome, especially as its stockpile of fissile material increases and the regime comes under increased international pressure.[27] While illicit trafficking of material out of regulatory control is an issue that the IAEA tracks, the database only publishes general statistics of incidents and not specific cases, so it is difficult to understand in which parts of the nuclear enterprise security vulnerabilities lie.[28] In addition, states are not obligated to report loss of nuclear or radioactive material to the IAEA so that it can be tracked. When states do report to the IAEA and make the information publicly available, experts note the variance in details provided, and the difficulty in obtaining an accurate representation of the problem.[29]

Drawing on his experience in the U.S. Senate with Senator Richard Lugar, President Obama called on world leaders to address nuclear security and asked that they give it the attention it deserved as a global security concern. Approximately 50 state leaders attended each of the four NSS that took place in Washington, DC, in 2010; in Seoul, South Korea in 2012; in The Hague, The Kingdom of the Netherlands in 2014; and the final Summit in 2016, again in Washington, DC. At these Summits, political commitments were made and fulfilled, marking important gains in reducing stocks of fissile materials and increasing security, with a focus on nuclear material not under military control.[30] Industry and NGOs held parallel summits to demonstrate their commitment towards securing nuclear materials along with their respective governments.[31]

While states, industry, and civil society committed to preserving the work undertaken at the Summits, it is unclear how post-Summit progress will be sustained. Commitments are being fulfilled by countries in a national capacity or through bilateral partnerships, but there is no longer a central political mechanism to provide ongoing momentum to ensure that efforts are coordinated in the future.

Mobilizing Post-Nuclear Security Summit Initiatives

Among Governments

Countries that participated in the Summit process tried to institutionalize their nuclear security efforts through developing supportive follow-on action plans for the five international organizations: the United Nations, the IAEA, the INTERPOL, the GICNT, and the Global Partnership. Russia, which possesses more nuclear weapons than any other country in the world, boycotted the last Summit. While Russia still partners with the United States to co-chair the GICNT, in order for these organizations to carry out their Summit mandate, a larger consensus amongst their respective member states must be achieved.

One of the biggest drivers of the Summit series was the Sherpa Group, comprised of state officials designated by their respective countries to be responsible for organizing the Summits, as well as communications and coordination between Summits. To carry on this function, some participating states agreed to form a "Nuclear Security Contact Group" to continue discussions at a high level among governments.[32] IAEA conferences and other meetings attended by a significant portion of the group will provide an opportunity for interested states to monitor and promote the many national commitments made at the Summits.[33] These commitments included dozens of promises from individual states as "house gifts" to the Summit process, and from groups of states in "gift baskets." For instance, the Summits highlighted the risks posed by research reactors using highly enriched uranium (HEU), and as a result, participating countries presented gift baskets to reduce the use of HEU both in medical applications and research. Since the beginning of international HEU minimization efforts, 29 countries plus Taiwan have removed all HEU in their territory. At the final Summit in 2016, 22 more countries committed to convert their research reactors to use low enriched uranium (LEU) and facilitate HEU removal. [34]

Another noteworthy gift basket is the Strengthening Nuclear Security Implementation Initiative that was raised at the 2014 Summit, in which 35 states committed to the security standards recommended by the IAEA.[35] But as it stands, no international group is actively monitoring these state commitments and thereby encouraging fulfillment of commitments.

Perhaps it takes a legally binding international agreement to achieve a rigorous level of enforcement. The CPPNM/A entered into force in 2016 and requires states to adhere to 10 fundamental principles on security, several of which must be demonstrated by the competent state nuclear regulatory authority as well as its nuclear licensees.[36] Under the convention, states are called to report to the IAEA on the laws and regulations that effect the convention's obligations. A review conference in 2021 will consider the status of the convention. **States party to the CPPNM/A should vote to convene regular reviews. This could serve to strengthen interest in the convention's obligations.**[37] The high-level CPPNM/A fundamental principles reflect the more detailed recommendations of IAEA's *Nuclear Security Recommendations on Physical Protection of Nuclear Materials and Facilities (*INFCIRC 225/Rev5), where principles such as security culture are further defined.[38]

In addition, synergies need to be explored among Summit country commitments, the new CPPNM/A, and the five implementing organizations, especially the United Nations and IAEA. Since many states complain of reporting fatigue, it would be useful for a state or group of states to explore the feasibility of developing a centralized and electronically coordinated reporting mechanism that would fulfill the reporting requests of various conventions, treaties, and relevant UNSCRs. For instance, the UNSCR 1540, passed under Chapter VII, has a 1540 Committee overseeing a matrix that interprets elements of nonproliferation security requirements, including nuclear security.[39] **An enterprising state or group of states party to the CPPNM/A in a pilot initiative could include the CPPNM/A fundamental principles as part of their voluntary 1540 reporting. The development of a common reporting system would help identify country needs and facilitate assistance. More broadly, developing common definitions among and within international organizations and stakeholders, including industry, could help foster more useful and frequent reporting.**[40]

To fully actualize the five implementing organizations' plans, some forceful forging of coordination among the organizations will be needed. This may be difficult and will no doubt depend on the personalities and politics involved. Civil society could help with monitoring, and industry can help with implementation.

In Civil Society

Through fostering dialogue and conducting policy work, NGOs played a key role in supporting the mission of the NSS. A coalition of about 80 international civil society groups seeking to reduce the threat of nuclear terrorism formed the FMWG to support the work of the Summits and to coordinate NGO efforts in making recommendations to world leaders. In addition to behind-the-scenes work with Summit organizers to shape the agenda and relevant deliverables, the FMWG held public conferences on the sidelines of each Nuclear Security Summit convening hundreds of experts from the NGO community to discuss strategies to further improve our global nuclear security system.[41] Furthermore, the FMWG's 2016 Nuclear Knowledge Summit agreed that future efforts to strengthen global nuclear security must be: comprehensive, sustainable, focused on minimization, rigorous, and confidence-building.[42] Going forward, the FMWG experts committed to track the progress toward greater nuclear security, provide education and training, and cultivate collaboration among all stakeholders with a stake in nuclear security.[43]

The World Institute for Nuclear Security (WINS) also played a significant role in pushing Summit commitments forward. WINS' efforts to provide consistency in performance through training and certification have helped internationalize the concept of a required level of security knowledge — a first step in building a professional nuclear security community. Roger Howsley, the Executive Director of WINS, said part of this new group's charge would be "to build on what has already been done in the summit process and its working groups and seek to review operating practices for nuclear security to identify what constitutes operational excellence."[44] Immediately after the 2016 Summit, Canada, along with 11 other countries submitted a Joint Statement on Certified Training for Nuclear Security Management to the Secretariat of the IAEA acknowledging the need for internationally recognized nuclear security training, education and certification. These countries commit to working with WINS to develop state action plans to provide a tangible commitment in

Organizing the NIS

"Immediately after the Hague Summit, the White House requested that NEI chair the industry summit to be held in Washington in 2016. Throughout the two year interval between summits a Board of Advisors met to discuss strategic elements of the industry summit. The Board was comprised of 24 organizations from the global industry including private and state-owned enterprises, NGOs and various industry entities including vendors and operators. One key decision was to engage with the Knowledge Summit. While the two summits had been held at the same time, they had never before engaged in a joint activity. The leads for these two summits were committed to bringing the two sides closer given their common interest in nuclear security issues. They chose two topics: Nuclear Security in Emerging Nuclear Countries and Nuclear Security in a Post-Summit World. The session also included a keynote from IAEA Director General Amano and former US Senator Sam Nunn, CEO of the Nuclear Threat Initiative. It has set the stage for on-going collaboration between industry and civil society. The Board also organized a special event uniting NSS, NIS and Knowledge Summit participants under the common banner of strengthening nuclear security.

The industry summit also prosecuted its work on cyber security, strategic materials (HEU, Plutonium and Spent Fuel) as well as defined new opportunities in spent fuel transportation and in radiological source security. It identified for a public audience the many benefits (energy, industrial, food, health) that industry brings to humanity through nuclear technology and materials — and how industry carefully manages the security of such materials. On the last day of the NIS, a group of industrialists and interested parties concluded that leverage of the positive developments was key to promoting global focus on security issues and in identifying relevant best practices. By the end of 2016, the industry had formed the NISGS. This is the current global entity, recognized by governments and agencies, to represent industry interests in the five Action Plans identified in the Nuclear Security Summit."

Daniel S. Lipman, Vice President, Suppliers, New Reactors, and International Programs, NEI. Via email, September 23, 2017.

support of the WINS Academy and certified professional development for nuclear security. Such actions can jumpstart a process that hopefully will be adopted at a future date by the IAEA and individual states.

