JAEA's Activities and International Contributions to Nuclear Nonproliferation and Nuclear Security

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Keynote Report

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29 November 2016
1. 活動概要
2. 核不拡散・核セキュリティ総合支援センター（ISCN）の活動紹介
3. 午後のパネル討論への導入

1. Activity Summary
2. Activities of Integrated Support Center for Nuclear Nonproliferation and Nuclear Security (ISCN)
3. Introduction to the Panel Discussions
Missions and Visions of Activities for Nuclear Nonproliferation and Nuclear Security

Missions for Nuclear Nonproliferation and Nuclear Security Activities

Combine technological powers built on the wealth of knowledge and experience of nuclear energy R&D

Contribute to compatibility of the peaceful use of nuclear energy with nuclear non-proliferation and nuclear security

Fully cooperate with relevant organizations at home and abroad

Three Visions of Nuclear Nonproliferation and Nuclear Security Activities

• Promoter and facilitator of the peaceful use of nuclear energy
  Support Japan in ensuring transparency in nuclear material management and use

• Engineers and scientists trusted by the international community
  Develop technologies in the field of nuclear non-proliferation and nuclear security for international organizations (IAEA, etc.) and other countries

• International center of excellence (COE) to support capacity building
  Carry out human resource development support activities for capacity building in the field of nuclear nonproliferation and nuclear security, mainly for Asian countries
活動概要

○機構内の適正な核物質管理への取組

核物質防護（PP）
核物質や原子力施設をテロリスト等から守る措置

- 防護対象特定核燃料物質を扱う事業所（防護施設）
  - 原研/核サイ/大洗研/もんじゅ/ふげん/人形峰
- PPの基本方針策定
- 核セキュリティ文化醸成活動の実施
- 核物質防護検査対応
- 法令改正や行政指導に伴う対応
- 輸送セキュリティ

保障措置（SG）
核物質の核兵器への転用がないことを担保する検証活動

- 主な保障措置対象事業所
  - 原研/核研/大洗研/もんじゅ/ふげん/人形峰等
- 国際規制物質の保障措置・計量管理に係る業務
- 保障措置・計量管理業務の維持・向上
- 法令改正や行政指導に伴う対応

物理保護（PP）: measures to protect NM & nuclear facilities from terrorists.

Facilities handling protected specified nuclear fuel materials (protective facilities): NSRI¹, NCL², Oarai³, Monju, Fugen, Ningyo-toge⁴

- Formulate basic policies of PP
- Foster a culture of nuclear security
- Respond to physical protection inspection
- Respond to act amendments and administrative directions
- Secure transportation, and so on...

確保（SG）: verification activities to ensure no diversion of NM into nuclear weapons.

Main facilities specified for safeguards:
NSRI¹, NCL², Oarai³, Monju, Fugen, Ningyo-toge⁴, etc.

- Perform SG and material accountancy operations for internationally regulated materials.
- Maintain and enhance SG and material accountancy operations.
- Respond to act amendments and administrative directions, and so on...

Activity Summary

○Approaches to proper management of nuclear material (NM) at JAEA

1: Nuclear Science Research Institute
2: Nuclear Fuel Cycle Engineering Laboratories
3: Oarai Research and Development Center
4: Ningyo-toge Environmental Engineering Center

Horonobe area

- Tsuruga area Monju, Fugen
- Ningyo-toge area
- Fukushima area
- Tokai area (NSRI, NCL)
- Aomori area (only SG)

Harima area

- Tono area
- Tokyo area

1: Nuclear Science Research Institute
2: Nuclear Fuel Cycle Engineering Laboratories
3: Oarai Research and Development Center
4: Ningyo-toge Environmental Engineering Center
### Activity Summary

#### Domestic and international contributions

**Technical Development for Nuclear Nonproliferation and Nuclear Security**
- Nuclear nonproliferation and safeguards technologies (e.g.)
  - Safeguards and material accountancy techniques for melted fuel in Fukushima
  - Advanced Pu monitoring technology
- Nuclear security technologies
  - Nuclear forensics techniques
  - Non-destructive detection techniques for nuclear material

