

ISCN's Mission and Efforts

HORI Masato



*Director, Integrated Support Center for
Nuclear Nonproliferation and Nuclear Security*

Japan Atomic Energy Agency



The International Forum on Peaceful Use of Nuclear Energy,
Nuclear Non-Proliferation and Security

14 December 2023

Japan's National Statement at 2010 Nuclear Security Summit:

- Establishment of an integrated support center for nuclear nonproliferation and nuclear security in JAEA
- Development of technology related to measurement and detection of nuclear material and nuclear forensics based on international cooperation.
- Contribute to the improvement of global nuclear security ...by implementing human resource development programs



Objective of JAEA



Mission: Contribution to the welfare and prosperity of human society through nuclear science and technology

Vision: Exploration of a New Future with the Synergy of Nuclear and Renewable

ISCN's Mission



To contribute to the welfare of humanity by realizing a world without nuclear weapons and nuclear terrorism, based on improvement of technological developments and institutional frameworks, and capacity building of human resources for nuclear non-proliferation and nuclear security

Typical Efforts Toward a World without Nuclear Weapons

- Prevent nuclear weapon development by non-nuclear weapon states
- Ensuring peaceful uses of nuclear energy
- Reduction and abolition of nuclear weapons

Nuclear Non-Proliferation Treaty (NPT)

Safeguards Agreement, Additional Protocol

NSG Guideline

Bilateral nuclear cooperation agreement

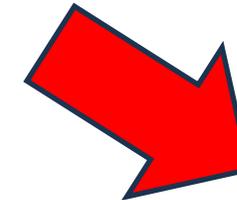
Nuclear-Weapon-Free Zone Treaty

New START, nuclear disarmament negotiations

Comprehensive Test Ban Treaty (CTBT)

Fissile Material Cutoff Treaty (FMCT)

Ensure agreement, entry into force, universalization of these frameworks, including monitoring and verification by international organizations, etc.



A world without nuclear weapon

Sustainable society through the peaceful use of nuclear energy

Typical Efforts Toward a World without Nuclear Terrorism

- Prevention of theft and sabotage of nuclear or radioactive materials from nuclear facilities.
- Prevention of illicit trafficking of nuclear and radioactive materials and other malicious acts.
- Reducing the risk of nuclear and radiological terrorism.

Convention on the Physical Protection of Nuclear Material (including amendments)

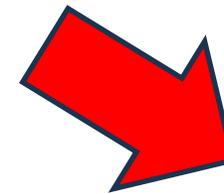
Nuclear Security Recommendations (INF CIRC/225/Rev.5 etc.)

Nuclear Terrorism Convention

Nuclear forensic, nuclear detection

Global Threat Reduction Initiative

States apply reliable and effective nuclear security measures based on these frameworks and others



Reduction of nuclear terrorism risk

A world without nuclear terrorism

Sustainable society through the peaceful use of nuclear energy

Main Activities of ISCN

Leveraging our strengths as a nuclear research institute, ISCN is committed to the following five activities, which are essential for realizing the world without nuclear weapon and nuclear terrorism.

1. Research and development activities for nuclear nonproliferation and nuclear security
2. Capacity building support through human resource development for nuclear nonproliferation and nuclear security
3. Support for CTBT international verification regime
4. Policy research on nuclear nonproliferation and nuclear security
5. Public engagement (awareness raising, information sharing)

Research and Development Activities for Nuclear Nonproliferation and Nuclear Security

Nuclear Security

Nuclear Forensics

Broad-area covering rapid nuclear and radioactive material detection technologies

Material Attractiveness evaluation study

- Develop a methodology to evaluate attractiveness of materials in fuel cycle process for theft and sabotage in nuclear and radiological malicious acts under Japan-US cooperation

Nuclear Nonproliferation

Development of active neutron NDA techniques

Recent Achievements (Nuclear Forensics)

1. "Signature" analysis techniques using Artificial Intelligence

- Improvement of machine learning algorithm for numerical data
- Development of sample identification technique by morphological analysis using deep neural network model

2. Study of Uranium ore Signature and it's analytical techniques

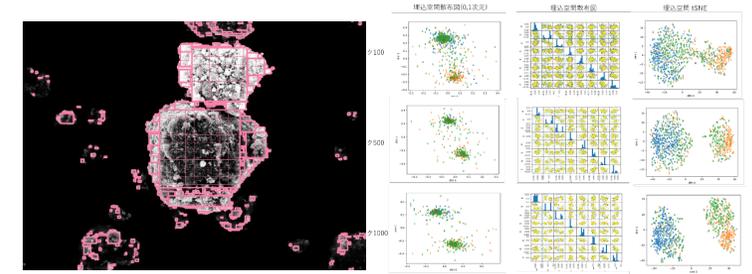
- Uranium ore and UOC sample preparation
- Joint study with DOE/NNSA

3. Uranium age dating using a spectrometry

- To develop uranium age dating techniques using low cost equipment for improvement of analytical capability for Newcomer countries and universities
- Joint study with Kanazawa Univ.