A major challenge for civil society to is to leverage the momentum of the Summits and effectively navigate internal and external bureaucracies to effect change. The action plans for the United Nations and the Global Partnership both call for civil society engagement, but these statements are largely open ended. Thus, there is opportunity for civil society to help shape what effective engagement can and should look like. But in such a tumultuous period of political transition — particularly in the United States where the current U.S. administration has yet to show whether it will continue the Obama Administration's legacy of publicly encouraging nuclear security through diplomacy — it is difficult to anticipate what the appropriate role for civil society should be. **Possible roles for civil society could include outreach to educate politicians and other policy practitioners on the importance of nuclear security, and strategic efforts to act as brokers among the different stakeholders — governments, international institutions, industry stakeholders — to encourage transparency and accountability in fulfilling the Summit commitments.** Thus, civil society must coordinate to ensure there is agreement on its overarching role within the global nuclear security architecture, and strategically plan which organizations will apply which tactics to keep progress moving. The FMWG can continue

to be a leader in this effort, with its participating NGOs coordinating among each other the task of monitoring and encouraging fulfillment of commitments made by states, international organizations, industry, and other stakeholders. **Further, NGOs can also identify and evaluate new avenues to increase nuclear security outside of existing engagement, e.g., develop and promote market incentives for increased sustainable security among operators and identify and reward good industry governance practices, among other initiatives.**[45]

Within Nuclear Industry

The nuclear industry is a mix of many different players — from operators to transporters, from commercial enterprises to fully or partly state-owned organizations. Achieving agreement among stakeholders can be challenging. And while industry has acknowledged the importance of security — indeed, security spending in nuclear facilities has tripled after 9/11 to account for more guards, guns, and gates — it is increasingly difficult to consider additional security expenditures amid rising costs in other areas. Many industry stakeholders are advocating for *smarter* security spending, as opposed to *more* security spending, making the argument that additional investments do not necessarily equate to improved security.

The importance of nuclear security clearly is not lost on some industry leaders. The organizers committed to contribute to the nuclear security architecture, and proposed to meet on a regular basis to continue to work on the most challenging problems, including cybersecurity. The NIS industry participants committed to enhance public and stakeholder confidence through high standards of transparency, integrity, ethical behavior, and social responsibility.

To sustain post-Summit industry engagement, an ad hoc group of industry executives agreed to organize the NISGS — tasked with, among other things, the need to "identify opportunities for industry to engage with the organizations charged with the Action Plans of the NSS."[46] It remains to be seen whether this group can gain broad international industry support, which would require buy-in from major industry stakeholders and close coordination with established industry groups to ensure that activities are complementary. Groups such as the World Association of Nuclear Operators (WANO), World Nuclear Association (WNA), World Nuclear Transport Institute (WNTI), and the International Source Suppliers and Producers Association (ISSPA) certainly must recognize the importance of coordinating as a central bloc to reduce duplicative efforts among stakeholders, and developing a united industry message on nuclear security. Any industry effort, including activities that could be developed under NISGS, must be coordinated closely with respective governments to ensure that activities align with state-level objectives. Finding a place for industry to share its voice more regularly with the IAEA is a necessary first step.

What follows is an in-depth review of specific industry commitments, and an assessment of how industry and international institutions can work together to the benefit of each.

NIS Working Group Recommendations

In conjunction with the Joint Statement, nuclear industry put forth specific recommendations based on working group discussions. Whether they will be implemented will be a function of good industry leadership, as well as governments, NGOs, and the public holding industry accountable.

IMPROVING GOVERNANCE AND CULTURE

The working group was tasked to develop recommendations on managing security practices primarily focused on how industry could gain public confidence. But the most innovative part of this group's outcomes is often overlooked, buried in the working group's report appendix. The appendix features a governance template that senior managers can adopt as an integral part of operations that cannot be managed separately. It proposes ten questions that could be addressed in an organization's annual report, without disclosing sensitive information. This appendix highlights executive accountability by requiring the organization/executive to explain whether a security policy, measure, or issue was followed, and if not, why. Developing a model for corporate/personal accountability for enterprise risk, including security, is a prerequisite for understanding and managing risks and reducing liabilities. This is perhaps the most important recommendation put forth at the NIS, and one that the NISGS can refine and implement in the short term. *Ambassador John Barrett, President and Chief Executive Officer, Canadian Nuclear Association, chaired the group.*

MANAGING THE CYBER THREAT

Cyber risks are a key concern for the nuclear industry, and continue to pose a challenge to nuclear insurers, given that complete international regulatory oversight does not exist and it has proved extremely difficult to quantify cyber risk. The working group noted the enormity and persistence of the threat and reviewed efforts underway to develop standards internationally, including through the International Electrotechnical Commission. Moreover, it recognized that regulators are currently not agile enough to really help guide industry in this area. The most significant outcome from this working group suggests organizations "like the IAEA and WINS (et al.)" to increase their development of cyber guidance and include industry as a stakeholder. The report aptly noted that the IAEA, as it represents states, is not the logical forum for industry discussions, although it could facilitate industry–state discussions, and recommended that "a platform could be established through an effective cooperation and coordination between organizations such as WANO, the WNA, the WNTI and WINS." Such a collaborative approach makes sense and should be expanded to include research reactors. *Amir Shahkarami, President & CEO, CASe Global Partners, Inc., and Anno Keizer, Manager, Security, URENCO Nederland B.V., led this working group.*

ON USE, STORAGE, AND TRANSPORT SECURITY

The working group reiterated support to minimize the use of HEU as fuel or target where technically possible and economically feasible, while continuing to have a stable supply of Molybdenum-99 for medical purposes. The working group also recognizes the importance of having appropriate financial incentives for conversion, and the need to work with health authorities and the health care industry to more accurately price certain medical procedures. Most importantly, the working group advised that the primary role be given to regulation and regulators, who had been generally conspicuous in their absence from the Summit process. Surprisingly, as industry does not usually ask for regulations, it called for "implementing new regulations and requirements pursuant to emerging threats" regarding used nuclear fuel and radioactive material transport. Reliance on regulators may be necessary but is certainly not sufficient, given the limited experience of some regulators in countries with little capacity. Market-based incentives, standards with independent verification of compliance with those standards, and expansion of peer reviews to include elements of security can all help move toward adoption of improved practices beyond what regulators require as a minimum. *Kent Cole of NAC International chaired this group.*

See "Working Group Papers," Nuclear Industry Summit 2016, http://nis2016.org/agenda/working-group-papers/

Fulfilling Nuclear Industry Summit Commitments

Significant Joint Industry Summit Commitments

During the last Nuclear Industry Summit (NIS),[47] industry representatives agreed to establish working groups to tackle the following topics: Overall management for security, cybersecurity, and material security. Recommendations from these working groups fed into the "Joint Industry Statement," with a preamble that commits industry to "high standards of transparency, integrity, ethical behavior and social responsibility."

The NIS Joint Statement noted that national regulations are the *minimum* standard, and that it must strive for *continuous improvement of security practices* beyond regulatory compliance. The Joint Statement also recognized the importance of the safety-security interface, and called on the WANO to take into account security when conducting reviews. While safety and security have traditionally been separated, perhaps due to political sensitivities around sharing security information, these two concepts can and should be complementary. Safety and security are intertwined in many areas — from human reliability to facility design to cybersecurity.

There is increased understanding that security is not something that is relegated only to the facility guards, but must be embraced by the entire workforce. Inculcating best security practices must start at the top, with executive leadership developing cross-functional oversight of security programs, i.e., physical and cyber security, with each of the teams communicating with each other. Active leadership, organizational management and enterprise risk management can lead

Nuclear Industry Summit 2016 Awards Luncheon that brought together industry with NGOs and government representatives. Pictured are the FMWG Steering Committee and Coordinating Director receiving the NGO Leadership Award. See the award presentation at: https://www.youtube.com/watch?v=qAHum9TeoZA.

PHOTO COURTESY OF THE NUCLEAR ENERGY INSTITUTE.

to continuous improvement in both safety and security.[48] Indeed, a WINS study found that the U.S.-based Institute of Nuclear Power Operators have outlined safety behaviors for its members that are just as relevant, if not crucial, to maintaining security in nuclear facilities.[49]

The NIS Joint Statement also called for senior executive leadership to be "demonstrably competent" in security. Previous Joint Statements had typically asked this only of security personnel. A theme resonating among stakeholders has been the need for management to be responsible for overall good governance. This was further supported by commitments to "enhancing security culture for management and personnel with accountability for security" — and to providing "workplace incentives" for excellence and encouragement for reporting suspicious behaviors. Notably, WANO recently added "leadership" to its peer reviews. It should include security as part of the evaluation of leadership and governance.[50]

Most importantly, industry committed to "*effectively* securing all nuclear and radiological materials in industrial facilities and applications [emphasis added]." While this may seem a given, the concept of what "effective" security entails has largely been defined without input from industry stakeholders. Many international treaties have similar language in terms of committing to implement vague practices that are "effective," "reasonable," or "practicable," leaving each state to define acceptable practices for itself.[51] The IAEA documents on security provide some guidance on what "effective" could mean for both regulators and licensees, but these documents were developed with limited industry input, allowing governments and their respective regulatory authorities to determine what is appropriate and adequate for their specific circumstances.[52] However, the IAEA engaged with industry and produced guidance on what may constitute "prudent management practice" in the uranium extraction industry.[53] This level of coordination between the IAEA and the nuclear industry is not common practice, but it could be. A habit of cooperation should be instituted through regular interactions between IAEA and industry, with state support.

Despite the variability in how "effectiveness" can be defined, there is movement on the state level to demonstrate adherence to the CPPNM/A to achieve uniformity in how nuclear security is implemented around the globe. Some of the 102 states party to the convention are already implementing regulatory measures, which demonstrate certain fundamental security principles, such as security culture,[54] as well as compliance with those principles.[55]

It is in industry's self-interest to define what constitutes operational effectiveness, before these elements are defined for them. Operators could develop an operational standard or a management framework that encourages senior managers to embrace the concept of accountability and good governance. Demonstrating adherence to such a standard or framework could be used as a confidence-building tool for the public and other industry stakeholders, including financiers, insurers, and regulators. This could also be demonstrated through public statements, corporate social responsibility reporting, and eventually a transparent peer-reviewed or third-party verification process. Industry could develop guidance through its own networking group, such as the NISGS, or in coordination with civil society groups such as WINS, and could seek IAEA's support in developing a networking mechanism for interested industry leaders and associations.