**Nuclear Nonproliferation Policy Research**
- Conduct policy research on nuclear nonproliferation and nuclear security based on technological knowledge
- Collect, analyze, and transmit information on international trends

**Support in Capacity Building, Mainly in Asia**
- Established ISCN in JAEA, following the government’s statement in the Nuclear Security Summit in April, 2010
- Provide training such as a course to strengthen nuclear security

**Contributions to the CTBT International Verification Regime**
- Operate CTBT radionuclide stations, an official laboratory, and a national data center.
- Develop CTBT verification techniques

**Enlightenment and International Contributions**
- Organize international forums and symposiums and publish ISCN newsletters
- Cooperate internationally with U.S. and EC/JRC.
- Support IAEA in technological development

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CTBT: Comprehensive Nuclear-Test-Ban Treaty
EC/JRC: European Commission/Joint Research Center
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Safeguards and material accountancy techniques for melted fuel from Fukushima

- Evaluate the applicability of nuclear fuel (NF) material accountancy techniques to melted fuel, etc., which contributes to nuclear material accounting and control (NMAC) of fuel debris from TEPCO’s Fukushima Daiichi Nuclear Power Plant.

**Example**

1. Measure gamma rays from FP coexisting with NF material.
2. Estimate the amount of NF using the ratio.
Technical Development for Nuclear Nonproliferation and Nuclear Security

Technical development for Nuclear forensics

Nuclear forensics is a method used to find out the origin, history, etc. of nuclear materials which have been seized/collection by the investigative authorities, thus supporting judicial procedures. ISCN develops techniques to analyze such materials for nuclear forensics.

- Isotopic composition
- Impurity
- Particle shape
- Purification age
- Building-up of nuclear forensics library

Elements of technical development

- Analyses of seized material
- Evaluation of the analysis data
- Forensics conclusions

Nuclear forensics

Traditional forensics

finger prints, DNA, blood, etc.

Illicit action
Technical Development for Nuclear Nonproliferation and Nuclear Security

○Technical development for NM detection and measurement

Develop basic technologies based on Japan’s advanced nuclear science and technologies, for more sophisticated techniques for safeguards, detection and property identification of concealed nuclear material, etc.

- Development of herium-3 alternative neutron detector techniques (JFY 2011-2014)
- Development of neutron resonance densitometry techniques (JFY 2012-2014)
- Development of active neutron NDA techniques (JFY 2015-)
- Demonstration tests of nuclear resonance fluorescence as a NDA technique (JFY 2015-), etc.

Development of neutron resonance densitometry techniques

JAEA-JRC joint team won a 48th Award for Distinguished Technology Development from the Atomic Energy Society of Japan. (March 2016)
Technology Symposium

“The International Symposium on Technology Development for Nuclear Security”
Tokyo, 27 October 2016
110 participants

- The symposium discussed future directions of technology development for nuclear security, particularly for nuclear material detection, with researchers from nuclear security and relevant fields, policymakers, regulatory authorities, law-enforcement officials, security authorities, and stakeholders from relevant industries.
- The symposium discussed various subjects on technology development, such as needs, approaches, application of achievements, a mid- to long-term plan, Japan’s strength, collaboration with relevant organizations, and international cooperation.

- Current statuses and achievements of technological development were presented by IAEA; Domestic Nuclear Detection Office of Department of Homeland Security (DHS/DNDO), EC/JRC, and other organizations from home and abroad.
- Useful information was gained to promote future technological development, industry-government-academia collaboration, and international cooperation.
Contributions to the CTBT International Verification Regime

CTBT Organization (CTBTO) Preparatory Commission
- Monitor data & analysis results

National Data Center (NDC)
- Receive monitored data from worldwide stations.
- Analyze and evaluate data.
- Develop analysis software.
- Build databases

Okinawa station (RN37)
- Measure radioactive particulates

Takasaki station (RN38)
- Measure radioactive particulates and noble gases

Tokai Radionuclide Laboratory (RL11)
- Analyze samples in detail

International Monitoring System (Seismological, Radionuclide, Hydroacoustic, Infrasound)
第3回核実験では、通常濃度変動範囲を超える2種類の放射性キセノンを同時検出。
第4回核実験では、通常濃度変動範囲を超える1種類の放射性キセノンを検出した。