4. Nuclear and other radioactive materials detection and imaging techniques for dispersed those materials at crime scene

- Development of nuclide identification algorithm using deep neural network
- Basic data collection for optimization study for hybrid detector system



Automatic image clipping tool for machine learning

Visualization of extracted features

Machine learning algorithm

Hybrid system using low cost detectors



Autonomous detection and classification of radionuclides to support crime scene investigator

Recent Achievements (Nuclear Detection and Measurement)

1. Development of active neutron NDA

(1) Integrated system with DDA, PGA and NRTA

- The system was constructed at the end of 2021 JFY
- Study is in progress with this system

(2) Compact DGA system development

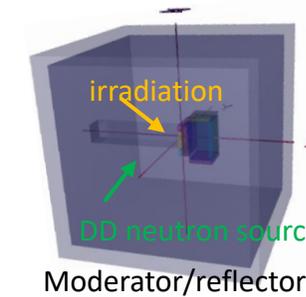
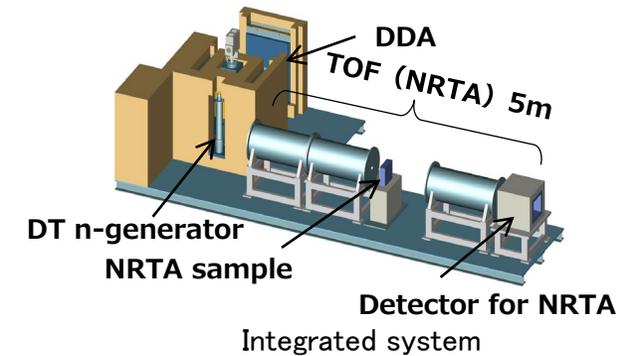
- Downsizing and safety designing
- Evaluation of measurement data and activation analysis simulation result

Neutron behavior
Detector system development

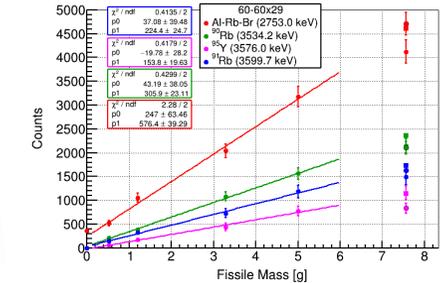
(3) NRTA system development using Laser driven neutron source (LDNS)

Study of short pulse neutron source for NRTA

- Development of neutron detector with low gamma ray sensitivity
 - Shown LDNS applicability for NRTA
- NRTA spectrum were observed at our experiments



Simulation study for DGA

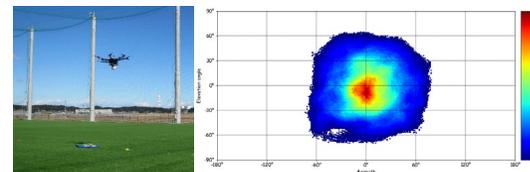


Gamma ray count for U-235 mass

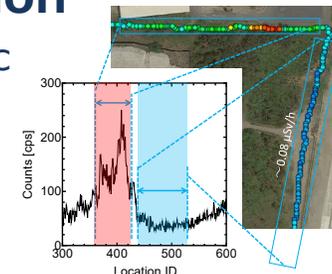
2. Broad-area nuclear and radioactive material detection

Counterterrorism at soft target, like sports event, shopping complex, etc

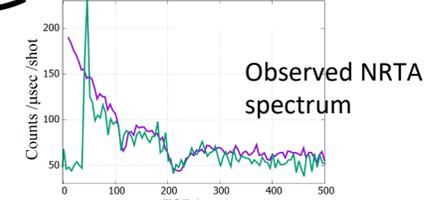
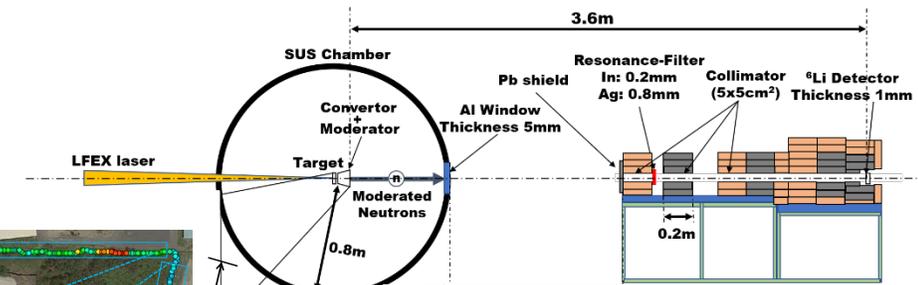
- Radioactive material detection test
- Development of detectors



