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The Capacity-Building Support Activities of the Integrated Support Center for Nuclear Nonproliferation and Nuclear Security of the Japan Atomic Energy Agency

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Abstract

International cooperation is essential to support states in building the human resources necessary for maintaining and strengthening nuclear security. As the nation's only comprehensive nuclear research and development institute, the Japan Atomic Energy Agency (JAEA) has long-standing experience developing and operating nuclear technology in all steps of the fuel cycle. The Integrated Support Center for Nuclear Nonproliferation and Nuclear Security (ISCN) was established within the JAEA in December 2010 as Japan's Center of Excellence for nuclear security. The ISCN provides assistance with capacity building to states throughout Asia and some other regions. The objective of this article is to describe the contribution of the ISCN to human resources development in the field of nuclear security, using its contributions to regional physical protection training and computer security training as illustrative examples. This article also considers the lessons learned from the ISCN's experience that may benefit other nuclear security training and support centers.

I. Introduction

The ISCN was established in December 2010 to provide international assistance with human resources and technology development, in response to the commitments of Japan at the 2010 Nuclear Security Summit in Washington DC. The ISCN is involved extensively in capacity building assistance in the fields of nuclear security and safeguards, mainly in Asia. The ISCN supports the commitments contained in the 2010 Nuclear Security Summit Work Plan, including that: "Participating States will encourage the

creation of and networking among nuclear security support centers for capacity building to disseminate and share best practices and will support IAEA activities in this area.”

This article describes the good practices of the ISCN, focusing on one of its core nuclear security courses, the Regional Training Course on Physical Protection of Nuclear Material and Nuclear Facilities (RTC on PP). The next section provides an overview of the ISCN’s main capacity building support activities, illustrating the diversity of the Center’s training offerings. The third section describes the development of the ISCN’s RTC on PP. The ISCN also conducts or contributes to training courses spanning a variety of established and emerging topics in the field of nuclear security. The fourth section of this paper describes the ISCN’s capacity building activities for one of these topics, computer security. The fifth section seeks to draw out lessons from the ISCN’s six years of experience for the benefit of newer nuclear security training and support centers (NSSCs).

II. Scope of Capacity-Building Support Activities

To accomplish its mission of promoting nuclear security, a center of excellence (COE) must contribute to training professionals and facilitate exchanges of information and experience. In pursuit of this goal, the ISCN conducts three types of training courses: Nuclear Security Courses, Safeguards and State System of Accounting and Control (SSAC) Courses, and International Nonproliferation Framework Courses. As of March 2016, the ISCN has conducted 100 training courses and trained a total of 2748 participants from 73 countries (including Japan) and three international organizations. Over 60% of these participants came from outside Japan. This article focuses on the ISCN’s provision of nuclear security courses – as of March 2016, the ISCN’s 65 Nuclear Security Courses alone have received 1676 participants.

The greatest need for capacity building support exists among states developing new nuclear energy programs or expanding existing programs. Most of these states are located in Asia. In order to analyze the training needs of potential recipients, the JAEA began conducting dedicated needs survey missions with ASEAN member states in 2010 (before the ISCN’s establishment). The ISCN later expanded these missions to include Bangladesh, Jordan, Kazakhstan, Lithuania, Mongolia, Saudi Arabia, Turkey, Ukraine, and the United Arab Emirates.

The ISCN determined that there was a need among many states for detailed technical training on physical protection, the first line of defense against malevolent acts. There was also a need for training on relatively new topic areas, such as nuclear forensics and nuclear security culture. Many of these topics could be handled in international or regional courses, allowing the ISCN to assist as many states as possible with limited resources. However, some state-specific issues would best be handled through bilateral dispatching courses tailored to the recipient state’s existing or planned nuclear activities. The ISCN has also developed training opportunities to meet the demand among domestic organizations responsible for specific aspects of nuclear security.

A. International/Regional Training Courses

The scope of the concept of nuclear security has expanded in recent years to accommodate new legal instruments and guidelines (including the Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM)), the International Convention for the Suppression of Acts of Nuclear Terrorism, United Nations Security Council Resolutions 1373 and 1540, and the 2003 revision to the Code of Conduct on the Safety and Security of Radioactive Sources. New technologies have also introduced new opportunities to prevent, detect and respond to unauthorized or malicious acts. These changes have impacted the work of a variety of individuals charged with maintaining the security of nuclear facilities and nuclear materials (and other radioactive materials), thereby introducing new requirements for practical, hands-on training.

