

THE ADVANCED NUCLEAR 3S EDUCATION AND TRAINING (ANSET) PROGRAM OF TOKYO TECH: (1) OVERVIEW OF YEAR 5

Hiroshi SAGARA, Chi Young HAN, Satoshi CHIBA, Yoshihisa MATSUMOTO, Noriyosu HAYASHIZAKI, Masako Ikegami, Akira OMOTO, Kenji TAKESHITA, Tatsuya KATABUCHI, Hiroshige KIKURA, and Koichiro TAKAO

Tokyo Institute of Technology, Tokyo, Japan

ABSTRACT

Tokyo Institute of Technology (Tokyo Tech) has established the Advanced Nuclear 3S (Safety, Security, and Safeguards) Education and Training (ANSET) program in 2017. The ANSET program provides students with an advanced 3S curriculum (3S Lectures, 3S Exercises, and 3S Internships), which educates them in 3S expertise, insight and leadership, and practical skills. This program is targeted at not only students specialized in nuclear engineering, but also students in other fields, and open to young professionals. The ANSET program provides students with an advanced 3S curriculum (3S Lectures, 3S Exercises, and 3S Internships), which educates them in 3S professionalism, insight and leadership, and practical skills. The curriculum is systemized to organically integrate nexus among 3S, and provide more practical hands-on exercises to build response capacity to social needs of nuclear security. Since 2017 to 2021 of August, more than 500 students have taken the courses of the curriculum and 25 students, who met the requirements of the curriculum, have received the certificate of curriculum completion as an evidence to show their expertise in this field. This program is financially supported by Nuclear Regulation Authority Japan.

INTRODUCTION

Tokyo Institute of Technology (Tokyo Tech) has started the nuclear science and engineering since 1957 at by the establishing the department of Nuclear Engineering as the graduate major, it was one of the earliest universities in Japan. For more than 65 years, Tokyo Tech has kept the front runner in both research and education in nuclear field. Even after the Fukushima Daiichi Nuclear Power Satiation accident in 2011, we emphasized nuclear safety and security education and, started a new education program, called the Global Nuclear Safety and Security Dojo Program, which was financially supported by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan. This program provides a specially designed curriculum from multiple disciplines for selected graduate students in nuclear engineering.

In 2017, Tokyo Tech established the Advanced Nuclear 3S (Safety, Security, and Safeguards) Education and Training (ANSET) program [1,2], supported by the Nuclear Regulation Authority (NRA) of Japan. The ANSET program aims to foster the next generation of leaders who have an expertise in nuclear safety, security, and safeguards, and can take the lead in 3S-related decision-making. This program is targeted at not only students specialized in nuclear engineering, but also students in other fields including part-time students, and open to young professionals as well. Building on Tokyo Tech's nuclear engineering program, the ANSET program provides students with an advanced 3S curriculum (3S Lectures, 3S Exercises, and 3S Internships), which educates them in 3S expertise, insight and leadership, and practical skills. **Figure 1** shows an overview of the program. The curriculum is systemized to organically integrate nexus among 3S, and provide more practical hands-on exercises to build response capacity to social needs of nuclear security.

This paper describes the results of year 5 especially in lectures and internships. The results of all exercises are described by other paper[3].