The Next Move for Industry

While industry has different motives, mandates, and processes than governments, it faces a similar challenge of having to encourage parties to commit beyond the required scope of responsibilities. Industry leaders who attended the NIS represent only a small subset of the global nuclear industry community. Their statements were expressions of intent and represented non-binding recommendations on the nuclear industry complex.

Strong leadership and cooperation are essential for leaders from both industry and participating states to achieve the Summit goals. The transnational and multinational composition of nuclear industry uniquely positions it to make inroads in security efforts where states and international organizations are impeded by diplomatic barriers. Further, this multinational characteristic allows industry to set standards across organizations, where there is consensus to do so.

There is nothing preventing industry from taking on a more proactive role to inspire public confidence in its safety and security programs, and to stay a step ahead of regulatory requirements that stem from the recent passage of the CPPNM/A. Industry should offer to take a leadership role in fulfilling some of the international organizations' action plan goals, as noted above. Industry can identify areas of high risk or high need, e.g., safety-security culture, and work with appropriate stakeholders to develop voluntary guidance or standards where industry could gain benefits from compliance.

Merging Interests: Achieving Coordination Among Summit Stakeholders

Industry is uniquely poised to advance security efforts by supporting the five intergovernmental organizations tasked with continuing the work under the NSS. Below is an analysis of the action plans for these five implementing international organizations, as well as recommendations on ways that these organizations and the nuclear industry could work together to the benefit of all *(see Appendices B and C for a detailed cross-walk of the action plans and potential industry engagement).*

IAEA Action Plan

States participating in the NSS proposed that the IAEA support the sharing of best practices in transport of nuclear and radioactive materials, which the WNTI could lead in collaboration with other relevant industry players. The plan also calls for the IAEA to support states' efforts to move toward non-HEU based production of medical isotopes and to explore financial incentives to make this viable. The plan recommends that the IAEA "take further advantage of the synergies" between nuclear security and safety, which complements the industry summit's recommendations for WANO. Indeed, the IAEA and WANO signed a memorandum of understanding on coordinating safety reviews after the Fukushima incident; this could potentially be expanded to include aspects of security.[56]

The IAEA plan also recommends broad enhancement of nuclear security culture, and indeed the IAEA has a central role in supporting the recently entered into force CPPNM/A that calls for adherence to fundamental security principles, including security culture. This newly amended and expanded convention outlines very broadly some responsibilities of license holders.[57] Industry has a vested interest in taking the lead on further defining some of these areas. With the IAEA plan

IAEA, Vienna, Austria. IAEA IMAGEBANK VIA FLICKR.

calling for expanded IAEA efforts on insider threats and on computer and information security, two areas of critical interest to industry, collaboration should be obvious. But the mechanisms to catalyze these collaborations have yet to be developed.

United Nations Action Plan

The proposed plan calls for better implementation of UNSCR 1540 nuclear security obligations by 2021, and urges countries to make improvements in nuclear and radiological physical protection and security culture. Some of these elements overlap nicely with the actions outlined under the IAEA action plan, as well as the CPPNM/A's fundamental principles. Industry could explore pathways to engage with the 1540 Committee experts to learn how industry in other sectors are helping fulfill 1540 commitments, such as an integrated safety and security culture approach in the biosecurity or chemical industry fields. The 1540 Committee could also benefit from this kind of industry engagement, as outreach to industry is part of its charge.[58]

Countries that could support the implementation of the U.N. action plan include Japan, France, Sweden, and the United Kingdom, who all have 1540 Committee leadership roles that they could use to foster greater cooperation.[59] Australia, Canada, the Netherlands, Norway, and Spain also have been active in the U.N. overall security and development efforts and have sway. The newly-formed Friends of the 1540 Committee allows states, including those not serving on the U.N.

Security Council, to continue to support important 1540 Committee work. The new group, developed under Spain's leadership, could help with the implementation plan.[60]

South Korea's and Germany's continued support for industry outreach to share good export compliance practices via the "Wiesbaden process" and other regional conferences could be coordinated with the NISGS and other appropriate industry groups. The nuclear industry has wanted some regulatory consistency internationally on strategic trade management; NISGS and trade groups could ask the 1540 Experts Committee and other international organizations like the World Customs Organization (WCO) to help facilitate.

Other Action Plans

The Global Partnership action plan intersects with industry in that it proposes to support nuclear security culture, personnel reliability programs, and computer security. The INTERPOL and the GICNT both discuss coordination, expert discussions, and other efforts where industry specialists could join the mix, but without clear directives on collaboration.

All international organization plans generally note that "other relevant organizations and initiatives" should be included, especially regarding information sharing, lessons learned, and good practices. Yet, how industry should be included is not directly addressed. For some organizations, industry associations may have observer status. However, that is a limited role without any formal mechanism for industry input. It may well be up to industry to insert itself and its interests more energetically into key issues. See Appendix B for the 2016 Summit's participating states' recommendations to the five international organizations and possible ways that industry could aid the organizations in effecting these plans and improving international nuclear security.

What Industry Should Do

A network of industry leaders and associations such as NISGS could undertake the following commitments and/or actions:

1. Develop a central hub for international information sharing and collaboration with industry on security issues.

Currently, international industry associations such as WANO, WNTI, and the ISSPA look broadly across safety and security practices in the nuclear sector, with heavy emphasis on safety. Thus, there is a need to develop an industry contingent to assist the five implementing international organizations in strengthening and maintaining the global nuclear security practices. A collaborative organization of industry leaders and associations can represent industry interest in future international nuclear security forums. By gaining industry input, the international organizations can better target their own work, e.g., to support security education and training that is better aligned with industry needs, such as tabletop exercises that reflect industry concerns. In addition, the network could help facilitate regular public outreach and develop and strengthen norms for engagement.[61]

Specifically, a security-focused industry contingent can:

- **Act as the central point of contact between the nuclear industry and the five international organizations to ensure that interests and ideas to improve nuclear security measures and practices are aligned.**
  - Propose a special information exchange meeting among the five international organizations to allow select industry stakeholders to present ideas on how industry can help improve nuclear security.
  - Identify new collaborations for security, e.g., engage national law enforcement along with INTERPOL, to discuss the feasibility of developing a centralized vetting system for background checks for those with access to protected areas and computer system administrator authority.
- **Encourage industry feedback and participation as it relates to activities mentioned in the action plans, including exercises, tabletops, reports, information exchanges, etc.**
  - Facilitate industry participation, as appropriate, in exercises and tabletops since industry serves as the first layer of defense to a security breach in a facility. How industry would interface with law enforcement and emergency responders in an event of an incident within moments is an important skill to hone.
  - Help "translate" how nuclear security and nonproliferation principles benefit industry — may it be power plants, research reactors, or hospitals with radiological sources — protect their operations and grow their bottom line.
  - Engage industry stakeholders working in other critical infrastructures to exchange lessons learned, noting that the nuclear sector may have common ground and could learn from other industry practices.[62]
- **Survey industry stakeholders for their needs and challenges, and communicate this to civil society, the International Network for Nuclear Security Training and Support Centers, existing nuclear security education networks, and other entities when appropriate.**
  - Support the IAEA's central coordinating role on education and support centers by informing IAEA of industry needs for its workforce, both in terms of education as well as training, and nominate industry good practices for sharing, including lessons learned in transport and other areas.
  - Consider ways to have industry assure stakeholders of the demonstrated competence of the industry operators and workforce.
  - Develop a website with controlled access for information sharing on current security practices (i.e., what works and what doesn't) among nuclear industry actors. The appropriate industry associations or a group like NISGS can relay information to the five international organizations or other entities when appropriate.

2. Develop an *industry framework for strong governance on nuclear security* to address issue areas highlighted in the action plans. Encourage industry stakeholders to provide input and consider adoption of the framework.

Several action plans called for participating states to "provide assistance and coordinate programs" for specific nuclear security challenges, including insider threats, computer and information security, and security culture. A lack of international standards contributes to low levels of state implementation in different fields, including nuclear security. The more that industry can do to develop or promote good operating principles or standards where they do not currently exist (or improve them where they do exist), the better. Industry can contribute to this commitment by helping develop an industry-led governance framework outlining how industry actors, especially at the corporate level, can better incorporate and elevate nuclear security into their operational practices to address these security challenges.

Nuclear security governance is an ideal niche where industry can contribute, given that it requires a proactive approach at the operational level to be truly effective. By taking the lead in this area, industry also would have the space to define the most practical and cost-effective model for good governance. Improving nuclear security governance at the operational level would then complement the international and state-level efforts outlined in the action plans. Organizational leaders signing onto a governance framework, for example, could help define this as the de facto industry norm. This could also be offered as industry's "gift basket" to help continue the spirit of the Summits.

Specifically, nuclear industry actors can:

- **Build upon the work of WINS, the Stimson Center, and other NGOs on security governance to establish an industry-led governance framework.**
  See: www.stimson.org/nucleargovernance.
- **Further define elements of the governance framework in specific areas of concern to industry, and as noted in the action plans. This includes:**
  - Defining what could constitute "appropriate effective controls" over materials.
  - Defining what could be acceptable as nuclear licensee performance in terms of security culture, quality assurance, and contingency (emergency) plans, as well as computer and information security.
  - Addressing specific areas of high risk, such as insider threats and transportation.

3. Promote industry discussions with the five organizations on the topic of emerging nuclear technologies/approaches, to explore benefits as well as potential and emerging threats.

