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Kwan Kyoo Choe

INSA, Korea Institute of Nuclear Nonproliferation and Control

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Cover Page Footnote

I would like to express my sincere thanks and appreciation on this occasion of publication of an article to all the colleagues and staffs of the KINAC/INSA, who have set the KINAC/INSA, its programs, courses and modules concerning nuclear security, safeguards, and strategic trade controls, including all the related infrastructure for education and training

Human Resource Development Activities of the International Nuclear Nonproliferation and Security Academy of the Republic of Korea

Kwan Kyoo Choe

INSA, Korea Institute of Nuclear Nonproliferation and Control

Abstract

Human resource development activities on nuclear security in international society have moved gradually from a focus on the military dimension of the problem to the social management of conflict and threat. The objective of this article is to describe the human resource development (HRD) activities in the area nuclear nonproliferation and security at the International Nuclear Nonproliferation and Security Academy (INSA) of the Korea Institute of Nuclear Nonproliferation and Control (KINAC).

This paper begins by touching on the relevant conception of nuclear security in the Republic of Korea (ROK), which has guided the ROK in its HRD efforts. Next, the international relations context that set the stage for the establishment of INSA as a Korean Center of Excellence (COE) in connection with the Nuclear Security Summit (NSS) is described. The third section offers a detailed explanation of INSA's mission and main activities. The final section considers lessons learned in the first year of INSA's nuclear nonproliferation and security HRD activities in terms of establishing a culture of nuclear security.

I. Introduction

During the Cold War, the field of nuclear security was mainly focused on strategies related to nuclear weapons and their deployment. The role of nuclear weapons in the confrontation between the capitalist and communist blocs of countries, led respectively by the United States and the Soviet Union, reinforced a simplified conception of nuclear security based on military aspects. However, following the Cold War, a wide range of socio-political and economic changes have given rise to a modification to the traditional military-focused concept of nuclear security, expanding it to include not only the civil sector but also our daily lives.

In this context, human resources development (HRD) activities regarding nuclear nonproliferation and security aim to address the changing needs arising from political and social transition and to promote a culture of nuclear security.

This article describes the HRD activities in the area of nuclear nonproliferation and security at the International Nuclear Nonproliferation and Security Academy (INSA) of the Korea Institute of Nuclear Nonproliferation and Control (KINAC), addressing specifically how the Institute's HRD activities in nuclear nonproliferation and security respond to related social needs and the dynamics of international relations.

The paper begins by touching on the relevant conception of nuclear security in the Republic of Korea (ROK), which has guided the ROK in its HRD efforts. Next, the international relations context that set the stage for the establishment of INSA as a Korean Center of Excellence (COE) in connection with the Nuclear Security Summit (NSS) is described. The third section offers a detailed explanation of INSA's mission and main activities. The final section considers lessons learned in the first year of INSA's nuclear nonproliferation and security HRD activities in terms of establishing a culture of nuclear security.

II. Korean Conceptions of Nuclear Security and the 2010 Nuclear Security Summit

The terrorist attacks of September 11, 2001, were a direct challenge to the new military and political world order after the end of the Cold War, which was characterized by the unipolar dominance of the United States. The possibility of attack against the civilian facilities not initiated by any specific government was an important factor that influenced the Nuclear Security Summit (NSS) in 2010.

Since the end of the Cold War, rapid economic growth in developing countries, unstable fossil fuel price fluctuation and exhaustion of oil and gas resources, and greenhouse gas mitigation efforts have caused the international community to seek sustainable energy alternatives such as nuclear energy, giving birth to what has been termed a "nuclear renaissance" in which many argue for a greater utilization of civilian nuclear power. The 2011 Fukushima nuclear disaster hurt this cause with its impacts on the natural environment, and also it raised a series of questions regarding international social crisis management capability, energy options in a country and the interface of nuclear safety and security. The so-called nuclear renaissance in newcomer countries has also raised worries about nuclear proliferation potentiality, which further highlights the need for human resources development (HRD) throughout the international community.