Radioactive material detection test using drone



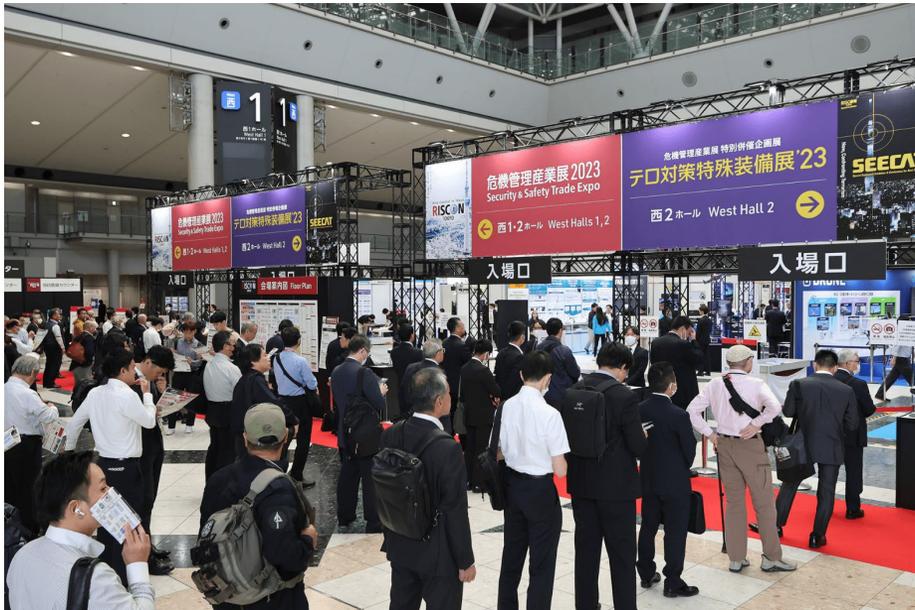
Performance evaluation by walking



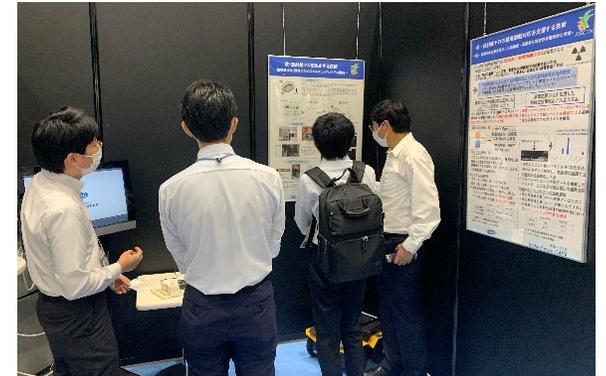
NRTA experiment at LFX facility, Osaka univ.

Efforts toward Social Implementation

To maximize our research and development findings and outcomes, we are distributing our results through presentations at academic conferences, holding workshops, and participating in exhibitions such as SEECAT (Special Equipment Exhibition & Conference for Anti-Terrorism).



SEECAT (Special Equipment Exhibition & Conference for Anti-Terrorism) '23, October 2023, Tokyo Big Sight
<https://www.seecat.biz/>



ISCN's exhibition booth at SEECAT '23

Capacity Building Support through Human Resource Development for Nuclear Nonproliferation and Nuclear Security

Three courses:

1. Nuclear security course (incl. security of Radiological materials)
2. Safeguards and SSAC* course (* State system of accounting for and control of nuclear material)
3. International non-proliferation framework course: bilateral cooperation

Needs-oriented approach:

Tailored training curriculum to reflect the needs of target audience

For efficient and effective training:

Cooperation with IAEA and DOE/NNSA, combination of the following methods:

Lectures



Group Exercises



PP Exercise Field



Virtual Reality



Online Training



New Training Tools and Methods

- Tools/methods developed for online trainings are incorporated in In-person trainings, E-Learnings, Remote live visit to Hiroshima, and Remote lectures.



E-learnings as pre-requisite



Virtual tour of Research Reactor (JRR-4)



Remote lecture



Complementary Access Demo Video
<https://elearning.iaea.org/m2/course/view.php?id=1257>



Group Exercises in classroom/PP exercise field



Virtual Reality System/ Equipment Demo

Training Tool 1: PP Exercise Field

Equipped with the main security devices (e.g. intrusion detection sensors; camera/video systems) that are in use at actual nuclear facilities, our PP Exercise Field provides hands-on learning opportunities including the devices' basic functions, the security system designs, and the performance testing techniques.