Intergovernmental organizations are not as in touch with current technological developments, and industry is not as informed about threat trends. Joint discussions in these areas can benefit all groups. In addition, IAEA tends to be stove-piped in its different functions and would benefit from looking at new technologies more holistically; this would allow industry to better inform IAEA guidance documents that national regulators often adopt.

- **Develop campaigns encouraging industry to contribute technical data that can help the five implementing organizations develop new or refine existing nuclear security resources (i.e., nuclear material signatures for nuclear forensic libraries).**
- **Provide industry input to INTERPOL guidelines and promote industry knowledge of how to support law enforcement in its investigations, including for materials out of regulatory control.**

4. As appropriate, a network of industry leaders and associations like NISGS can support other initiatives of the five organizations.

The implementing institutions have a wide variety of demands with which industry can help, such as the IAEA being asked to facilitate the removal of unused material, and the Global Partnership being asked to explore alternative technologies and end-of-life management for radioactive sources.

- **Inform industry on its liability over materials, including materials no longer used, to thereby persuade better stewardship, use minimization, and the exploration and development of alternative technologies.**
- **Explore development of buy-back programs that could be supported by states or international organizations, but implemented by industry, including industry associations.**

See Appendix C for how these recommendations support the summit-proposed work plans of the five implementing organizations. Different international organizations may engage differently with industry, thus any industry network should be willing to adapt to each organization's requirements in moving forward on some of the institutions' higher-level recommendations.

Conclusion: Collaborating for Security

The 2016 Nuclear Industry Joint Summit Statement called for many ambitious commitments, but the rhetoric must be transformed into action. The promises of state leaders during the Summit process must be realized, not only to protect national security interests but also to improve collective security. This is vital at a time when security threats have jarring effects on global economic and overall political stability. Thus, it is important to mobilize action at the state-level to achieve the commitments under the action plans to support the five international organizations that uphold the nuclear security architecture.

Industry involvement is critical to security. For industry, commitments must make economic sense to sufficiently motivate action. The actions described in this report will not materialize without significant industry commitment, given that the proposed activities will require keen cooperation from industry to be truly effective. Networking different industry associations and leaders together into a group like NISGS could help avoid duplication of efforts. Such a group should leverage the foundational work that the IAEA and other organizations have already accomplished on nuclear security. The outcomes would also be self-serving: Industry engagement on these issues will help not only the five international organizations operationalize the summit imperatives put forth by the participating countries, but also demonstrate industry's commitment to security, assure the public of its vested interest in improving security, and potentially produce operational gains for the industry.

Overall, nuclear industry must continue its support for NISGS, so that it could take a proactive approach towards nuclear security that would not only meet industry commitments under the NIS Joint Statement, but also align with industry operational requirements and business interests.[63]

Effective nuclear management is an interconnected system that requires all aspects of performance, from safety to security, safeguards, and emergency response to coexist; when one falters, they all are affected. In today's world, where the term "nuclear" holds an ambiguous role as a weapon of mass destruction, an essential energy commodity, and a breakthrough medical application, industry has a special responsibility to provide assurances that it is capable of safe, secure, and efficient management of nuclear materials. The security calculus has changed; recognition of industry's leadership role in security and the importance of partnering may have been slow to materialize, but continuing efforts must be supported. Clearly, achieving operational excellence will require a community of cooperation and a collaborative effort.

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Appendix A: Small Modular Reactors

Small reactor designs under construction

NAME	CAPACITY	TYPE	DEVELOPER
KLT-40S	35 MWe	PWR	OKBM, Russia
CAREM-25	27 MWe	Integral PWR	CNEA & INVAP, Argentina
HTR-PM	2x250 MWt	HTR	INET, CNEC & Huaneng, China
ACPR50S	60 MWe	PWR	CGN, China

Small reactors for near-term deployment – development well advanced

NAME	CAPACITY	TYPE	DEVELOPER
VBER-300	300 MWe	PWR	OKBM, Russia
NuScale	50 MWe	Integral PWR	NuScale Power + Fluor, USA
SMR-160	160 MWe	PWR	Holtec, USA
ACP100	100 MWe	Integral PWR	NPIC/CNNC, China
SMART	100 MWe	Integral PWR	KAERI, South Korea
PRISM	311 MWe	Sodium FNR	GE Hitachi, USA
ARC-100	100 MWe	Sodium FNR	ARC, USA
Integral MSR	192 MWe	MSR	Terrestrial Energy, Canada
BREST	300 MWe	Lead FNR	RDIPE, Russia
SVBR-100	100 MWe	Lead-Bi FNR	AKME-engineering, Russia

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Appendix B: States' Requests of Implementing Institutions – and Possible Roles for Industry

Below are the 2016 Nuclear Security Summit's recommended action plans for the international institutions, all as reported in the official texts. Links to all the plans can be found at: http://www.nss2016.org/2016-action-plans/. The right column details some possible roles for industry in facilitating these plans.

GICNT Action Plan

A. Capacity Building	Industry Role
1. Advocate for GICNT activities that promote capacity building across the spectrum of nuclear security challenges to further promote the ability of partner nations to work together to prevent, deter, detect, and respond to nuclear terrorism events.	
2. Increase technical capacity of GICNT partner nations by promoting understanding of critical technical concepts and sharing models for practical implementation of important nuclear security concepts, encouraging and assisting States to undertake measures consistent with relevant legal instruments, national legal frameworks, and IAEA Nuclear Security Series guidance documents.	
3. Build awareness of international resources that are available to partners interested in seeking additional support.	
4. Host exercises, workshops, expert discussions, and other activities that seek to build national capacity of GICNT partners in nuclear security, particularly in the three current focus areas of GICNT: nuclear detection, nuclear forensics, and response and mitigation.	Provide opportunities for industry to participate in exercises, workshops and other activities and to be acknowledged for their participation, including in the governance template.
5. Convene expert meetings to discuss issues and develop GICNT activities in other technical subjects or on cross-disciplinary issues consistent with the GICNT Statement of Principles.	Support governmental and intergovernmental discussions by arranging for industry to contribute to technical discussions and operational issues.
6. Sponsor GICNT activities that provide a forum for partners to exchange information and deepen understanding of a specific technical topic.	As above.
7. Ensure that GICNT activities continue to uplift the dialogue between the technical community and decision-makers.	
B. Cooperation Among Partners	**Industry Role**
1. Actively sponsor and participate in GICNT activities that provide a foundation for cooperation and the exchange of information to flourish among GICNT partners.	
2. Recognize and uplift the efforts of GICNT partners to engage in bilateral, regional or multilateral frameworks.	

3. Ensure activities in the GICNT are conducted with regard to the confidentiality of sensitive information.	
4. Emphasize within GICNT activities mechanisms for engagement between the partners in a nuclear security crisis situation.	Help arrange for industry to participate in crisis management planning as needed.
5. Engage proactively and directly with other GICNT partners to jointly share experiences, mentor, and collaborate on nuclear security issues.	As above on coordinating industry's input.
6. Work bilaterally or multilaterally to plan and implement GICNT meetings, workshops and exercises that recognize and demonstrate opportunities for cooperation in nuclear security.	As above on coordinating industry's input.
7. Ensure that subject matter experts from relevant organizations participate in GICNT activities and encourage a cross-disciplinary dialogue and exchange of expertise, to include representatives of law enforcement, emergency management, customs, border security, public health, regulatory agencies, industry as well as the technical/scientific communities and national laboratories.	Establish a central point of contact to communicate with industry both globally and across industry sectors.
8. Share information on and reports from national and multilateral activities in nuclear security within the GICNT as appropriate.	
C. Scenario-based Discussions, Tabletop exercises, and Field Exercises	**Industry Role**
1. Host activities under the auspices of GICNT that promote experiential (scenario-based) practice of nuclear security principles and guidance documents through expert-level scenario-based discussions, tabletop exercises, and field exercises.	Coordinate industry input to efforts, per above.
2. Host and support GICNT activities that promote the cross-disciplinary exchange of expertise and practices among key communities of nuclear security experts (e.g., detection, forensics, law enforcement, and response experts).	As operators are the first responders, ensure appropriate operator inclusion in activities.
3. Convene groups of technical experts, policy experts and decision-makers for in-depth analysis of issues and discussions of practical implementation of IAEA Nuclear Security Series guidance documents and scenario-based practice through tabletop exercises and field training exercises.	As above.
4. Host cross-disciplinary tabletop exercises, under the coordination of the GICNT's Implementation and Assessment Group that encourage the exchange of experiences and expertise among the key communities of nuclear security experts.	Promote appropriate industry participation in exercises.
5. Host exercises in coordination with partner nations to examine and demonstrate mechanisms for bilateral coordination.	
6. Invite other nations and official observers to observe national exercises and report on national exercises to the GICNT partners.	
7. Participate in GICNT activities that intentionally build partners' capacity to develop and implement national-level exercises.	
8. Build GICNT activities and exercises to increase level of technical depth or otherwise ensuring such activities become progressively more challenging and informative for partner nations.	
9. Leverage important lessons learned and conclusions from each exercise or workshop to enhance subsequent events and the overall strategic plan of the GICNT.	Develop own lessons-learned document for industry.