In this international context, the Republic of Korea (ROK) contracted with the United Arab Emirates (UAE) in December 2009 to supply four APR-1400 commercial reactors. The ROK also won a contract in the beginning of 2010 to supply Jordan with a HANARO research reactor. As a result, the ROK has emerged as a new supplier in the nuclear power plant industry.

At the first NSS, held in Washington, DC in April 2010, former ROK President Lee Myung-bak committed to the establishment of a center of excellence (COE) in the ROK that would provide nuclear security education and training to the international community.

As a supplier country in the nuclear power plant industry, the ROK understands its responsibility to strengthen the international nuclear security regime. This policy orientation represents the main factor in the establishment of INSA.

Following the 2001 attacks on the World Trade Center and the Fukushima accident, the international community has become nervous about nuclear technology and reluctant to pursue its peaceful uses for energy. Instead, collective international efforts have been further driven to strengthen a networking toward chemical, biological, radiological and nuclear (CBRN) risk mitigation. In an effort to strengthen the HRD activities with the networks of expertise required for this risk mitigation, the ROK, China and Japan ~~jointly~~ declared at the 2010 NSS that they would establish their own centers of excellence for nuclear security and open them to the international community.

Japan opened its COE, the Integrated Support Center for Nuclear Nonproliferation and Nuclear Security (ISCN), in 2011. INSA of the ROK opened in Feb. 2014, just before the third NSS in Hague. China's COE, called the State Nuclear Security Technology Center (SNSTC), is still under construction in the vicinity of Beijing, and is scheduled to be opened in late 2015 or early 2016. Since February 2013, the three countries, each represented by their own COE personnel, have met together regularly in Vienna under the leadership of the International Atomic Energy Agency (IAEA) to discuss the exchange of education and training program/courses and related information.

The ROK conception of nuclear security has two faces. The first reflects a general concern about threats from both state and non-state actors. Following global trends, the ROK values strong preparedness against terrorism. Due to the continuation of the geopolitical *status quo* of the Cold War as represented by North Korea, traditional military concerns also remain strong, as North Korea has further isolated itself from the international community with nuclear brinkmanship and other provocations, including the testing of nuclear weapons in 2006, 2009 and 2013. But the other face of nuclear security in the ROK is a comprehensive and integrated approach, which requires a change of awareness and practical responses from the nuclear facility operators, generally working very near to civilian life-space, in connection with safeguards, safety and security.

III. INSA's Mission, Operational Direction, and Main Activities

An effective nuclear security system requires the provision of capabilities to prevent, detect and respond to a criminal or an unauthorized act with nuclear security implications, involving nuclear and other material. In order to remain effective, such a system also requires systematic development sustained by the state and by competent authorities [1]. This goal can be achieved by the establishment of a COE with a mandate that includes the spreading of awareness and understanding of nuclear security for persons indirectly related to the nuclear security system. These aims of a single state-focused nuclear security COE could be equally applied to a regional and international scope. Thus, local or national nuclear security systems can be considered as a part of international nuclear nonproliferation systems. The establishment of an effective and sustainable nuclear nonproliferation system in a state in connection with peaceful uses of nuclear energy requires an integrated approach that includes three aspects: nuclear security, safeguards, and export/import controls. Even though the aspect of nuclear safety has been decisively important for the efficient, peaceful and sustainable uses of nuclear energy, we don't deal with the safety aspect in this paper.

To accomplish its mission of preventing the proliferation of nuclear weapons, a COE might develop and mobilize a network of nuclear nonproliferation experts. Such a network can facilitate the exchange of information and experience among its members and provide access to relevant scientific and technical knowledge and tools to state nuclear nonproliferation authorities. It might be said, then, that the essential activities of a COE are its education and training for human resource development. The effectiveness of this core function is bolstered by the support of sustainable technical and scientific research and development.

A national nuclear nonproliferation training program should be based on a process such as the systematic approach to training (SAT), which has five key elements: analysis, design, development, implementation, and evaluation (ADDIE) [2]. These five elements constitute a cyclical process, beginning with an analysis that is based on the tailored training needs of all the

related nuclear facilities and activities in a state or in targeted regional and international countries [1].