Thermal Camera



Free-Standing X-Field Sensor



Buried E-Field Sensor



Laser Sensor



High Definition Camera

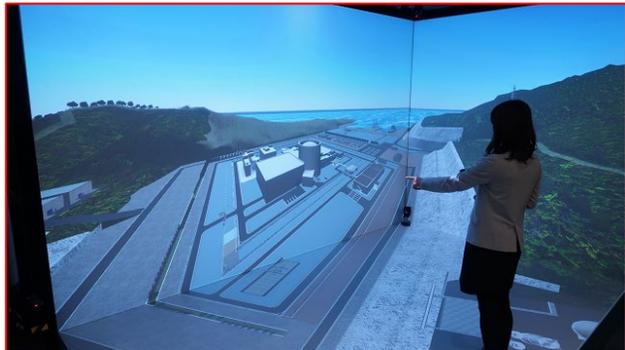
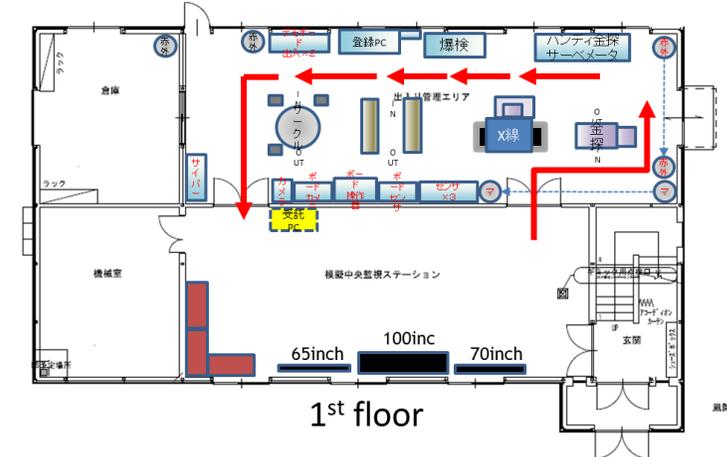
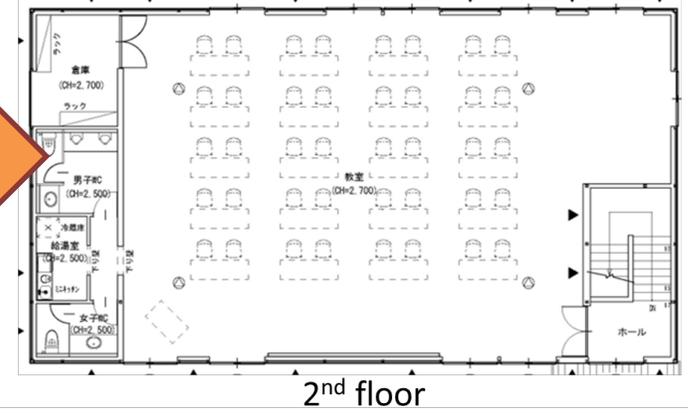
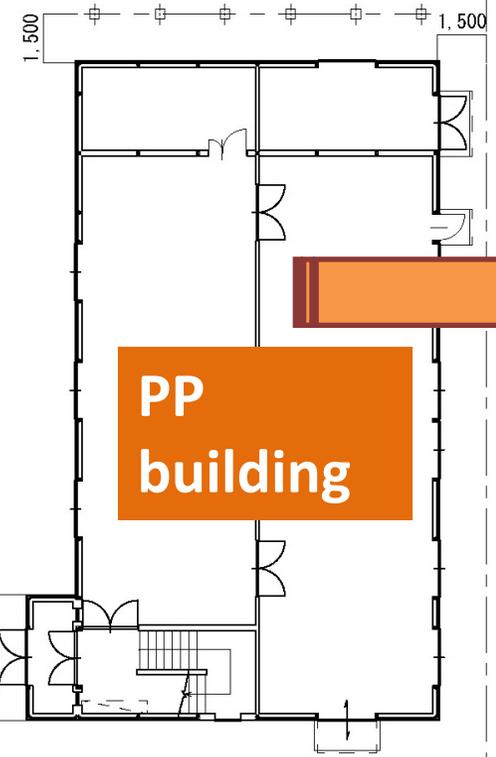
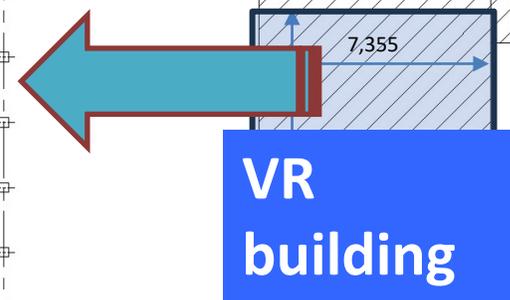
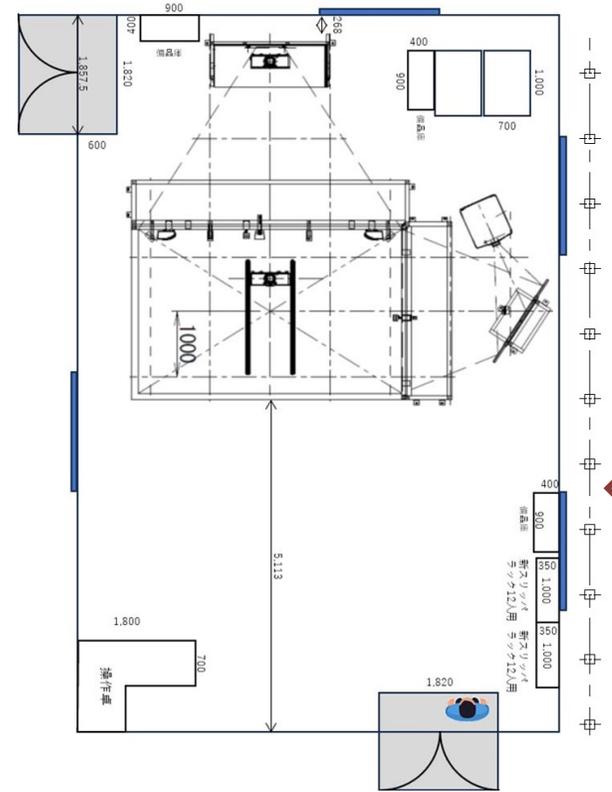