D. Coordination and Collaboration	Industry Role
1. Promote coordination and collaboration between GICNT and relevant international institutions and initiatives to support nuclear security capacity building.	
2. Ensure that the activities of the GICNT support and complement the work of the five official observers of GICNT (the IAEA, INTERPOL, the UN Office on Drugs and Crime (UNODC), the European Union, and the United Nations Interregional Crime and Justice Research Institute (UNICRI)) as well as other relevant organizations and initiatives in coordinating sharing, lessons learned, good practices, guidance and resources, recognizing the central coordination role of the IAEA, and including active participation of relevant GICNT officials in IAEA-hosted Information Exchange Meetings.	Become the official hub for international information sharing with industry.
3. Incorporate the IAEA nuclear security guidance and highlight applicable training resources and other tools within GICNT activities and workshops.	
4. Convene workshops or experts meetings to highlight the critical importance of the legal framework in support of nuclear security, to uplift IAEA, UNODC and other available training on the legal framework pertaining to nuclear security.	Work with multiple stakeholders, including legal teams and NGOs, to highlight the benefits of appropriate national laws and regulations and industry input into these and its own development of norms and standards.
5. Conduct workshops that underscore partners' lessons learned in practical implementation of nuclear security guidance, in coordination with other international institutions.	As above.
6. Report outcomes and lessons learned to all stakeholders.	As above.
7. Ensure regular dissemination of technical documents and reports and products of GICNT activities to other cognizant international organizations.	And to industry as relevant.
8. Coordinate with other international organizations, including through the IAEA Information Exchange Meetings, to recognize and uplift efforts of GICNT partners to engage in scenario-based dialogue and discussion of key nuclear security challenges and to review and implement lessons learned.	As above.
9. Encourage GICNT collaboration with other expert communities such as industry, the medical community and scientific research institutions, by inviting experts from these communities to participate in GICNT events as appropriate, to further identify practical measures, tools and resources available to countries seeking to build or improve national capacity in specific areas of nuclear security related to combating nuclear terrorist threats.	Become the official hub for international information sharing and collaboration with industry.

Global Partnership Action Plan

A. Focused Areas of Coordination and Funding in Nuclear and Radiological Security	Industry Role
ENHANCEMENT OF NATIONAL NUCLEAR SECURITY REGIMES	
1. Provide assistance to and coordinate programs and activities on the development of Nuclear Security Culture and Personnel Reliability Programs.	Develop the governance template to expand on security culture, and personnel reliability.
2. Provide assistance to and coordinate their programs and activities towards reducing insider threats.	Expand in the governance template on insider threats.
3. Provide assistance to and coordinate programs and activities on strengthening measures of transportation security and the sharing of good practices and lessons learned among the relevant industries and Centers of Excellence (COEs) working on transportation of nuclear material, without detriment to the protection of sensitive information.	Work with WNTI and others to develop lessons learned.
4. Provide assistance to and coordinate programs and activities on enhancing nuclear security, exploring the development of alternative technologies, and end-of-life management for radioactive sources – especially high activity ones.	Work with ISSPA and others to develop end-of-life alternatives including possibly buyback programs and delivery assistance. Develop industry advisory group to consult on proliferation and security implications of alternative technologies.
5. Provide assistance to and coordinate programs and activities on enhancing computer security, supporting the use of the IAEA Implementing Guide on Security of Nuclear Information by States and conducting scientist engagement, which is one of the priority areas of the Global Partnership.	Further develop governance template in area of cyber security.
6. Provide assistance to and coordinate programs and activities on training centers / COEs and in doing so, work collaboratively with the IAEA International Network for Nuclear Security Training and Support Centres.	Assist process by surveying industry stakeholder for their needs and conveying this to the center, COEs and support centers. Consider developing a model for accreditation of nuclear security programs and training.
7. Provide assistance to and coordinate programs and activities that implement the actions of the Gift Basket on Nuclear Security Training and Support Centres / COEs.	As above for template and accreditation of training, plus consider developing an information- sharing mechanism to rate TSOs and share assessments.
8. Provide assistance to and coordinate programs and activities on support for equipment and maintenance of nuclear security systems, as well as the advice on the implementation of the IAEA's guidance document INFCIRC/225/Rev. 5.	Incorporate guidance from 225 Rev. 5 in template.
9. Provide assistance to and coordinate programs and activities on the development of awareness training and exercise efforts for countering nuclear smuggling focused on interior law enforcement and emergency management personnel. Such assistance would also address sharing information and new technologies to enhance enforcement capacity of customs and border personnel, collaborating with INTERPOL.	Share information on new technologies relevant to emergency management and other functions.

NUCLEAR FORENSICS	
10. Provide assistance to and coordinate programs and activities on strengthening nuclear forensics capacities by ways of, inter alia, exchange of experts and support for upgrading capacities of nuclear forensics, collaborating with other international initiatives such as the GICNT.	Explore the use of taggants in nuclear industry, especially relating to HEU and PU [see proceedings from the Joint Committees on the Future of the Nuclear Security Environment in 2015].
DISPOSITION AND CONVERSION OF NUCLEAR MATERIALS	
11. Provide assistance to and coordinate programs and activities on the safe, secure and timely consolidation of nuclear materials inside countries, removal of such material to other countries for disposal, down-blending HEU to LEU, converting plutonium to mixed oxide (MOX) fuel, reducing stockpiles of separated plutonium, and minimizing HEU, where technically and economically feasible.	
B. Geographic Focus Area	**Industry Role**
1. Consider risks that may result in nuclear and other radioactive material, goods or devices falling into malicious hands, or where malicious actors may attack sensitive facilities or transports.	
C. Global Partnership Engagement	**Industry Role**
STRENGTHENING GLOBAL PARTNERSHIP MATCHMAKING	
1. Advocate the organization of at least one assistance matchmaking event a year. Organizers are expected to align project proposals with Global Partnership priorities, share proposals in advance of meetings, and allot time in the Global Partnership Working Group (GPWG) meetings for presentation and discussion of the proposals.	
2. Advocate for the Global Partnership to work with the UNSCR 1540 Group of Experts to develop a process for matching resources with UNSCR 1540 requests.	
3. Advocate for the Global Partnership to work with the IAEA on matching Global Partnership donors with requesting states to respond to gaps or needs 4 as identified through IAEA Integrated Nuclear Security Support Plan (INSSP) missions.	
STRENGTHENING COOPERATION WITH OTHER INTERNATIONAL FORA	
4. Advocate for the Global Partnership to cooperate with the UN, the IAEA, INTERPOL and, when suitable, other relevant organizations and initiatives such as the GICNT, in coordinating information sharing, lessons learned, good practices, guidance and resources, recognizing the central coordination role of the IAEA, including active participation of relevant Global Partnership representatives in IAEA-hosted Information Exchange Meetings so that the activities of the Global Partnership support and complement the work of other international organizations and initiatives.	Note that IAEA has the Global Nuclear Safety and Security Network for information sharing, and the Unified System for Information Exchange for International Nuclear and Radiological Event Scale (INES).

5. Advocate for the Global Partnership to strengthen its ties with other international organizations and initiatives that support nuclear and radiological security. These fora, most of which are represented at Global Partnership meetings, include the UNSCR 1540 Committee, the United Nations Office for Disarmament Affairs (UNODA), and the United Nations Office on Drugs and Crime (UNODC), the United Nations Institute for Disarmament Research (UNIDIR), the WCO, and the European Union (EU).	Be the industry point of contact at these meetings.
EXPANDING MEMBERSHIP	
6. Continue to advocate for the Global Partnership to expand its membership, particularly from regions not well represented.	
RAISING THE PROFILE WITH GP LEADERS, INCLUDING G7 LEADERS	
7. Seek opportunities to continue to engage GP leaders, including G7 leaders, on nuclear security.	
PROMOTING THE WORK OF THE GLOBAL PARTNERSHIP IN NUCLEAR SECURITY	
8. Advocate for the Chair of the Global Partnership to widely distribute the Global Partnership Annual Report beyond Global Partnership members to include other States and relevant international organizations.	Distribute report to industry so that industry can share ideas for security with their country and international org reps.
9. Advocate that, where applicable, all Global Partnership members include the report and other references to nuclear security achievements of the Global Partnership on their own websites and other relevant media.	
DEVELOPING A RAPID FUNDING RESPONSE CAPABILITY	
10. Advocate for the Global Partnership members, whenever possible, to rapidly respond to unanticipated nuclear and radiological security situations by providing assistance to and coordinating their nuclear and radiological programs and activities to address those situations.	
ENHANCING ACCOUNTING OF ASSISTANCE FUNDING FOR NUCLEAR SECURITY	
11. Advocate for the Global Partnership to develop a more standardized process for accounting for the non-sensitive data submitted to the Chair of the Global Partnership for the annual Global Partnership Annex of financial and in-kind expenditures on nuclear and radiological security.	