- 通常の濃度変動範囲の上限値

2013年4月の検知は、第3回核実験由来の放射性キセノンと判断
2016年2月の検知は、第4回核実験由来かの明確な判定はできなかった

Contributions to the CTBT International Verification Regime

Detections of nuclides from DPRK’s nuclear tests

- Two kinds of radioxenon isotopes were detected simultaneously beyond normal background range of the activity concentrations after the 3rd nuclear test
- One kind of radioxenon isotopes was detected beyond normal background range of the activity concentrations after the 4th nuclear test

- Analyses to estimate the possible region of the radioxenon emission source were made after the 3rd and 4th nuclear tests and showed that the estimated region covered the test site

- The detection in April 2013 led to the conclusion that the radioxenon isotopes derived from the 3rd nuclear test
- The detection in February 2016 fell short of clearly identifying the isotopes as emissions from the 4th nuclear test
Nuclear Nonproliferation Policy Research

Research subjects examined thus far

- Review and analysis of Japan’s efforts to ensure nuclear non-proliferation
- Research for promoting confidence-building and increasing transparency in the peaceful use of nuclear energy in Asian region
  - Developed to capacity building support activities supervised by ISCN.
- Research on the implications of the US nuclear nonproliferation policies on Japan’s nuclear fuel cycle policies
- Research on ensuring nuclear nonproliferation in the international cooperation for peaceful nuclear use
- Research on nuclear fuel cycle backend from the aspects of nuclear nonproliferation and nuclear security
- Research on promotion devices for nuclear nonproliferation (safeguards) and nuclear security (2Ss)
  - For stronger and more efficient 2Ss, ISCN sorted out synergies and challenges expected to be brought by the both groups’ sharing their technologies and measurement/monitoring information; and studied and evaluated the applicability of such synergies to nuclear fuel cycle facilities

Information collection, analysis, and release on nuclear nonproliferation trends

- IAEA and US’s trends, Iran and DPRK’s nuclear issues, etc.
帰化機関との連携・協力

- アジア3COEs、APSN、FNCA等 アジア地域ネットワーク
- IAEA (INSEN, NSSC)
- 美国DOE/NNSA、EC/JRCとのパートナーシップ

IAEA

INSEN
International Nuclear Security Education Network

NSSCs
International Network for Nuclear Security Training & Support Centers

Bilateral Partners

DOE/NNSA  EC/JRC

Regional Frameworks in Asia

COEs

ISCN (JAPAN)
Integrated Support Center for Nuclear NP & NS

INSA (ROK)
International Nuclear Security Academy

SNSTC (China)
State Nuclear Security Technology Center

CBRN COE South East Asia of EC-JRC (in Philippines)

APSN
(Asia Pacific Safeguards Network)

FNCA
(Forum for Nuclear Cooperation in Asia)

Other COEs

Support in Capacity Building, Mainly in Asia

Collaboration and cooperation with international organizations

- Asian region network including three COEs, APSN, FNCA
- IAEA (INSEN, NSSC)
- Partnerships with U.S. DOE/NNSA, EC/JRC

IAEA

INSEN
International Nuclear Security Education Network

NSSCs
International Network for Nuclear Security Training & Support Centers

Bilateral Partners

DOE/NNSA  EC/JRC

Regional Frameworks in Asia

COEs

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International Nuclear Security Academy

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State Nuclear Security Technology Center

CBRN COE South East Asia of EC-JRC (in Philippines)

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(Asia Pacific Safeguards Network)

FNCA
(Forum for Nuclear Cooperation in Asia)

Other COEs
Support in Capacity Building, Mainly in Asia

〇Contents of training
1. Nuclear security course
2. Safeguards and SSAC course
3. International nuclear nonproliferation framework course

Achievements (2011-2016 Oct.)
3,100 participants from 74 countries and 3 international organizations took part in 114 courses.