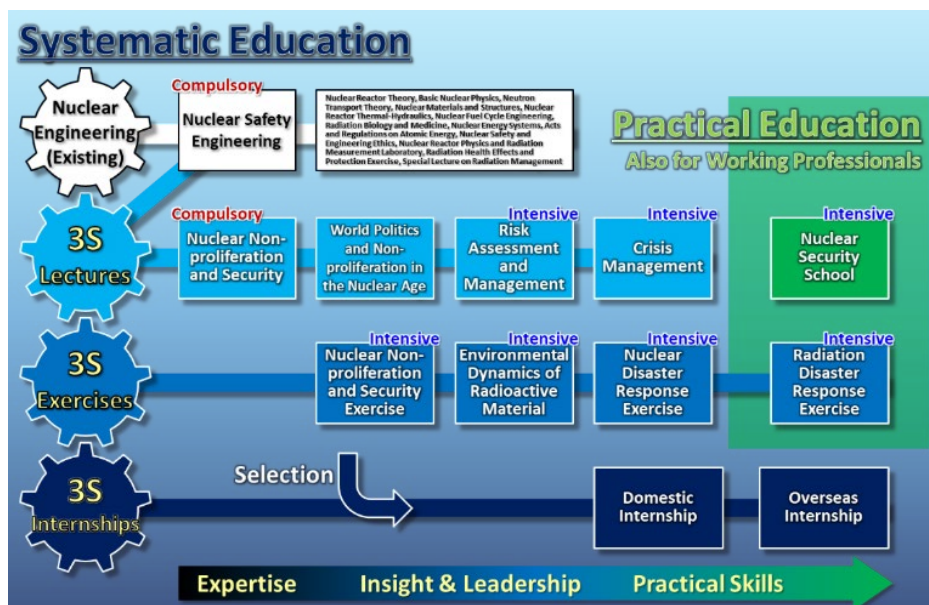


Figure 1. Overview of the ANSET Program

RESULTS OF YEAR 5

Since 2017, we have started 4 lectures, 4 exercises, and internships as in the course program of Tokyo Tech graduate students. And 2 of events were opened to the working professionals. As a result of year 5 of August 2021, there were more than 500 students registered to the course program, and more than 61 working professionals have joined the open events (TABLE 1). As for internships, we could send more than 26 students to the domestic and international internships. In year 2020, due to the COVID-19, we could not send any in the year, but it tended to be gradually recovered in 2021. Since our goal of the program was to provide 3Ss learning opportunities to the students and young professionals as much and wide as possible, and it was achieved more than the original plan from statistic points.

Table 1. Number of registrations in each course, as of August 2021

JAPAN FIS. YEAR	2017	2018	2019	2020	2021	TOTAL
Lecture	15	121	112	113	74~	435~
Exercise	-	18	16	19	10~	63~
Internship	-	9	8	0	9~	26~
Working Professionals	-	10	28	11	22~	61~

More details of each lecture, internship is described in the next section.

(1) LECTURES

We have established all the lectures described as followings, by 2019, and 435 Tokyo Tech students have already registered the lectures by August 2021. Due to the impact by COVID-19, all the lectures were forced to change to online style since 2020.

Nuclear Non-proliferation and Security

This course offers the fundamentals of nuclear non-proliferation and security. A comprehensive view is presented of history and legal framework, science and technology, proliferation resistance and physical protection, and human factors and security culture. Role-plays such as diversion and inspection, nuclear threat and physical protection, and cyber security are assigned to individual students or small groups to enhance their interest in nuclear non-proliferation and security. (Figure 2)

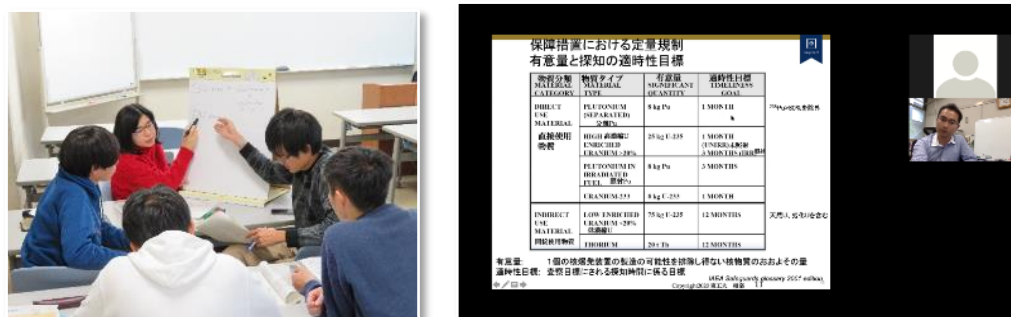


Figure 2. Lecture scenes, before 2020 at left, after 2020 at right.

World Politics and Non-proliferation in the Nuclear Age

This course is designed for students to understand nuclear non-proliferation and safeguards from a more historical and political point of view. Various case studies on the international community for nuclear non-proliferation are discussed about Treaty on the Non-Proliferation of Nuclear Weapons (NPT), safeguards and verification, nuclear disarmament and verification, nuclear suppliers group, and denuclearization. (Figure 3)



Figure 3. Lecture scenes

Risk Assessment and Management

This course aims to cultivate expertise for risk assessment and risk management. Lectures covers not only PRA and risk management method but also focused discussions on uncertainties and knowledge, external events, human factors, and emergency preparedness and response. Examples of cases of risk management are taken together with approaches in use. Students will understand basics for prevention, preparation and minimization of the consequence of accident. Students are expected to learn how to analysis risks, how to be prepared for unexpected events, and decision-making under uncertainties. (Figure 4)