Microwave Sensor



IR Sensor

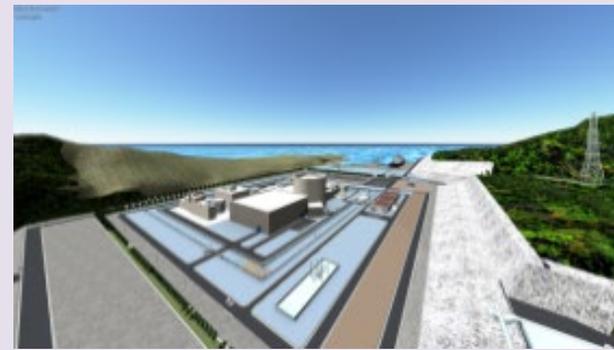
PP Exercise Field Upgrade



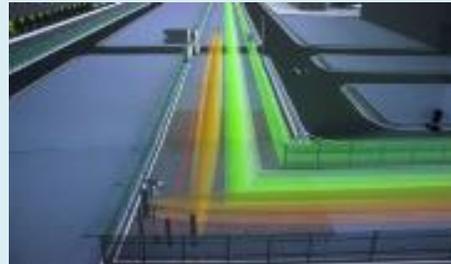
Training Tool 2: Virtual Reality (VR) System

Virtual experience of observing the inside /outside of a nuclear facility

- Construct a virtual nuclear power plant (NPP) in the cyberspace
- Display a NPP on the three-sided screen in 3-D
- walk-through/fly-through of a NPP



Learning the characteristics of a facility and its physical elements by examining a three-dimensional view of the facility



Verify monitoring functions and image features of cameras and sensors



Learning skills for handling contingency in a virtual central alarm station



camera



sensors



metal detector



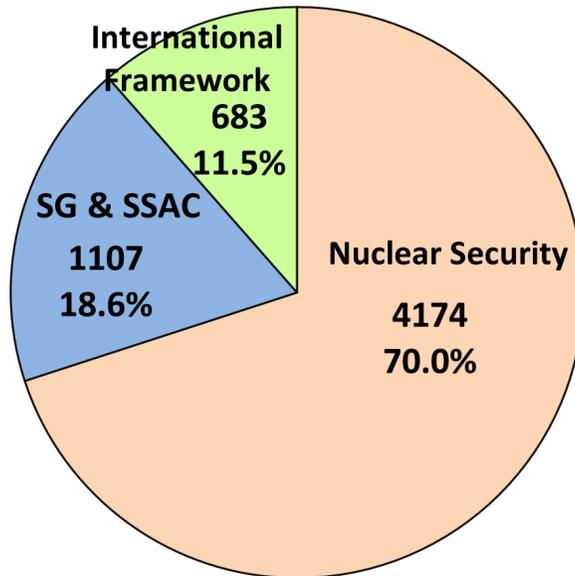
Verify installation and functions of security tools

ISCN's Training Course Participants

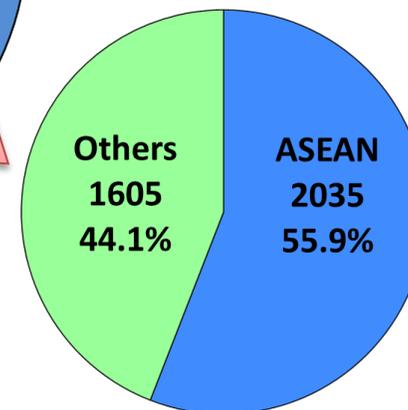
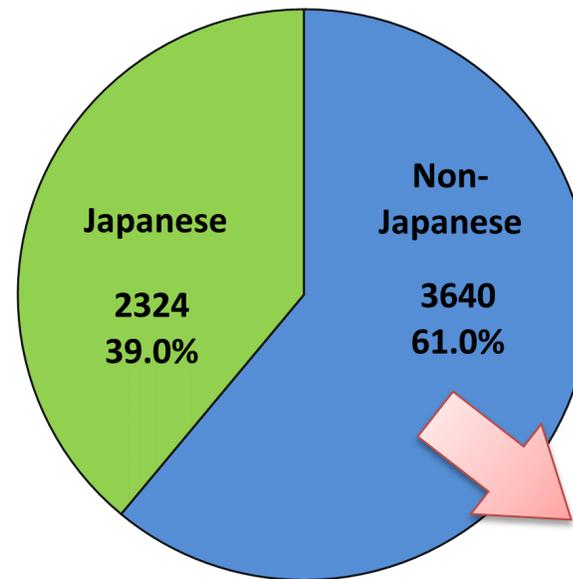
2011- November 2023

Total 235 courses with 5,964 participants
(105 countries, 6 international organizations)

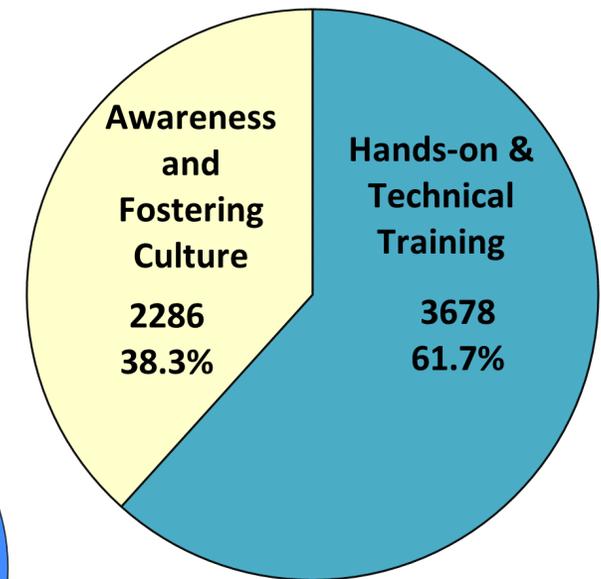
Course Topic



Nationality



Course Style



Contribution to Universalization of Safeguards Agreement and Protocols

- Comprehensive Safeguards Agreement (CSA)
- Small Quantities Protocol (SQP) :States that have minimal or no nuclear material and no nuclear material in a facility
- Additional Protocol: significantly increases the IAEA's ability to verify the peaceful use of all nuclear material in States