Recognition for ISCN’s activities from international communities
- U.S. (U.S.-Japan joint statement at 2016 Nuclear Security Summit)
  The U.S. applauds ISCN’s role in capacity building
- IAEA (2015 seminar, etc.)
  IAEA is strongly supported by ISCN’s activities
- Support-target countries (2015 ASEAN + 3 Ministers on Energy Meeting)
  ISCN’s activities are welcome
理解増進
圆国際フォーラムの開催（毎年開催）
原子力平和利用と核不拡散・核セキュリティに関する国際フォーラム
➢ 社会への理解増進及び情報発信
➢ 国内外専門家・有識者との交流・情報交換

圆情報発信（機構Webサイト）
➢ ISCNニュースレター（毎月配信）
➢ 核不拡散動向（年に2〜3回更新）
（http://www.jaea.go.jp/04/iscn/）

Enlightenment
圆International forum (held annually)
International Forum on Peaceful Use of Nuclear Energy, Nuclear Nonproliferation and Nuclear Security
➢ Increase understanding in society and release information
➢ Interact and exchange information with experts and intellectuals home and abroad

圆Information release (JAEA’s website)
➢ ISCN newsletter (monthly)
➢ Nuclear nonproliferation trends (2 or 3 times a year)
（http://www.jaea.go.jp/04/iscn/）
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午後のパネルの論点

○パネルディスカッション 1
ポスト核セキュリティ・サミットの国際的な核セキュリティ強化のモメンタム維持と、今後の人材育成・能力構築支援COEの活動
  • 核セキュリティ・サミット終了後も、核セキュリティ強化のモメンタムを維持していくための具体的な方策
  • アジア地域の核セキュリティ強化に向けた効果的な人材育成・能力構築支援COEの活動方策

○パネルディスカッション 2
核兵器のない世界へ－我が国の核軍縮への貢献－
  • 非核兵器国が核軍縮検証作業へ参画する意義
  • 参画するための課題解決策とその仕組み
  • 核軍縮検証に向けた非核兵器国の技術的な貢献策

Points for Panel Discussions

○Panel Discussion 1
Post-Nuclear Security Summit Efforts to Maintain the Momentum to Internationally Strengthen Nuclear Security and Future COE Activities for Human Resources Development and Capacity Building
  • Specific means to maintain the momentum to strengthen nuclear security after the last Nuclear Security Summit
  • Effective activities for a COE to support human resources development and capacity building to strengthen nuclear security in Asian region

○Panel Discussion 2
Efforts toward a world without nuclear weapons—Japan’s contributions to nuclear disarmament
  • The significance of non-nuclear-weapon states’ (NNWSs’) participation in nuclear disarmament verification operations
  • Solutions and how-to’s for NNWSs’ to overcome obstacles to their participation
  • NNWS’ means of technological contributions to nuclear disarmament verification
パネル1の背景（1）

○核セキュリティサミット 共同声明（概要）

第1回 米国ワシントンD.C./2010年4月
● すべての脆弱な核物質の管理を4年以内に徹底
● 高濃縮ウラン（HEU）と分離プルトニウム（分離Pu）には特別な予防措置が必要。技術的・経済的に可能な場合、HEU使用量の最小化を奨励
● 核に関する検査及び鑑識、新技術の開発等の関連する分野における情報等の共有

第2回 韓国ソウル/2012年3月
● 福島事故を受けて原子力安全及び核セキュリティ問題に取り組むため、持続的努力が必要
● 輸送における物質その他の放射性物質のセキュリティ向上させる取組を継続し、各国がベスト・プラクティスを共有することを奨励

第3回 オランダ・ヘーグ/2014年3月
● 各国首脳が核テロ対策について議論を行う「政策シミュレーション」、核セキュリティ・サミットの将来について討議する「首脳トリート」を実施

第4回 米国ワシントンD.C./2016年3月
● セキュリティ分野におけるIAEAの重要な責任と主導的役割を再確認
● 政治的モメンタムの確保及び核セキュリティの継続的な強化のため、関係国際機関及び枠組み（5つの機関・枠組み）における行動計画の実施を決定

Backgrounds of Panel Discussion 1 (1)

○Nuclear security summit joint statements (summary)

1st summit in Washington D.C., U.S. in April 2010
● Secure all vulnerable nuclear materials in four years
● Minimize use of HEU, where technically and economically feasible
● Agree to share information in relevant areas such as nuclear detection, forensics, and expertise