The ISCN has designed its regional training courses to meet these training needs. Section III explains the development of the ISCN's annual RTC on PP in detail. Since establishing this course, the ISCN has progressively expanded its training offerings in line with its growing expertise to meet the human resource development needs of governments, competent authorities, and operators in a number of relatively new topic areas. The ISCN held its first workshops on the IAEA's Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev.5) in 2011 in cooperation with Japan's Ministry of Education, Culture, Sports, Science, and Technology (MEXT), U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA), and Sandia National Laboratories (SNL). These workshops took place just a few months after the IAEA issued the revision. The IAEA recognized the good practice of the ISCN and SNL in providing training to states on the practical implementation of the IAEA guidelines and requested that the ISCN and SNL transfer their workshop curriculum. The IAEA, the ISCN, and SNL then worked together to establish an expanded five-day IAEA Regional Training Course on INFCIRC/225/Rev.5 in 2013.

The ISCN now also conducts or contributes to courses on nuclear forensics, nuclear security culture, measures against sabotage, insider threats, radioactive sources security, and transport security. The ISCN's contributions to computer security training are described in detail in Section IV.

B. Bilateral Dispatching Courses

The ISCN has also tailored training cooperation to appropriately match the identified needs of individual states that request the ISCN's assistance. As of May 2016, the ISCN has conducted a total of nine nuclear security dispatching courses in five states. For example, in 2013, the ISCN co-organized a workshop on border security monitoring with the European Commission's Joint Research Centre and DOE/NNSA for Lithuania's new COE in its Border Guard School. In 2015, the ISCN and SNL hosted a more advanced, five-day National Workshop on Evaluation of Nuclear Security Plan to enhance the Turkish Atomic Energy Authority's capability to review the nuclear security plans that will be submitted by the operator of reactors scheduled to begin construction later this year.

As the first COE in Asia, the ISCN has taken on a role as a model for other states that are setting up NSSCs. The ISCN has expanded bilateral cooperation to share best practices in the steps involved in establishing a training center. In June 2016, the ISCN hosted a preliminary meeting for human resources development with DOE/NNSA and Kazakhstan on the latter's nascent nuclear security training center. The ISCN shared its experience of establishing a COE and training courses with Kazakhstan.

Indonesia's Nuclear Energy Regulatory Agency (BAPETEN) and National Nuclear Energy Agency (BATAN) are each establishing security centers. Both agencies are sending visiting researchers to ISCN to learn how to develop and teach nuclear security courses. In September 2016, the ISCN, BAPETEN, and BATAN are hosting a five-day "follow-up" training course on physical protection in Indonesia with former visiting researchers serving as lecturers. Through this course, the ISCN will assist Indonesia's security centers to become providers of domestic training courses. Malaysia has also asked the ISCN to provide similar support to build capabilities to train its domestic audience.

C. Domestic Courses

As explained in Section III, the ISCN began providing training on physical protection for Japan's operators and regulators in 2012. The ISCN has also provided physical protection and emergency response training courses for security authorities that have requested its assistance, including the Chemical School of the Japan Ground Self-Defense Force, the Japan Coast Guard, and the National Police Agency.

The ISCN has partnered with the World Institute for Nuclear Security (WINS) to provide an annual workshop promoting nuclear security culture to domestic audiences (operators, regulators, and other relevant government officials). The ISCN has also partnered with DOE/NNSA to develop courses on physical protection detection system performance testing (2013) and scenario development (2014).

In addition to these courses, the ISCN reaches the broadest possible audiences of facility personnel, research institutes, competent authorities, and other relevant government officials by conducting lecture series in Japan and seminars overseas aimed at raising (or refreshing) awareness of nuclear security threats and individuals' responsibilities. In 2013, the ISCN received a request from a domestic operator for support with the operator's nuclear security awareness raising and culture fostering activities. In response to the request, the ISCN introduced a Nuclear Security Culture lecture series covering the history of the international nuclear security framework, real cases of security breaches at nuclear facilities around the world, and the roles and responsibilities of staff members [1]. The lectures have expanded since 2013 as more utility companies have invited the ISCN to speak to their workers. In 2015, the ISCN conducted lectures at thirteen nuclear power plants across Japan for a total audience of 2300 workers. The ISCN also reaches out to policy makers, energy ministry officials, and nuclear security regulatory authorities in Southeast Asia through an annual joint seminar on nuclear security with the ASEAN Center for Energy, which discusses the implementation of international legal instruments, development of human resources, and promotion of nuclear security culture.