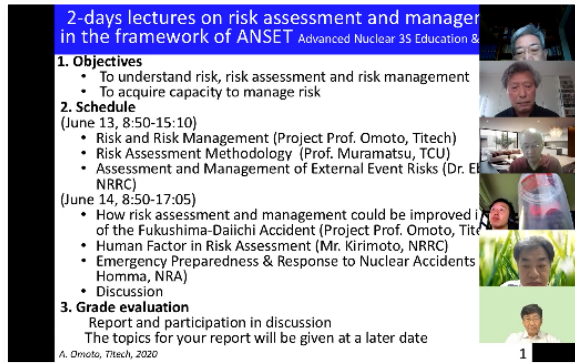


Figure 4. Lecture scenes

Crisis Management

This course is intended to cultivate understanding on how to deal with crisis situation. Students discuss with experts invited from nuclear and non-nuclear fields on such topics as national crisis management scheme, risk communication, crisis management of power systems, international terrorism and countermeasure, information infrastructure in crisis management and cyber security, and international frameworks of crisis management. (Figure 5)



Figure 5. Lecture scenes

(2) EXERCISES

We have established the following 4 exercises and successfully conducted.

- Nuclear Non-proliferation and Security Exercise
- Environmental Dynamics of Radioactive Material
- Nuclear Disaster Response Exercise
- Radiation Disaster Response Exercise

The details are reported in another paper [3].

(3) INTERNSHIPS

The internship courses are to deepen understanding of the 3S expertise, insight, and leadership learned from 3S Lectures and Exercises, and promote practical skills through working experiences in 3S fields. Students receive a full financial support from the ANSET program. As for internships, we could send more than 26 students to the domestic and international internships. In year 2020, due to the COVID-19, we could not send any in the year, but it tended to be gradually recovered in 2021.

Domestic Internship

The destination of domestic internship includes the Nuclear Material Control Center (NMCC), the Japan Atomic Energy Agency (JAEA), and the Japan Nuclear Fuel Limited (JNFL). Students experience nuclear safeguards and security of Japan at Rokkasho Safeguards Center and Tokai Safeguards Center of NMCC, at Uranium Enrichment Plant and Reprocessing Plant of JNFL, at Plutonium Fuel Production Facility, TRP Decommissioning Center, and Integrated Support Center for Nuclear Nonproliferation and Nuclear Security (ISCN) of JAEA.

Overseas Internship

The destination of overseas internship includes the International Atomic Energy Agency (IAEA), the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). Two selected students participate in the overseas internship every year. Tokyo Tech have made the agreement on the internship between IAEA in 2020, this frame work enhanced the internship procedure much effectively, and we could send 4 interns, 2 for 6 months and 2 for 3 months in 2021 in the variety of fields of jobs. **(Figure 6)**



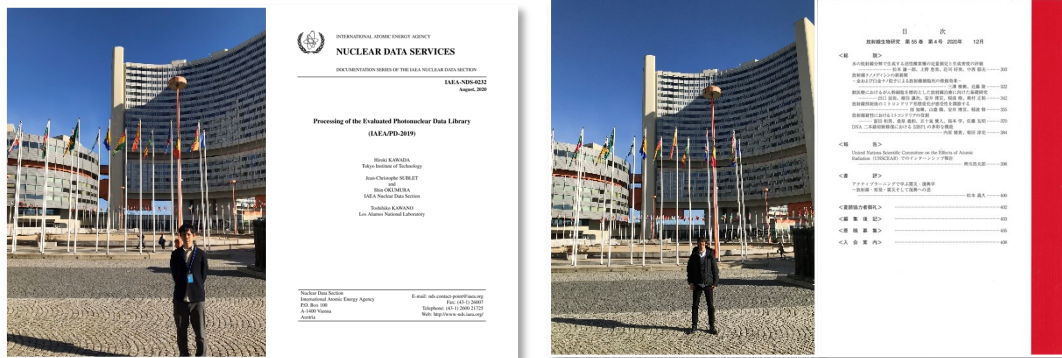


Figure 6. Overseas Internship

(4) NUCLEAR SECURITY SCHOOL

The ANSET program hosted the Nuclear Security School of Tokyo Tech was held in 2019 (NUSST 2019) and in 2021(NUSST 2020). NUSST 2019 that is the first nuclear security school in Japan was designed to enhance the learning experiences in a wider variety of class settings in cooperation with NRA and IAEA. In NUSST 2020, by changing to the online style, 22 working professionals from outside could join it together with the students in Tokyo Tech. It provided lectures and exercises including role-playing exercises as a regulator or an operator for several cases to deepen practical understanding of nuclear security according to social needs (Figure 7). The topics covered protection of materials and facilities, nuclear security regulations, materials out of regulatory control, human factors and nuclear security culture.