IAEA Action Plan

A. High Level Support for IAEA's Nuclear Security Activities	Industry Role
1. Support the IAEA to continue convening regular ministerial meetings on nuclear security to promote political commitment, enhance awareness and keep momentum on strengthening the global nuclear security architecture and achieving high standards of nuclear security in all States, and to participate in such meetings at a high level.	Hold official side meetings to ministerial meetings to help inform IAEA and ministers' discussions.
2. Advocate for the IAEA to continue to develop and implement its Nuclear Security Plans to address current and emerging nuclear security issues.	Highlight potential activities where IAEA and industry stakeholders can work together, e.g., supplier certifications, contract guidelines, for the benefit of industry security.
3. Contribute effectively to the implementation of the IAEA Nuclear Security Plan, including through reliable and sufficient resources.	
4. Provide the appropriate political, technical and financial support and continue to contribute, on a voluntary basis, to the Nuclear Security Fund.	Provide technical expertise through international associations, e.g., WANO, IGORR, WNTI, WINS.
5. Enhance the importance of nuclear security within the IAEA and achieve a suitable balance between the IAEA's nuclear security program and nuclear safety program thereby making them more effective and efficient and taking advantage of synergies between the respective programs.	Provide input to future revisions of the GS-R-3 integrated management approach to allow it to be more integrated, as now it gives minimal guidance to security.
B. Coordination Role of the IAEA	**Industry Role**
1. Advocate for the IAEA to continue its leading role in coordinating international nuclear security activities, and to encourage continued interaction with relevant institutions and other international initiatives in order to enhance cooperation and avoid duplication and overlap of activities.	
2. Advocate for the IAEA to continue organizing on a regular basis Information Exchange Meetings with other relevant international nuclear security institutions and initiatives, including the United Nations, INTERPOL, Global Initiative to Combat Nuclear Terrorism (GICNT) and the Global Partnership.	Help further these goals through outreach to international industry associations and participation in these meetings.
3. Advocate for the IAEA to coordinate the cooperation and complementary activities between Centres of Excellence (COEs) and other relevant centres, including through the Nuclear Security Support Centre (NSSC) and International Nuclear Security Education Networks, to promote their sustainability.	Inform the security support centers and education networks of industry in order to ensure that the activities of the training and education institutions are best targeted to meet market needs.
4. Advocate for the IAEA to develop for COEs/NSSCs a process for sharing good practices, requesting peer review and harmonizing of their course content on the basis of the Nuclear Security Series.	Nominate good training practices to inform the centers, working through industry associations.
5. Support regional networks on nuclear security in conjunction with the IAEA.	

C. Convention on the Physical Protection of Nuclear Material (CPPNM) and its 2005 Amendment	Industry Role
1. Encourage the earliest possible entry-into-force of the amended CPPNM and seek its universalization. - Participating States that have ratified the 2005 Amendment to the CPPNM commit to, together with the IAEA, reach out to and encourage all States that have not yet done so to deposit their instrument of ratification, acceptance or approval as a matter of urgency."	
2. Advocate for the IAEA to play a central role in assisting States Parties in the implementation of the CPPNM and its 2005 Amendment, including States Parties informing the IAEA of their laws and regulations in accordance with Article 14.1 of the Convention.	Lead in developing a governance template that can be built out to demonstrate licensee compliance with the principles of the CPPNM that apply to them, i.e., quality management, security culture, emergency response, physical security, graded approach.
3. Advocate for the IAEA to continue to organise and support regular meetings of CPPNM Points of Contact to support and promote their active engagement and to further facilitate the implementation of CPPNM and its 2005 Amendment, including the sharing of good practices.	Further develop the CPPNM principles' application. Highlight to IAEA and CPPNM Points of Contact those licensees who are demonstrating compliance with the principles and their levels of compliance.
4. For States Parties to the CPPNM, advocate for the Director General of the IAEA, in his or her role as depositary, to convene regular review conferences, as provided for in Article 16.2 of the Convention, further to the conference to be convened by States Parties after the entry into force of its 2005 Amendment.	Assist in the review conferences by reporting on the above.
D. Provision of Guidance	**Industry Role**
1. Advocate for the IAEA to continue its central role to develop guidance documents on nuclear security, in particular through the Nuclear Security Series, and – meet the intent of the Fundamentals and Recommendations contained in these documents; – share experiences on the implementation of nuclear security guidance; – support the development of the nuclear security guidance in accordance with the Roadmap agreed by the Nuclear Security Guidance Committee; – take further advantage of the synergies between nuclear security and nuclear safety while acknowledging the distinctions between the two areas; and – use IAEA guidance to expand efforts to strengthen preventive and protective measures against insider threats at nuclear facilities, including through the use of nuclear material accountancy and control systems.	Industry committed to "effectively securing all nuclear and radiological materials in industrial facilities and applications" – without defining what is effective, which is the hard part, although International Atomic Energy (IAEA) guidance documents will in part inform what is effective. - While not binding in any sense, this industry commitment can be viewed as an incremental step beyond IAEA's purely voluntary guidance in the quest for nuclear security "standards."
2. Advocate for the IAEA to continue developing and updating the existing guidance, including through the Nuclear Security Series, for the management of radioactive sources, complementing the guidance in the Code of Conduct on the Safety and Security of Radioactive Sources, and assisting States in implementing such guidance.	Take the lead in developing and updating guidance by such groups as ISSPA being champions for the development of voluntary consensus standards, possibly working through a country or countries' or industry's standards development organization.

E. IAEA Services for States	Industry Role
1. Use the IAEA's extensive nuclear security services and to make available experts to the IAEA to carry out these services, including the International Physical Protection Advisory Service, International Nuclear Security Advisory Service, nuclear security training, exercises, education and workshops. Furthermore Participating States advocate for the IAEA: – continue to use Integrated Nuclear Security Support Plans to assist States' efforts to establish effective and sustainable national nuclear security regimes. – share good practices and lessons learned resulting from using its nuclear security services and to improve these services to reflect current international instruments, standards and guidance; and – continue seeking opportunities for greater advocacy and outreach to Member States on nuclear security and its nuclear security services.	Note that some industry experts have been constrained from participating in peer reviews because their governments have deemed their knowledge-sharing as falling under export controls. How can industry help rectify this issue?
2. Undertake IAEA review and advisory missions of nuclear security periodically and – take into account the resulting recommendations; – make review and advisory services complementary to States' national review arrangements; – communicate more generously the results of missions in such manner that this does not compromise the confidentiality of sensitive information; – contribute to the pool of experts available to the IAEA's review and advisory missions; and – assist the IAEA in drawing lessons from how international organizations and States carry out review and advisory services in other comparable areas.	Consider lessons learned from aviation and maritime and other critical sectors and provide to IAEA.
3. Advocate for the IAEA to use Coordinated Research Projects and working groups to tackle emerging nuclear security issues and disseminate the results and to facilitate the implementation of key nuclear security activities.	
4. Use information sharing mechanisms managed by the IAEA to build domestic, regional and international confidence in the effectiveness of national nuclear security regimes.	
F. Nuclear Material	**Industry Role**
1. Work with the IAEA to minimize the use of HEU, where technically and economically feasible, through the conversion of reactor fuel from HEU to LEU and the development and qualification of LEU fuels for high performance research reactors.	
2. Advocate for the IAEA to support Member States' efforts to further develop, promote and use non-HEU-based technologies for the production of medical radioisotopes, including through the exploration of financial incentives that may contribute to the overall goal of long-term economic sustainability.	Help prompt industry interest in contributing to the urgency of conversion by demonstrating to licensees the potential liabilities from sabotage or diversion of materials.

3. Advocate for the IAEA to support efforts to maintain an assured and reliable supply of medical isotopes.	
4. Advocate for the IAEA to support States' efforts to keep their stockpiles of separated plutonium to the minimum level, consistent with their national requirements.	
5. Advocate for the IAEA to expand efforts to facilitate the removal and disposition of nuclear material from facilities no longer using them.	Help prompt industry interest in contributing to urgency of removal by demonstrating to licensees the potential liabilities from sabotage or diversion of materials.
G. Transport	**Industry Role**
1. Advocate for the IAEA to increase attention given to the security of nuclear and other radioactive material in transport, including by: – producing guidance documents and facilitating associated exercises, training and capacity building activities; and – organizing the sharing of good practices and lessons learned from transporting nuclear and other radioactive material, among Member States, relevant industries and COEs/NSSCs, while protecting sensitive information.	Organize a "lessons learned" portal to compliment industry's current efforts with a larger expansion into security. Actively solicit information on incidents or "near misses" to produce a "don't let this happen to you" regular report that will help sustain interest in security.
H. Response to Nuclear Security Events	**Industry Role**
1. Advocate for the IAEA to increase attention given to the response to nuclear security events by: – producing guidance documents and facilitating associated exercises, training and capacity building activities; – organizing the sharing of good practices and lessons learned, while protecting sensitive information."	Help promote good practices by sharing industry lessons learned.
I. Radioactive Material	***Industry Role***
1. Implement the IAEA's Code of Conduct on the Safety and Security of Radioactive Sources, if not yet done so, and to follow its Supplementary Guidance.	Adapt the governance template that is currently focused on CPPNM to apply to the Code of Conduct.
2. Advocate for the IAEA to promote and facilitate technical exchanges of experience, knowledge and good practices on the use and security of high activity radioactive sources and the exploration of alternative technologies.	
3. Advocate for the IAEA to facilitate further cooperation among suppliers and users of radioactive sources on management of radioactive sources no longer in use.	Work with ISSPA and others in industry to help support this.
J. Nuclear and Other Radioactive Material Out of Regulatory Control	**Industry Role**
1. Advocate for the IAEA to strengthen national nuclear detection capabilities and architectures by developing guidance, training, workshops and exercises, facilitating the exchange of good practices and providing a forum for discussion and cooperation.	