III. The ISCN's Regional Training Course on Physical Protection (RTC on PP)

The ISCN developed its RTC on PP in 2011 to help satisfy the human resource development needs of countries in Asia with respect to this core topic of nuclear security. Focusing on physical protection allowed the ISCN to make optimal use of the JAEA's existing experience.

To help build the ISCN's capacity, the ISCN partnered with DOE/NNSA and SNL to host a train-the-trainer (pilot) course on physical protection in August 2011. The pilot course relied on lectures and materials from SNL's subject matter experts, many of whom had considerable experience as instructors for SNL's long-standing three-week International Training Course on the Physical Protection of Nuclear Material and Nuclear Facilities. Participants for the pilot course included engineers, researchers, and managers from the JAEA with experience in fuel cycle-related projects.

The ISCN then co-hosted the first of its annual two-week RTCs on PP in October 2011 in cooperation with DOE/NNSA and SNL. The RTC on PP included lectures by JAEA staff with SNL experts on hand to assist. This arrangement allowed relatively new ISCN instructors to gain experience with delivering the course while guaranteeing the highest possible standard of training for participants.

The ISCN has progressively increased its contribution to the RTC on PP over time. The ISCN has built up its base of expert instructors to the point where it now provides the majority of instructors and undertakes the majority of curriculum development for the course. However, the course still receives a couple instructors from SNL each year to work alongside the ISCN's instructors. To ensure a consistent standard among trainers, the ISCN and SNL continue to cooperate on the training of the ISCN's instructors, with new instructors attending SNL's International Training Course.

A. Realistic Training Environments

The ISCN introduced major innovations into the curriculum of the RTC on PP in 2012, utilizing the JAEA's new Physical Protection Exercise Field and Virtual Reality System. The Physical Protection

Exercise Field allows participants to gain hands-on experience with real physical protection equipment in a realistic environment. The Virtual Reality System allows participants to train using the detailed layout of a realistic facility. Together, these practical tools provide comprehensive environments for conducting a range of training exercises.

The Physical Protection Exercise Field incorporates a variety of types of fences, sensors, cameras, lighting systems, and contraband detection equipment. The interior of the main building of the Exercise Field includes a Central Alarm Station, which collects and displays signals and data from the Field's physical protection system equipment. Participants learn the functions of each device and have the opportunity to act as Central Alarm Station officers, security guards, police officers, or intruders. The Field provides participants with experience in design of physical protection systems, including entry control, intrusion detection, access delay, and response to simulated alarms. The Field is also designed to facilitate realistic equipment performance assessment and analysis of intrusion pathways.

Since 2012, the ISCN has also used the Physical Protection Exercise Field to support part of the inspector training courses of the Nuclear Regulation Authority (NRA) of Japan through practical, realistic exercises and interactive equipment demonstrations. The fact that this highly specialized institution regularly looks to the ISCN to use its capacity building expertise to enrich its training programs demonstrates the good practices of the ISCN in the provision of hands-on and technical training.

The Virtual Reality System is a three-dimensional simulation of a hypothetical nuclear facility and surrounding environment. Virtual reality allows access to all parts of the facility, including locations that would be inaccessible during a tour of a real facility due to information security or radiation protection constraints. The Virtual Reality System also allows participants to view detection zones (sensing areas and blind spots) for different sensor configurations. Compared with a real site, the virtual site is easy to modify to test the strengths and weaknesses of various physical protection systems. The ambient environment (geography, lighting, weather, etc.) can also be varied in order to illustrate the impact of a variety of conditions on physical protection systems. The Virtual Reality System also supports simulation of different types of security incidents and intrusions that would be impractical or unsafe to recreate at a real site.