2nd summit in Seoul, ROK, in March 2012
● Noting the Fukushima accident we consider that sustained efforts are required to address the issues of nuclear safety and nuclear security
● Continue efforts to enhance the security of nuclear and other radioactive materials in transport, and encourage States to share best practices

3rd summit in the Hague, the Netherlands in March 2014
● State leaders interacted in a “Scenario-Based Policy Discussion (SBPD)” to resolve a fictional nuclear terrorism threat. A “top-level retreat” was also held to discuss the future of the nuclear security summit process

● Reaffirm the essential responsibility and the central role of the IAEA in nuclear security
● Important action Plans, in support of the international organizations and initiatives (5 entities altogether)
パネル1の背景（2）

○FCA及びKUCAの機微な核燃料の撤去
  - 2016年4月の第4回核セキュリティサミット時に、日米両首脳が、原子力機構の高速炉臨界実験装置（FCA）から全ての高濃縮ウラン燃料及びプルトニウム燃料の撤去を完了したことを表明した。
  - また、両国は、京都大学臨界集合体実験装置（KUCA）の全ての高濃縮ウラン燃料を米国に移送して希釈し、恒久的に脅威を削減するために協働することを表明した。

○国際核物質防護諮問サービス（IPPAS）ミッションの受入れ
  - IPPASミッションは、IAEAが国の核セキュリティ体制の強化のために当該国を支援するサービス。2015年2月に受け入れた。
  - 「日本の核セキュリティ体制、原子力施設及び核物質の核物質防護措置の実施状況は、全体として、強固で持続可能なものであり、また近年顕著に向上している。」との見解を得た。

Backgrounds of Panel Discussion 1 (2)

○Removal of sensitive nuclear materials from FCA and KUCA
  - At the 4th Nuclear Security Summit in April 2016, Japanese Prime Minister and U.S. President announced the completion of the removal of all highly-enriched uranium (HEU) and separated plutonium fuels from the Fast Critical Assembly (FCA) at JAEO.
  - Two countries further announced their pledge to work together to remove all HEU fuels from the Kyoto University Critical Assembly (KUCA) to the United States for downblend and permanent threat reduction.

○Invitation of International Physical Protection Advisory Service (IPPAS) mission
  - An IPPAS mission is an IAEA’s service to support a country in strengthening its national nuclear security regime. Japan invited the mission in February, 2015.
  - The mission concluded that, overall, the nuclear security regime and the implementation of physical protection measures for nuclear facilities and nuclear material in Japan was robust, sustainable, and had been significantly enhanced in recent years.
Backgrounds of Panel Discussion 1 (3)

○ Development of nuclear security culture

1. Workshops by ISCN-WINS (World Institute for Nuclear Security)
   Five workshops have been organized annually for national industries, regulators, security authorities, etc., which totaled approx. 300 participants

2. Delivery of lectures on nuclear security culture to electric utility companies
   Thirty nine lectures have been delivered, mainly to nuclear power plants, and attracted approx. 2,700 participants in total

3. JAEA’s 2016FY action plans for fostering nuclear security culture (summary)
   Give weight to education to build awareness of the existence of threats and the significance of nuclear security
パネル1の背景（4）

○IAEA核セキュリティ国際会議（2016/12/5-12/9）
各国の閣僚級会合を含むハイレベル国際会議。核セキュリティ・サミット以降の政治的モメンタム維持と核セキュリティにおける国際社会の連携強化を図る。

(ISCNの貢献)
1. ISCNによる核セキュリティ強化に関する活動内容の報告（12件）
2. ISCN活動概要の紹介展示
3. 「アジアにおける核セキュリティCOE：進展そして今後」をテーマとしたワークショップの実施（在ウィーン国際機関日本政府代表部、ウィーン軍縮不拡散センター協力）
   ○ アジア地域における日中韓3か国の核セキュリティ支援センターによる核セキュリティ強化の国際的活動に対する貢献と、その課題を議論
   ○ 議論の成果は核セキュリティ・サミット・プロセス終了後の核セキュリティ強化に向けた国際的活動に貢献

Backgrounds of Panel Discussion 1 (4)