2. Strengthen information-sharing on incidents involving nuclear or other radioactive material, especially through the IAEA Incident and Trafficking Data Base.	
K. Nuclear Security Culture	**Industry Role**
1. Enhance the practice of nuclear security culture such that it is infused into all elements of national nuclear security regimes.	Look for best practices including in other industries in developing good culture and leadership models and advocate for their adoption by operators.
2. Advocate for the IAEA to increase its assistance to States to develop and foster nuclear security culture, including through published guidance and related self-assessment and training materials.	Build out of governance template per above.
L. Nuclear Forensics	**Industry Role**
1. Advocate for the IAEA to advance and sustain States' nuclear forensics capabilities, including through building upon the expertise of the Nuclear Forensics International Technical Working Group, by developing guidance documents, promoting international nuclear forensics cooperation, sharing experiences and knowledge, and supporting the development of national nuclear material databases or national nuclear forensics libraries.	Consider supporting industry use of taggants in nuclear materials.
M. Computer and Information Security	**Industry Role**
1. Work with the IAEA to raise awareness of the threat of cyber attacks with potential impacts on nuclear security and promote computer and information security with regard to nuclear and other radioactive material and associated facilities.	Develop a guidance document for industry that can become a graded standard, e.g., a buildout of the governance template. This would be based on existing IAEA guidance (and current Chatham House effort), but also take into account other industry, regulator, and national best practices.
2. Advocate for the IAEA to produce guidance and training, to address information security and the threat of cyber attacks against nuclear and other radioactive material and associated facilities.	As above.
3. Advocate for the IAEA to develop a proposed methodology for the reporting by Member States of incidents associated with cyber or computer security attacks on nuclear or radiological facilities, while ensuring the protection of sensitive information.	Develop a safe harbor standard document that States can use to encourage reporting.
4. Advocate for the IAEA to coordinate research and information exchange to promote resilience against cyber attacks, guidance for computer security regulations for the nuclear domain, and develop methods to foster and sustain computer expertise for nuclear security.	See 1 and 2.
5. Advocate for the IAEA to develop guidance on maintaining confidentiality, integrity and trustworthiness of information pertaining to nuclear or other radioactive material encountered outside of regulatory control.	Be involved in these IAEA discussions, including to ensure operator ability to implement.

INTERPOL Action Plan

A. Operational Data Services and Information Sharing	Industry Role
1. Facilitate transnational information exchange between law enforcement agencies and, when relevant, nuclear security institutions on criminal and terrorist offences and threats involving nuclear or other radioactive materials, associated facilities and activities; and strengthen information sharing mechanisms consistent with the INTERPOL Member Countries' national laws and procedures.	With support of national authorities, operators can be encouraged to dual report incidents to states and INTERPOL.
2. Share information on terrorist and other criminal offences and threats involving nuclear and other radioactive material, their perpetrators, associated facilities and activities.	As Above.
3. Promote further INTERPOL cooperation with the IAEA to ensure effective international coordination between law enforcement and technical communities responsible for nuclear security and countering nuclear and radiological trafficking. INTERPOL could actively encourage Member Countries to supply complementary law enforcement information about Incident and Trafficking Data Base cases through INTERPOL's National Central Bureaus and its secured global communication network I-24/7, consistent with the established procedures approved by the governing bodies of the two organizations.	
4. Advocate for INTERPOL to assist Member Countries by providing access to the INTERPOL databases for broader national law enforcement services, including border guard structures.	Consider establishing a centralized vetting system with Interpol for best practices in background checks and for Interpol to assist in these checks, e.g., for those with access to protected areas, for developers/suppliers of key components, and for computer system administrators.
5. Advocate for INTERPOL to cooperate with the UN, the IAEA, the GICNT, the Global Partnership and, when suitable, other relevant organizations and initiatives in coordinating information sharing, lessons learned, good practices, guidance and resources, recognizing the central coordination role of the IAEA, including active participation of relevant INTERPOL officials in IAEA-hosted Information Exchange Meetings in order that the activities of INTERPOL support and complement the work of other international organizations and initiatives.	
B. Support to Investigations and Operations	**Industry Role**
1. Enhance INTERPOL's capacity to support multinational investigations of terrorist and other criminal offences involving nuclear or other radioactive material including Operation Fail Safe and facilitating effective prevention, detection, response to, and investigation of, nuclear and radiological offences and the prosecution of offenders.	Industry associations can help distribute communications to members on Operations Fail Safe target individuals.
2. Advocate for INTERPOL to provide assistance to Member Countries to enhance the capability for monitoring and tracking of persons with a known history of involvement in illicit trafficking of nuclear or other radioactive material.	

3. Advocate for INTERPOL to provide support to ongoing multinational investigation of terrorist and other criminal offences involving nuclear or other radioactive material. This could be achieved through facilitating the exchange of law-enforcement-sensitive information relevant to ongoing investigations.	
4. Advocate for INTERPOL to strengthen its efforts in countering radiological and nuclear threats through the enhancement of coordination among the RNTPU and the other INTERPOL counter-terrorism and border management specialized units.	
5. Advocate for INTERPOL to identify good practices relating to existing national law enforcement capacities and technical resources to respond to the terrorist and other criminal offences involving nuclear and other radioactive material and authorize INTERPOL to make this information available to all Member Countries through a dedicated database.	
6. Advocate for INTERPOL to identify national law enforcement points of contact within the INTERPOL's National Central Bureaus who may be contacted in the case of terrorist and other criminal offences involving nuclear and other radioactive material.	Establish and communicate to industry a known point of contact in country and, by agreement, in INTERPOL for industry to confidentially share reporting of offenses.
C. Capacity Building	**Industry Role**
1. Support INTERPOL's building of multidisciplinary and cross agency capacity through training and exercises to prevent and respond to the terrorist and other criminal offences involving nuclear or other radioactive material, including by developing and providing training resources and good practice guidance to the law enforcement community.	Work with industry associations to support development of good practice guidance and industry participation in exercises and training as appropriate.
2. Advocate for INTERPOL to develop and provide capacity building activities to national law enforcement agencies with regard to the illegal acquisition, possession, trafficking or other illicit use of nuclear or other radioactive material.	
3. Advocate for INTERPOL to work with the IAEA and when suitable, other relevant institutions, on assisting States to develop comprehensive national plans for responding to terrorist and other criminal offences involving nuclear or other radioactive material, and to organize field simulations and exercises.	
4. Advocate for INTERPOL to hold workshops and conferences to raise awareness of the threat of illicit trafficking of nuclear and other radioactive material and promote stronger interagency and international cooperation to respond to terrorist and other criminal offences involving nuclear and other radioactive material.	
5. Advocate for INTERPOL to develop and execute joint operations with relevant national government agencies to detect and deter illicit trafficking of nuclear or other radioactive material.	
6. Advocate for INTERPOL to work with Member Countries to regularly assess the existing INTERPOL guidelines in the field of preventing and combating terrorist and other criminal offences involving nuclear or other radioactive material, identify possible gaps and promote good practices through non-binding recommendations.	Provide industry input to guidelines to ensure they are best structured to be implementable by operators.

7. Advocate for INTERPOL to document and share case studies that demonstrate good practices for successful investigations, seizures, arrests, and prosecutions of radiological and nuclear material trafficking cases, taking into account the different national standards for investigations and prosecutions across the spectrum of INTERPOL Member Countries.	Provide information to industry on best practices for managing incidents, including with classified or confidential information, in order to ensure successful investigations, seizures, arrests and prosecutions.
8. Advocate for INTERPOL to develop and leverage existing e-learning modules to enable widely accessible law enforcement training for nuclear security.	
9. Advocate for INTERPOL to publish from a law enforcement perspective a comprehensive study of scams and hoaxes involving illicit trafficking of purported nuclear or radioactive material to help inform Member Countries and provide lessons learned, including to provide a more measured response to such events in the interest of preserving limited response assets and capabilities.	
D: Support for Nuclear Security Within INTERPOL	**Industry Role**
1. For those in a position to do so, generate and provide additional funding and other resources from Member Countries, including support for additional staff, to support INTERPOL RNTPU programs and activities.	
2. Advocate for INTERPOL to consider strengthening the activities of the CBRNE Sub-Directorate with a view to increasing its capacity to provide law enforcement guidance, training, and capacity building for prevention, detection and responding to criminal and terrorist related offences involving nuclear or other radioactive material.	

United Nations Action Plan

A. National Implementation	**Industry Role**
1. Step up efforts to implement in full UNSC Resolution UNSCR 1540 nuclear security obligations by 2021 as referenced in UNSC Presidential Statement of 2014.	Can assist 1540 efforts by helping to define "appropriate domestic controls" through the governance template's expansion on issue of physical security.
2. Submit voluntary reports on national implementation of UNSCR 1540 to the 1540 Committee.	
3. Use the opportunity offered by the 2016 Comprehensive Review of UNSCR 1540 to enhance its implementation and support the 1540 Committee and its Group of Experts.	
4. For States Parties to ICSANT, implement in full their obligations under the ICSANT as soon as possible. [International Convention for the Suppression of Acts of Nuclear Terrorism].	
5. For States Parties to ICSANT, seek to convene through an UNGA resolution, a high-level meeting of ICSANT States Parties in 2017 to review implementation of the ICSANT on the occasion of the 10th anniversary of its entry into force.	
6. Implement in full the nuclear security-related commitments and obligations of all relevant UN General Assembly and Security Council resolutions.	