B. Unique Learning Opportunities

The ISCN's initial course offerings came just months after the Great East Japan earthquake and tsunami in March 2011. Several of the ISCN's training offerings have included lectures on the lessons learned from the accident at the Fukushima Daiichi Nuclear Power Plant to underscore the importance of preventing, detecting and responding to incidents at nuclear facilities, including sabotage. The events at Fukushima Daiichi highlight the importance of extending protection to auxiliary systems, in addition to reactors themselves [2]. The lectures also illustrate that, even in the aftermath of a severe nuclear accident, the nuclear material must always be secured against theft.

ISCN training courses include visits to Hiroshima or Nagasaki, incorporating the good practice of placing the gravity of the threat of nuclear proliferation in context for participants. The horror of the atomic bombings serves as a stark reminder of the importance of controlling the use of nuclear materials. In this way, training builds not only the participants' knowledge and skills but also their attitudes toward nonproliferation and their motivation to continue to work in the field of nuclear security.

C. Expansion to Domestic Training

Although the ISCN's training on physical protection was initially established with an international audience in mind, in 2012 the ISCN began offering a domestic training course on physical protection of

nuclear materials and facilities for utility companies and government officials. The ISCN translated the course materials developed with SNL for the RTC on PP into Japanese for the benefit of these domestic training recipients. The ISCN also modified the materials to fit the specific requirements of national physical protection regulations. Many of the participants in this course are established experts in specific aspects of nuclear security or related technologies. This training course gives these experts the opportunity to expand their expertise and understand how their work fits into the broader national nuclear security regime.

IV. Computer Security Training at the ISCN

Computer security is an emerging training area experiencing high demand. Worldwide, there is a shortage of practitioners who have experience in both computer security and nuclear security. Planning a computer security training course involves the additional challenge of reaching out to officials who do not necessarily have a background in physical protection.

A. Meeting Domestic Training Needs

In contrast with the RTC on PP, the ISCN's computer security courses have their origins in domestic training needs. Japan revised security regulations in 2011 and 2012 and developed implementation guidance for operators on protecting computer systems at nuclear facilities based in part on a draft of the IAEA's Nuclear Security Series No. 17 Technical Guidance on Computer Security at Nuclear Facilities [3]. Consequently, the NRA began including computer security in physical protection inspections. To assist the implementation of these new measures, the NRA asked the ISCN to provide an introductory computer security course for both operators and government officials in Japan.

The ISCN partnered with the IAEA to host a course in Tokyo in May 2014. The IAEA had experience offering five-day awareness training courses based on its technical guidance on computer security. The ISCN shortened the course to one day for government officials and two days for operators since most of these prospective participants are too busy to attend a longer course. Thirty-two officials from government ministries, the National Police Agency, and the Japan Coast Guard attended the one-day training aimed at establishing awareness of threats and consequences, as well as Japan's regulatory framework [4]. This part of the course emphasized the unique challenges of computer security for nuclear facilities and industrial control systems, as compared with office IT security.

The two-day training for operators introduced methods for conducting risk assessments and developing computer security policies. The course received 35 participants, including personnel with responsibility for facility operation and safety-related computer systems. In hosting this course, the ISCN, therefore, gained experience training a broader range of domestic participants, including officers who are not usually part of physical security. The course's exercise on risk assessment highlighted the importance of developing channels of communication between these practitioners and traditional physical protection personnel at nuclear facilities.

B. Expansion to International Training

The ISCN co-hosted the IAEA Regional Workshop on the Development of National Training Programs in Computer Security in Tokai, Japan from June 27 to July 1, 2016. This was the first ever train-the-trainer course on computer security by the IAEA. The course received seventeen participants from regulators, NSSCs, and other research institutes in Asia. The course aimed to enable participants to use the IAEA's computer security guidance documents and training materials to fulfill training needs in their home countries. Participants commented that the course also encouraged them to participate in the review

or development of national computer security regulation and computer security policies at their own organizations.

The course incorporated country presentations by the participants. This provided an opportunity for the IAEA, the ISCN, and other nuclear security stakeholders to discuss the capacity building needs of states in the region with respect to this relatively new nuclear security topic. The IAEA is also using its experience of partnering with the ISCN to develop online e-learning training materials based on the courses held in Japan and feedback received from participants [4].