The operational direction of INSA is driven by practical approaches and an emphasis on substantiality and applicability, where trainees can actively participate and learn through hands-on experiences. This involves an outdoor test field and IT-based training. INSA intends to help nuclear newcomer countries establish their national integrated nuclear nonproliferation and security systems, and implement them effectively and efficiently for their eventual peaceful uses of nuclear energy.

In 2010, KINAC/INSA began its preparative activities with an analysis of the educational and training needs, weak points, and capacity gaps at the national, regional and international levels. Based on this initial analysis, it completed the dimension of design in 2011 regarding the scale and composition of training facilities, HRD activities, and the necessary actions for developing trainers, programs, and detailed courses and modules, including mid- and long-term budgets. This design phase was immediately followed by the development during 2012-13 of all facilities, equipment, programs with courses and every module. After its official inauguration ceremony on February 19, 2014, INSA entered the phase of implementation, holding its first international nuclear security-training course from March 10-14, 2014, inviting about 30 international trainees from 12 foreign countries. The second international training course on safeguards was held the week of June 9, 2014, while the international course on nuclear export/import control was held the week of November 10, 2014.

Through 2016, INSA will be in the evaluation phase of its activities, setting objectives and instituting a reliable assessment mechanism. For the preparation of the assessment system, INSA has contracted a group of consultants in the ROK to perform a special research project on how to promote quality education and training, and how to establish an effective evaluation system for education and training. Based on this preliminary research, carried out during 2014, the main research and development project will be completed during 2015-16.

There are three different categories of education and training at KINAC/INSA: a legally binding education/training course for domestic nuclear facility personnel and national safeguards and security inspectors; international education and training; and non-legally binding training for other domestic organs, including the public.

Regarding the first category of education and training, the Korean government has entrusted KINAC by law to provide education and training on nuclear nonproliferation and nuclear security for personnel working in facilities related to peaceful uses of nuclear energy. These personnel include those who carry out activities of nuclear material accounting and control on special nuclear materials, research-project managers who carry out nuclear fuel cycle-related projects and R&D, and nuclear facility operators and staff who work in nuclear security and physical protection-related areas.

International education and training courses are directly related to the *raison d'être* of KINAC/INSA. These courses are organized around nuclear security, safeguards, and export/import control. There are also international programs for the Regional Training Course (RTC) program of the IAEA for the Asia and Middle East regional personnel on nuclear security and safeguards as well as an IAEA inspector-training course in close association with IAEA.

The purpose of the first KINAC/INSA initiated course, held on March 10-14, 2014 in Daejeon, was to raise participant awareness about the need for a nuclear security system that reduces the

threat of nuclear terrorism. This course also covered a methodology for the prevention of radiological sabotage and theft of nuclear materials, based on the IAEA booklet on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev. 5). The course consisted of lectures and subgroup exercises, which utilized INSA's security training and test (SETT) facilities located at INSA, and evaluation software.

The course began with an introduction of the global nuclear security framework and IAEA guidance, followed by an overview of physical protection concepts. A three-step methodology for design and analysis of a physical protection system was also covered. This included the following aspects: (1) definition of physical protection system requirements, (2) design of a physical protection system, and (3) evaluation of a physical protection system design. Then, subgroup sessions provided the participants with the opportunity to apply the lecture material to practical situations. Exercises included not only field exercises at the SETT facility but also an evaluation of a physical protection system using 3D software. Finally, the development of a national nuclear security system was discussed in the context of the Korean experience.

The second KINAC/INSA course on nuclear safeguards, held from June 9-13, 2014, covered state systems for accounting for and control of nuclear material (SSAC). The course consisted of lectures, exercises, and a facility visit. As with the first course on international nuclear security, exercises provided the participants with the opportunity to apply the lecture material to practical situations. The main topics of the course were as follows:

- 1) The international nuclear nonproliferation regime
- 2) The IAEA safeguards system under its Comprehensive Safeguards Agreement
- 3) Provision of nuclear material accounting reports and design information to the IAEA
- 4) Establishment of a state system of accounting for and control of nuclear material
- 5) Additional protocol and integrated safeguards

Finally, the participants visited the Hanbit nuclear power plant (Type OPR-1,000), which is located 87 miles southwest from INSA.