To strengthen safeguards, it is important to facilitate understanding of protocols

Original SQP  Revised SQP

 Enter into force
Additional Protocol

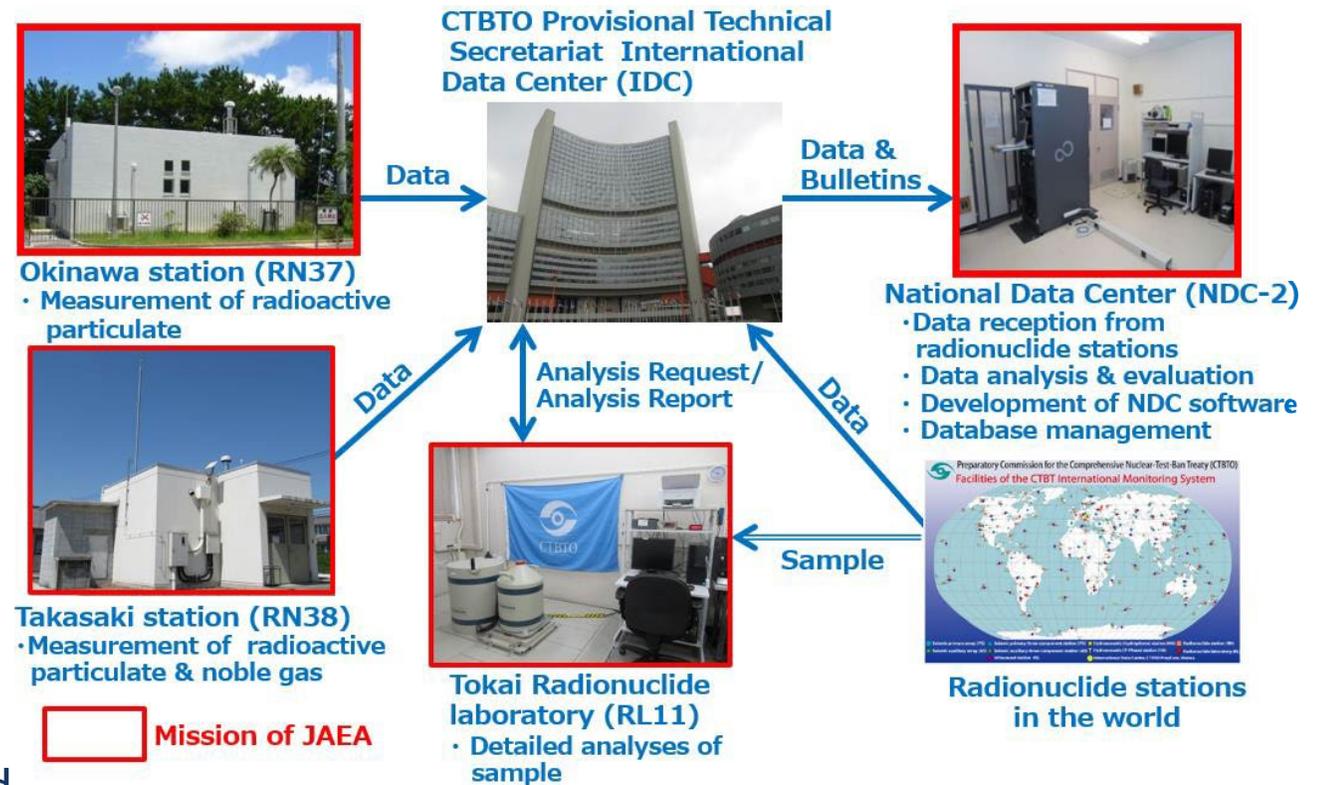


Strengthen nuclear nonproliferation

Expand networks to strengthen nuclear nonproliferation

Contribution to CTBT International Verification Regime

- JAEA operates the radionuclide monitoring stations in Okinawa and Takasaki, the radionuclide laboratory in Tokai and the national data center for nuclear test monitoring.
- The radionuclide laboratory received the highest A rating in the Proficiency Test Exercise (PTE2022) to evaluate analytical ability.
- In order to enhance the detection capability for nuclear tests, the transportable xenon laboratories (TXLs) were installed at Horonobe, Hokkaido and Mutsu, Aomori, respectively and have been measuring radioxenon since 2018 for investigation of the background behavior of radioactive noble gases in collaboration with the CTBTO.