V. Lessons for Development of Nuclear Security Training and Support Centers

The ISCN's six years of experience have yielded a number of lessons for other states establishing NSSCs. Firstly, the decision to site an NSSC within either an operator or a regulator should be based on the degree of experience of each body and the aims of the NSSC. The ISCN's contribution to nuclear security has been enriched by being located within the JAEA, an institution with a long-standing role in research and development and an operator of many facilities. Operators have central responsibilities for security at their facilities, and for the development of personnel, so being attuned to their training needs is enormously beneficial. Furthermore, the JAEA's analytical laboratories have developed experience in fields like nuclear forensics, which contributes to the ISCN's course offerings.

As an independent administrative institution, the JAEA does not have the authority of a government organization. Domestic utility companies and competent authorities often request assistance from the ISCN, and the ISCN provides a forum for the free exchange of information among these bodies. However, the ISCN cannot make its training courses mandatory. For other states, siting an NSSC within a regulatory authority may be advantageous, particularly if the NSSC is intended to reach out to all domestic utility companies as a matter of priority.

Secondly, an NSSC must have effective working relationships with the IAEA and other NSSCs. These relationships are invaluable in building up a base of instructors. Cross-institutional train-the-trainer programs provide new instructors with a pathway to gain essential experience. Many of the individuals who were trained through ISCN courses have themselves gone on to provide training, either at the ISCN or elsewhere.

As more NSSCs begin offering training opportunities, harmonization of these activities is becoming increasingly important. The ISCN works particularly closely with SNL and the IAEA to develop its course materials and its instructors. The IAEA's International Network for Nuclear Security Training & Support Centers (NSSC Network) is a useful development in this respect. The NSSC Network is currently comprised of 63 institutions designated by 54 member states [5]. The ISCN discusses the coordination of the scheduling of training activities and the harmonization of the contents of training courses with other institutions in the Network. By taking care to avoid scheduling clashes with courses at other centers, it will be possible to maximize opportunities for other states to send participants for training without being short-staffed at home. The ISCN is also preparing to share resources (instructors/personnel, curricula, and training materials) with other NSSCs so they may be used at maximum capacity.

The ISCN participates in information exchanges about training activities with the other nuclear security COEs in the region, the International Nuclear Nonproliferation and Security Academy (INSA) of the Korea Institute of Nuclear Nonproliferation and Control and the State Nuclear Security Technology Center (SNSTC) of the China Atomic Energy Authority. The COEs share good practices by dispatching instructors and observers to each other's courses [6]. The ISCN and INSA have also conducted regular telephone conferences since 2013 with a view to coordinating their training activities [7].

Finally, curriculum design and course organization should follow a needs-oriented approach based on participants' roles and responsibilities in nuclear security and their background knowledge. It is helpful to offer multiple types of courses based on the needs of participants. Some courses are necessarily brief and directed toward raising awareness, particularly for senior government officials with busy schedules. Others courses should cover measures in full technical detail, build practical skills, and provide hands-on experience, particularly for officials working at nuclear facilities.

VI. Conclusion

The ISCN was one of the first COEs to come out of the Nuclear Security Summit process. Many other states have since established or are establishing nuclear security training and support centers. The ISCN demonstrates how a center can build up a repository of knowledge in cooperation with others in order to meet the training needs of domestic and international regulatory authorities, security authorities, research institutes, and operators. Its training programs also demonstrate the value of sharing experience among stakeholders in nuclear security without revealing sensitive information. The ISCN's role as a provider of capacity building assistance and as a model for other training centers continues after the final Nuclear Security Summit in 2016.

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Mr. Yosuke Naoi is a Deputy Director of ISCN. He had been involved in heavy water reactor development projects "Fugen" for a total of 20 years since 1983 as a station chemist and a safety analyst.

During these assignments, he was on loan to the Ministry of Foreign Affairs of Japan as a technical adviser for the KEDO (Korean Peninsula Energy Development Organization) project from 1998 to 2000. His past experiences vary from very technical tasks (at the Fugen NPS as a station chemist and a nuclear safety analyst) to diplomatic negotiations (KEDO), and his current duties include not only international cooperation (ISCN) and R & D on nuclear material detection and measurement for safeguards and nuclear security but also managerial and administrative tasks at ISCN.

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