The third KINAC/INSA course, on strategic trade control, held from November 10-14, 2014, was designed to introduce participants at the beginner level to strategic trade controls that satisfy and implement international norms. The course consisted of lectures and a visit to operating nuclear facility. The main topics of the course included the following:

- 1) WMD proliferation risk and awareness
- 2) The multilateral nonproliferation regime
- 3) Trigger list items and dual-use items
- 4) The experience of the ROK and the US on strategic trade controls.

Participants visited the Doosan Heavy Industry Co., which is located at 109 miles south of INSA.

Regarding domestic education and training which is not legally mandated, KINAC is expanding its education and training service *vis-à-vis* indirectly related facilities and organs involved with the strengthening of a nuclear nonproliferation and security culture, including members of the public. Prior to the opening of INSA, KINAC had been providing education courses to colleges and graduate students, particularly to those majoring in nuclear engineering and international relations. These activities are aimed at enlarging and deepening a domestic nuclear nonproliferation and security culture.

A. INSA Facilities

In a five-story main building of about 205,000 square feet, INSA built its education and training facilities with lecture rooms in a diverse range of sizes. The complex has internal and external security training and test (SETT) facilities. The external SETT facilities consist of four sectors, providing a comprehensive system for the simulation of detection, delay and response. Sector 1 houses radiation portal monitoring and the access control system. Sector 2 is dedicated to the testing of a conventional physical protection system (PPS). Sector 3 is for the testing of an advanced PPS, where the results of research and development performed by KINAC, competent institutes and related industries can be tested before practical application and commercialization. Sector 4 is for small-scale “force on force” training, including an intrusion-related destructive testing system. Internal SETT, located in the main building, allows INSA users to have hands-on experience with physical protection equipment and to test internal equipment with tabletop exercises. It also exhibits equipment for the exercise of force on force. As an internal SETT, the Central Alarm Station (CAS) was built for both R&D and education and training purposes. The CAS collects signals and data of the various PPS installed at the external SETT. It is comprehensively interfaced with the Video Management System (VMS), the Intrusion Detection Management Systems (IDMS) and the 3D convergence solution system. The CAS system, in association with VMS, IDMS and the 3D convergence solution system, can be applied as a similar testing method for a CAS function, being under operation in actual nuclear facilities.

INSA houses safeguards-related R&D facilities in the main building, which include the Radiation Measurement and Equipment Training (RMET) lab and the Clean Room for Estimation and Assay of Trace Nuclear Materials (CREAN) lab. The objectives of these facilities are to improve existing radiation detection equipment, develop new radiation detection systems, and to provide a suitable environment for education and training on radiation detection equipment.

As a training tool, INSA has prepared a Virtual Reality Program (VRP); 3D-based educational software applied to safeguards inspection activities in connection with nuclear material accountancy in light water reactor power plants. For the purpose of safeguards training, INSA provides diverse real equipment and tools. Its at-risk evaluation software of nuclear power plant facility PPS, called Integrated Code for Risk Analysis 3D (INCOREA 3D), allows trainees to experience a simulated design of a nuclear facility PPS and to evaluate its vulnerability. INSA also operates an e-learning system for the benefit of national nuclear R&D institutions and nuclear power plant facility personnel, which is a Web-based e-learning system providing courses on nuclear security and nuclear nonproliferation, including export controls.

IV. Effects and Lessons Learned

KINAC’s ability to establish INSA in a relatively short time after the Korean government statement at the first NSS can be attributed to the fact that KINAC had played a regulating role as a technical support organization (TSO) in the area of safeguards, physical protection and export/import control since 2004 in the ROK. Previous to establishing the COE, KINAC had well-established procedures for reviewing documents related to nuclear nonproliferation and control in the ROK, and also carried out inspection activities in the field of nuclear safeguards and physical protection for Korean authorities.