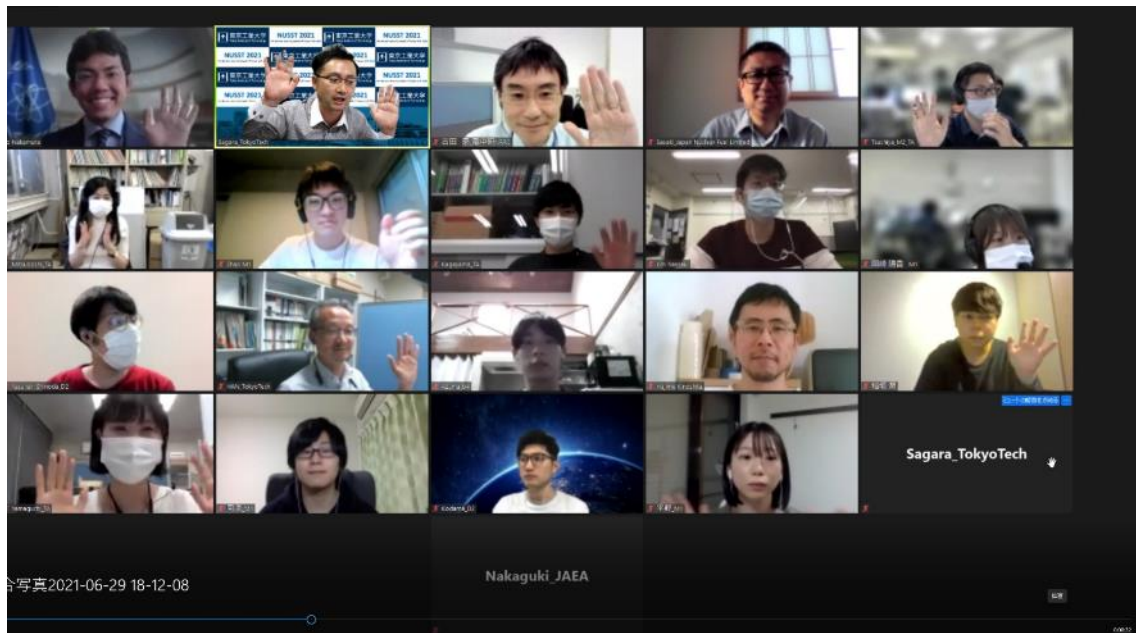


Figure 7. Lecture scenes of NUSST 2021.

CONCLUSIONS

Since 2017 to August 2021, more than 500 students have taken the courses of the ANSET program and 25 students, who met the requirements of the curriculum, have received the certificate of curriculum completion as an evidence to show their expertise in this field. The present phase of the program will be completed in March 2022 successfully. In the next phase, the development and expansion of the program would be the key especially to more global contents. We hope the future collaboration with the international society in nuclear security and nonproliferation.

ACKNOWLEDGEMENT

This program is supported by Nuclear Regulation Authority, Japan.

REFERENCES

- 1 Chi Young HAN, Shuichiro EBATA, Hiroshi SAGARA, Satoshi CHIBA, Yoshihisa MATSUMOTO, Noriyosu HAYASHIZAKI, Masako IKEGAMI, Akira OMOTO, Kenji TAKESHITA, Tatsuya KATABUCHI, Hiroshige KIKURA, and Koichiro TAKAO, "THE ADVANCED NUCLEAR 3S EDUCATION AND TRAINING (ANSET) PROGRAM OF TOKYO TECH," Proceedings of the INMM 61st Annual Meeting, July 12-16, 2020.
2. <http://www.ne.titech.ac.jp/kiseijinzai/en>
3. Chi Young HAN, Hiroshi SAGARA, Tatsuya KATABUCHI, Hiroshige KIKURA, Yoshihisa MATSUMOTO, Kenji TAKESHITA, and Koichiro TAKAO, and Satoshi CHIBA "THE ADVANCED NUCLEAR 3S EDUCATION AND TRAINING (ANSET) PROGRAM OF TOKYO TECH: (2) 3S EXERCISES." Proceedings of the INMM & ESARDA joint Annual Meeting, August 2021.