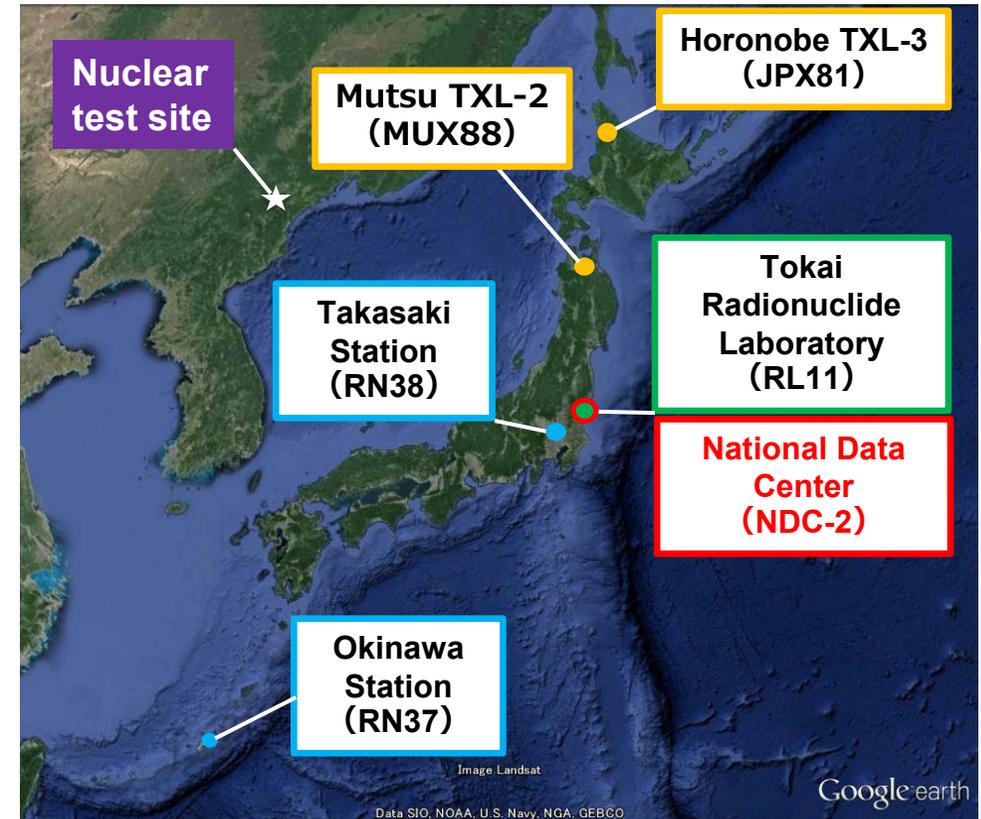
JAEA's activities related to the CTBT



Exterior and interior of TXL installed at Horonobe

Past Results of Radionuclide Detection Relating to DPRK Nuclear Tests at RN38 Takasaki Station

DPRK's nuclear test	Test date	Definitive detection of radionuclides derived from nuclear test
1st	9/Oct/2006	None <i>(The noble gas measurement system had not been installed yet in RN38 Takasaki station.)</i>
2nd	25/May/2009	None
3rd	12/Feb/2013	Early in April, Xe-133 and Xe-131m were detected same time far beyond normal background level of the activity concentration at RN 38 Takasaki station (JPX38).
4th	6/Jan/2016	Middle in February, Xe-133 of possible nuclear test origin was detected.
5th	9/Sep/2016	None
6th	3/Sep/2017	Early in October, Xe-133 of possible nuclear test origin was detected.



[Radionuclide Stations]

- Okinawa (RN37)
- Takasaki (RN38)

[Radionuclide Laboratory]

- Tokai (RL11)

[National Data Center]

- Tokai (NDC-2)

[Temporary stations for Joint Project with CTBTO]

- Transportable Xenon Laboratory (TXL)
- Mutsu TXL-2 (MUX88)
- Horonobe TXL-3 (JPX81)

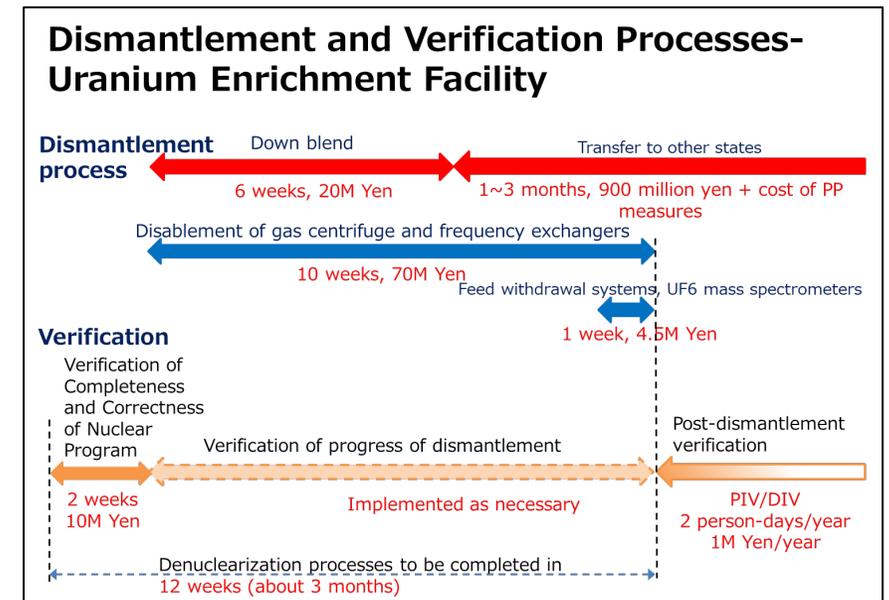
Policy Research on Nuclear Nonproliferation and Nuclear Security

ISCN conducts policy research based on technical knowledge reflecting international trends related to nuclear nonproliferation and nuclear security.