Despite the fact that only one year has passed since its inauguration, INSA has already seen a number of effects in connection with its international education and training efforts. As the first COE in a former newcomer country (as opposed to one of the advanced nuclear industry countries), INSA has based its activities on the Korean experience as a nuclear power plant

supplier country, with 23 NPPs in operation as of the end of 2014. While an integrated and comprehensive approach to nuclear nonproliferation and security focused on nuclear safeguards, security and strategic trade controls have previously been performed mainly by the US, the IAEA, and other Western entities, INSA represents the operation of an Asian COE in cooperation with the US and the IAEA. This has positioned KINAC/INSA to play a facilitating role in the region, sharing best practices with its neighbors, particularly China and the Philippines [3].¹ In September 2014, INSA concluded memoranda of understanding (MOUs) for HRD cooperation with the Indonesian regulatory body BAPETEN, and with the Vietnamese regulatory body VARANS. In these ways and others, INSA has served as a nexus for these regional countries to increase their cooperation and networking for nuclear nonproliferation and nuclear security, based on a common regional culture.

KINAC/INSA has also observed a number of lessons learned from the initial phases of its establishment. First, the establishment of a COE should be based on a national decision in harmony with its long-term policies, in order to assure a necessary budget and sustainable resources. Second, a regulatory body could be in a better position than a facility operator for establishing a COE. This is because the regulatory body has relatively more experiences and competent manpower in the area of nuclear safeguards, security and strategic trade controls in conjunction with the reviewing of documents and implementing inspections. Third, the application of the ADDIE method can serve as a useful, universal guideline for establishing a sustainable COE. Fourth, in the phase of development of a COE in conjunction with the ADDIE method, it is vital to have access to the services of a capable lecturer in nuclear nonproliferation and nuclear security that also has an excellent command of English. This is one reason why it's very important to have a close network with native English-language experts apart from the IAEA, despite the fact that the IAEA can provide a COE with a generalized and universalized logic and information for education and training. Fifth, for success in the long term, a COE should develop an original approach to education and training. A COE should try to differentiate itself from other COEs as it develops its own best practices. One way to achieve this is through the frequent application of exercises for each course with a relevant nuclear facility visit program. Sixth, a COE should arrange to accommodate a diverse range of cultural and religious preferences.

V. Conclusion

In addition to its domestic programs and courses, INSA has carried out three self-initiated international education and training programs in the areas of nuclear security, safeguards and export/import controls in 2014. It has also conducted two coordinated regional training courses with the IAEA in the fields of on nuclear security and safeguards.

In 2015, INSA will carry out three intermediate-level programs on nuclear security, safeguards and export/import controls, while hosting four IAEA regional training courses on sabotage, forensics, and a train-the-trainers (TTT) course on physical protection of nuclear material and nuclear facilities, in addition to introductory course of safeguards. INSA has also strengthened its

¹ The ROK, represented by INSA, made an agreement with China, represented by the State Nuclear Support Technology Center (SNSTC) on the occasion of the 11th ROK-China Bilateral Nuclear Energy Cooperation Meeting, held in Beijing in May 2014 for exchange of information and lecturers. In addition, INSA, invited by the IAEA and represented by the Director General, visited the Philippine Nuclear Research Institute (PNRI) to attend the workshop entitled, "Review of the Integrated Nuclear Security Support Plan (INSSP)" and organized by the IAEA and PNRI on Nov. 27-28, 2014, in Manila, where INSA presented to the PNRI and related Philippine authorities of the Philippines on the topic of "The Experiences of the INSA to Establish a COE." The INSSP is a planning tool of the IAEA to support the systematic implementation of nuclear security activities.

domestic education and training endeavors, focusing on highlighting and deepening awareness of a culture of nuclear nonproliferation and security. Domestic efforts are gradually moving toward the harmonized approach of 3S—Security, Safeguards and Safety—with its relevant organizations, even though it can take substantial time for related entities to overcome conventional factionalism.