高レベルglobal conference including international ministerial-level talks, with the aims of maintaining political momentum after the last nuclear security summit and strengthening collaboration for nuclear security in the international community

(ISCN’s contributions)
1. Twelve reports on ISCN’s activities to strengthen nuclear security.
2. Exhibition of ISCN’s activity summary
3. Workshop entitled “Nuclear Security COEs in Asia: their development and future” (in cooperation with Permanent Mission of Japan to the International Organizations in Vienna and with Vienna Center for Disarmament and Non-Proliferation)
   ○ Discuss contributions and challenges of Asian nuclear security support centers in Japan, China, and ROK to international activities to strengthen nuclear security
   ○ Benefits derived from the discussion will be used to contribute to international activities to strengthen nuclear security to be continued after the nuclear security summit process
Backgrounds of Panel Discussion 2 (1)

○ World nuclear weapons today
- Nuclear Weapons Increased during the Cold War -> Over 70,000 at its peak (1986)
- Approx. 16,000 nuclear warheads still exist in the world
  ✓ NPT nuclear-weapon states (P5). Non-NPT nuclear-armed states (India, Pakistan, Israel*).
  ✓ U.S. and Russia possess over 90% of the total
- DPRK’s nuclear arms development -> Five nuclear explosion tests have been conducted.
  * Israel has not officially declared its possession of nuclear weapons.

○ Recent international trends in nuclear disarmament
- U.S. President Obama’s speech in Prague (April 2009)
  ✓ commitment to seek the peace and security of “a world without nuclear weapons”
- Progress and stagnation in nuclear disarmament negotiations between U.S. and Russia
  ✓ The Strategic Arms Reduction Treaty (START) started a process for reduction (1991-).
- NPT Review Conference: Differences in the stands of nuclear weapon states (NWSs) and non-nuclear weapon states (NNWSs) became clear
  ✓ NNWSs’ complaints about the nuclear disarmament stagnation, issues in the Middle East, etc.

○ Current situations of nuclear disarmament treaties
- Ban on production of nuclear fissile material for nuclear weapons
  → FMCT (Negotiation for the treaty has not even started.)
- Ban on nuclear explosion test. → CTBT (open for signature since 1996 but not effective yet.)
- Reduction in nuclear weapons (U.S. and Russia)
  → START, etc. (Standstill due to missile defense issues and deteriorated diplomatic relations.)
Backgrounds of Panel Discussion 2 (2)

○ Verification in the nuclear disarmament process
  ● Three nuclear disarmament principles; Verifiability, irreversibility, and transparency
    ✓ Verifiability
      • Measures to enable signatory and ratifying states to mutually check their compliance with obligations and commitments to the treaty.
    ✓ Irreversibility
      • Measures to prevent nuclear fissile material and such from being reused for military purposes.
    ✓ Transparency
      • Measures to resolve nuclear security concerns in order to build confidence
      • Measures to clearly inform the international community of progress in the disarmament process.
  ● Challenges of nuclear disarmament verification
    ✓ Handling of classified information on national security
    ✓ Both NWSs and NNWSs need care not to breach NPT Articles 1 and 2 (when NNWSs are involved)
    ✓ Guaranty of effectiveness
    ✓ Verifying body, verification costs, etc.
Backgrounds of Panel Discussion 2 (3)

○ Technological contributions by Japan
  • Needs for the development of nondestructive verification techniques which assures all states, even NNWSs, that the verification is reliable, while securing highly sensitive and confidential information
    ➢ Japan hopes to make contributions based on its nuclear technology infrastructure as well as its knowledge and experience of verification technology development for IAEA safeguards, etc.

○ Areas of technical contributions by JAEA
  • Safeguards technologies. Nuclear material measurement and detection technologies.
    ✓ Unattended verification device, neutron/gamma-ray measurement techniques, containment/surveillance techniques, etc.
    ✓ Applicable to verification technologies for FMCT, IPNDV, etc.
  • Radionuclide monitoring/analysis techniques
    ✓ Apply to advanced technologies for nuclear test monitoring
  • Disposition of Pu from dismantled nuclear weapons
    ✓ Contribute to a Pu disposition project in which Pu is convert to and burned as fuel in civilian nuclear power plants