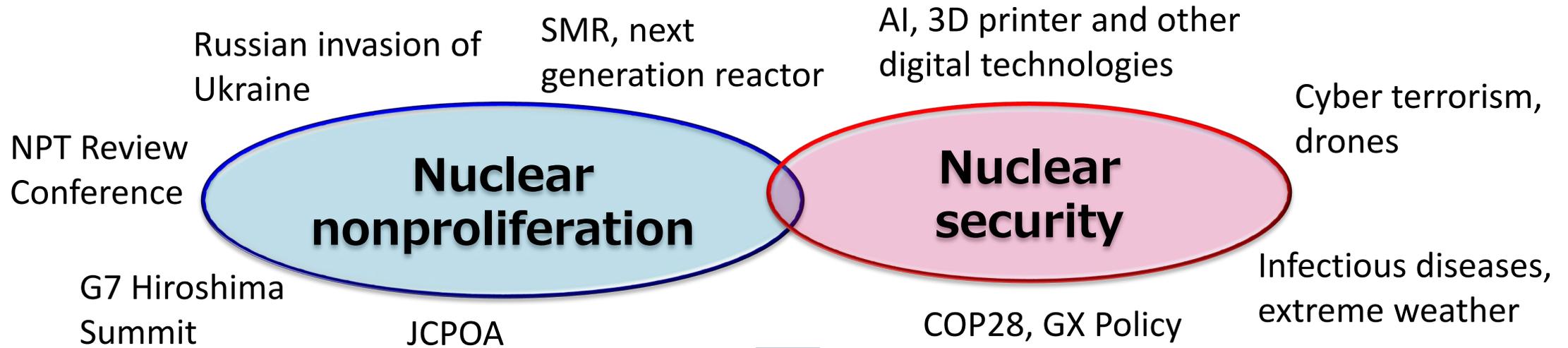
Example: Denuclearization Study by ISCN

To improve preparedness of future denuclearization, series of study to achieve effective and efficient denuclearization have been performed in JAEA.

- Lessons learned from past denuclearization experiences
 - South Africa, Libya, Iraq, 3 states of former Soviet Union (Ukraine, Kazakhstan, and Belarus), Iran and DPRK
- Possible Future Dismantlement and Verification Options
 - Quantitative evaluation of effectiveness (irreversibility) and resources requirement including resources for verification



Changes in International Trends Surrounding Nuclear Nonproliferation and Nuclear Security



Information collection and analysis, policy research

Reflect in ISCN's efforts

Support policy maker

Information dissemination

Public Engagement (Awareness Raising, Information Sharing)

For deepen understanding of nuclear nonproliferation and nuclear security and peaceful use of nuclear energy, we report and share our achievements at conferences, hold international forums, and disseminate information through the JAEA website and ISCN Newsletter.

ISCN Newsletter

Collect and summarize timely and various information on nuclear non-proliferation and nuclear security, add commentary and deliver as newsletter.



International Forum on Peaceful Use of Nuclear Energy, Nuclear Non-Proliferation and Nuclear Security



"The Impact and Challenges of Russia's Aggression against Ukraine on Nuclear Nonproliferation, Nuclear Security, and Peaceful Use of Nuclear Energy", Dec. 2022

Thank you for your kind attention.


Integrated Support Center for Nuclear Nonproliferation and Nuclear Security
 核不拡散・核セキュリティ総合支援センター

[JAEA Home](#) | [Sitemap](#) | [Japanese](#)

[Google Search](#)

[jaea.go.jp/04/iscn](#) [www](#)



[Home](#) | [Introduction](#) | [News & Topics](#) | [Technology Development and Contribution to CTBT](#) | [Capacity Building Support](#) | [Policy Research](#) | [Promote Understanding](#)

Latest Topics

2023.11 International Forum
 The 2023 International Forum on Peaceful Use of Nuclear Energy, Nuclear Non-Proliferation and Nuclear Security "Toward a sustainable society through the peaceful use of nuclear energy and a world without nuclear weapons"



2023.11 ISCN Newsletter
 ISCN Newsletter No.323

2023.10 ISCN Newsletter
 ISCN Newsletter No.322

2023.09 ISCN Newsletter
 ISCN Newsletter No.321

2023.08 ISCN Newsletter
 ISCN Newsletter No.320

ISCN video
 – Project JAEA “Realizing a world without threats of nuclear weapons and nuclear terrorism” –



This video summarizes how ISCN is contributing to build a safe and secure world without the threat of nuclear weapons and nuclear terrorism through its capacity

Please access to our Website

https://www.jaea.go.jp/04/iscn/index_en.html