INSA is working closely with the US and the IAEA to assure the quality of its instructors and course materials, making use of government-level of bilateral and multilateral cooperation channels for its HRD activities. In this sense INSA's HRD activities have been performed in a globally cooperative way for the common international goal of peace and security. The majority of the trainees involved with INSA's international HRD activities are from nuclear newcomer countries.

As international societies become ever more interdependent for technological, socio-political, and economic reasons, particularly in the aftermath in the Cold War and 9-11, HRD activities have become a commonly recognized tool for taking appropriate and universalized measures against social, economic, technical and intellectual management. This approach applies even to the management of crisis and security threats [4].²

While the nuclear share in the total electricity production in 2013 in the ROK was 27.6 percent, the ROK imports approximately 96 percent of its natural energy resources—primarily oil, gas, and coal—from abroad. This means that the ROK is seriously dependent on foreign markets to assure its natural energy resources [5]. Yet, as a member of the club of nuclear reactor-supplying countries since 2009, the ROK is assuming an increased role in strengthening the international nuclear nonproliferation and security regime, and is giving emphasis to the importance of HRD programs domestically and for newcomer countries.

A center of excellence aims to develop human resources and also provide technical and scientific support to ensure the long-term sustainability and effectiveness of nuclear nonproliferation and security system in a state. Such a mission also includes spreading awareness and understanding on nuclear nonproliferation and security to people who are indirectly related to the nuclear industry. The aims of a state-focused COE of nuclear nonproliferation and security can be extended to a regional and international scope. In particular, many leading think-tanks and COEs have been trying to seek solutions for how to continue to strengthen nuclear security after the 2016 NSS, where COEs could play a leading role in implementing a nuclear nonproliferation and security culture.³

To share lessons learned is to share knowledge and wisdom. Sharing knowledge and wisdom in the form of best practices can result in security and prosperity in a society, which can be spread

² See, Guy B. Roberts, *NATO Centers of Excellence: A Model of Excellence*, Paper Presented by the Former NATO Officer in the workshop at the Vienna Center for Disarmament and Non-Proliferation (VCDNP) with technical and policy experts on nuclear security to explore the potential for collaboration among the existing and planned COE for nuclear security in Asia, co-hosted by the Center for Strategic and International Studies (CSIS) and the Stanley Foundation on October 8, 2014.

³ The CSIS and The Stanley Foundation organized a series of workshops to exchange ideas in an off-the-record setting among government and other experts on the potential for collaboration among COEs in Asia in technical and policy areas on July 17-18, 2014, at the CSIS in Washington, DC, which was followed by the workshop at VCDNP, in Vienna on Oct. 8, 2014. Recently, the Ministry of Foreign affairs and International Cooperation and Italian National Agency for New Technology, Energy and the Environment in cooperation with the European Commission (EC) and the IAEA organized a high-level workshop, entitled "The NSS 2016 and Beyond: the Role of Training and Support Centers, and COE," on May 7-8, 2015, at Bologna, Italy. KINAC will hold a workshop entitled "The Role of the COE and Its Future Direction in Preparation of the Post-NSS" at Daejeon, ROK, on August 26-28, 2015.

on a regional and international scale. Sharing lessons learned and wisdom is the main goal of INSA, which aims to strengthen national, regional and global peace and security.

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VII. Author's Bio and Contact Information

Dr. Kwan Kyooh Choe is the Director General of the International Nuclear Nonproliferation and Security Academy (INSA) in the Korea Institute of Nuclear Nonproliferation and Control (KINAC). Before joining the KINAC in 2006, he spent 5 years at the Korea Atomic Energy Research Institute (KAERI) and at the National Nuclear Management and Control Agency (NNCA). After having worked from September 1998 at Yonsei University in Korea as a Research Professor on issues in political science, he joined KAERI in 2001. His research interests include international relations, nuclear nonproliferation, nuclear security, and HRD. He is a member of the Korea Nuclear Society, the Institute of Nuclear Materials Management, and the Korean Association of International Studies. Contact: harim@kinac.re.kr