7. Advocate for reviews of implementation of all relevant UN resolutions and instruments relating to nuclear and radiological security by the relevant UN body, with the aim of broadening awareness and strengthening effective implementation.	
B Assistance	**Industry Role**
1. For those in a position to do so, support the provision of adequate assistance, including contributions in kind, to requesting States for implementing UNSCR 1540, ICSANT and relevant UN resolutions and instruments, which could include: • making responding to such requests a priority in national and international assistance programs; • supporting efforts by the 1540 Committee and among States to fully utilize and further improve the system of "match-making" between assistance requests and potential sources of support; • providing technical expertise and funding to answer specific assistance requests; • providing assistance in developing relevant legislation; • funding support, where applicable, for regional/sub-regional capacity building events including those sponsored by regional organizations; • funding and/or training of national Points of Contact and regional/sub-regional coordinators on UNSCR 1540; • providing relevant equipment and transferring technology; • funding programs to secure or safely dispose of disused radioactive sealed sources and recover sources out of regulatory control; • providing assistance to improve the physical protection of nuclear and other radioactive material; • providing assistance to strengthen customs and border control of nuclear and other radioactive material; and • providing assistance to improve nuclear security culture.	Develop a program with ISSPA to secure and safely dispose of disused sealed sources and to provide market incentives to recover sources out of control.
2. Share information on effective practices, assistance tools and technologies -- for example, model legal frameworks and e-learning modules -- with the 1540 Committee.	
3. For those in a position to do so, pledge additional resources to the UN Trust Fund for Global and Regional Disarmament Affairs managed by UNODA, ideally in the form of regular contributions dedicated to implementing Resolution 1540, with an aim to meet increasing demand, noting the voluntary nature of these contributions.	
4. For those in a position to do so, support/fund UNODC's activities and programs to promote the ratification and effective implementation of ICSANT.	
C. Coordination and Cooperation	**Industry Role**
1. Participate actively in the formal Points of Contact network on UNSCR 1540 as outlined in UNSCR 1977(2011).	
2. For States Parties to ICSANT, conduct consultations with one another to share information and good practice to support effective implementation.	

3. Advocate for enhanced coordination on nuclear security among all relevant parts of the UN system, including various Security Council Committees and the Secretariat entities, according to their respective mandates. Support cooperation among the UN and the IAEA, INTERPOL, GICNT, and the Global Partnership, and, when suitable, other relevant organizations and initiatives, in coordinating information sharing, lessons learned, good practices, guidance and resources, recognizing the central coordination role of the IAEA, including active participation of relevant UN officials in IAEA-hosted Information Exchange Meetings in order that the activities of the UN support and complement the work of other international organizations and initiatives.	Be the point of contact for industry involvement in meetings as appropriate and for general information exchange.
D. Outreach	**Industry Role**
1. Conduct targeted outreach, focusing in particular on non-reporting States, on the obligations inherent in UNSCR 1540, combined with offers of assistance.	Conduct outreach to industry to help States fulfill the obligations of 1540 in terms of: complying with imperative for "appropriate effective controls" over related materials; informing industry of its obligations regarding nonproliferation (see below); and supporting the work of related treaties, such as the amended CPPNM, on nuclear licensee performance in the first instance in terms of security culture, quality assurance, and contingency (emergency) plans.
2. For States Parties to ICSANT, encourage states that have not yet done so to become States Parties, and conduct targeted outreach to promote the merits of ICSANT ratification as a matter of urgency, combined with offers of assistance.	
3. For States Parties to ICSANT, offer States that have signed or ratified ICSANT assistance to implement their obligations fully as soon as possible.	
4. Highlight and promote the outcomes of the NSS to the 1540 Committee and UNGA to mobilize broader political support and momentum for nuclear security among all UN Member States.	
5. Lead and support ongoing outreach activities to States, parliamentarians, civil society, industry, academia and scientific/technical experts about UNSCR 1540, ICSANT and other UN nuclear security activities.	Take the lead in helping industry to understand its nonproliferation obligations as they relate to nuclear materials, technologies and knowledge transfer.

Appendix C: Recommendations for Industry to Support the Five Nuclear Security Summit International Organizations

Cross Reference Appendix B: States' Requests of Implementing Institutions

1. Develop a central hub for international information sharing and collaboration with industry on security issues. This would support the following language found in the five action plans:

IAEA

- **A1, A2, A4.** Support and contribute to developing and implementing IAEA's Nuclear Security Plans.
- **B2, B3, B4.** Organize information exchanges, cooperate with other relevant centers, and develop a process for sharing good practices, e.g., among various education and training centers.
- **D1, D2.** Focus on developing new, and updating existing, guidance documents on nuclear security.
- **F5, I3.** Focus on expanding efforts to facilitate the removal and disposition of nuclear material from facilities no longer using them, and facilitate further cooperation among suppliers and users of radioactive sources on management of materials.
- **G1, H1.** Organize the sharing of good practices and lessons learned from transporting nuclear and other radioactive material, as well as response to nuclear security events.

INTERPOL

- **A1, A2, A3.** Facilitate transnational information exchange and ensure cooperation with technical communities.
- **A4.** Provide access to the INTERPOL databases for broader national law enforcement services.
- **B1, C1.** Support training and exercises to prevent and respond to offenses.
- **C1, C6, C7.** Assess INTERPOL guidelines and documents, and share case studies of good practices.

GICNT

- **A5, A6.** Convene meetings and develop GICNT activities that focus on technical subjects or cross-disciplinary issues consistent with the GICNT Statement of Principles.
- **B5, B7.** Engage with other GICNT partners, representatives of emergency response, law enforcement, customs, border security, public health, regulatory agencies, and industry, as well as the technical/scientific communities and national laboratories in order to share experiences and collaborate on nuclear security issues.
- **C1, C2, C3, C4, C9.** Host scenario-based discussions, tabletop exercises, and field exercises that promote the cross-disciplinary exchange of expertise and practices among key communities of nuclear security experts.
- **D2, D5, D6, D7, D8, D9.** Promote coordination and collaboration between GICNT and relevant international institutions and initiatives to support nuclear security capacity building, sharing, lessons learned, good practices, guidance, and resources.

GLOBAL PARTNERSHIP

- **A6.** Coordinate programs and activities on training centers/COEs and in doing so, work collaboratively with the IAEA International Network for Nuclear Security Training and Support Centres.
- **C4, C5.** Coordinate information sharing, lessons learned, good practices, guidance and resources, recognizing the central role of the IAEA. Strengthen ties with other international organizations and initiatives that support nuclear and radiological security.

UNITED NATIONS

- **C3.** Support cooperation among other implementing institutions and, when suitable, other relevant organizations and initiatives in coordinating information sharing, lessons learned, good practices, guidance and resources, recognizing the central coordination role of the IAEA.
- **C5.** Lead and support ongoing outreach activities to civil society, industry, academia, and scientific/technical experts about UNSCR 1540, ICSANT and other U.N. nuclear security activities.

2. Develop an industry framework for strong governance on nuclear security to address issue areas highlighted in the action plans, and encourage industry stakeholders to provide input and consider adoption. This would support the following action plan items:

IAEA
- **C2, C3, C4.** Further facilitate the implementation of CPPNM and its 2005 Amendment.
- **D1, D2.** Develop and update guidance documents on nuclear security.
- **K1, K2.** Enhance the practice of nuclear security culture.
- **M1, M2, M3.** Raise awareness of the threat of cyber attacks and promote computer and information security with regard to nuclear and other radioactive material and associated facilities.

GICNT
- **A1.** Promote capacity building across the spectrum of nuclear security challenges to further promote the ability of partner nations to work together to prevent, deter, detect, and respond to nuclear terrorism events.

GLOBAL PARTNERSHIP
- **A1, A2.** Coordinate programs and activities on the development of nuclear security culture and reducing insider threats.
- **A5.** Coordinate programs and activities on enhancing computer security, conducting scientist engagement, and supporting the use of the IAEA Implementing Guide on Security of Nuclear Information by states.

UNITED NATIONS
- **A1.** Step up efforts to implement in full UNSCR 1540 nuclear security obligations by 2021.
- **D1.** Conduct targeted outreach on the obligations inherent in UNSCR 1540.

3. Promote industry discussions with the five organizations on the topic of emerging nuclear technologies/approaches with the purpose of exploring benefits as well as potential and emerging threats. This would support the following action plan items:

IAEA
- **A2.** Address current and emerging nuclear security issues.
- **A3.** Enhance the importance of nuclear security within the IAEA and achieve a suitable balance with safety.
- **B2.** Hold regular Information Exchange Meetings with other relevant international nuclear security institutions and initiatives.
- **F1.** Advance forensics capabilities.

GICNT
- **A4.** Host workshops and expert discussions on forensics.
- **D9.** Collaborate with expert communities, e.g., industry, to participate in GICNT events and identify practical measures to build capacity related to combating terrorist threats.

INTERPOL
- **B1.** Support investigations and facilitate effective prevention and response practices.
- **C6.** Regularly assess guidelines on preventing and combating offenses involving nuclear/radiological materials.

GLOBAL PARTNERSHIP
- **A9.** Share information and new technologies to enhance enforcement capacity of customs and personnel.
- **A10.** Strengthen nuclear forensics capacity.

RE-ENERGIZING NUCLEAR SECURITY

This study surveys the international security landscape and the architecture surrounding the nuclear enterprise, and develops an array of options and recommendations for how private industry can enhance its contribution to global nuclear security. The report proceeds from the realization that the progress made toward enhanced security from the Nuclear Security Summits — and the companion industry and civil society summit meetings — must continue. The active participation of private industry and other stakeholders is no longer a luxury, but a requirement. Overall, the report offers pathways for all stakeholders in the nuclear community -- from governments to industry to civil society -- to find common ground and forge pragmatic partnerships to strengthen nuclear security.

ABOUT STIMSON

The Stimson Center is a nonpartisan policy research center working to solve the world's greatest threats to security and prosperity. Think of a modern global challenge: Refugee flows, arms trafficking, or terrorism. These threats cannot be resolved by a single government, individual, or business. Stimson's award-winning research serves as a roadmap to address borderless threats through collective action. Our formula is simple: We gather the brightest people to think beyond sound bites, create solutions, and make those solutions a reality. We follow the credo of one of history's leading statesman, Henry L. Stimson, in taking, "pragmatic steps toward ideal objectives." We are practical in our approach and independent in our analysis. Our innovative ideas change the world.

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