Chapter 3. Nuclear Security[1]

Even today, approximately 15,000 nuclear weapons still exist in various arsenals around the worldwide. Meanwhile, the peaceful use of nuclear energy continues to expand, partly as a way to mitigate global warming and for sustainable development. Under these circumstances, securing weapons-grade fissile material – what is sometimes termed "loose-nukes" —and ensuring the safety of civil-use fissile material that may be attractive to terrorists remains a global security issue. In order to minimize these dangers, it is important that all countries undertake continuous efforts to strengthen nuclear security in line with their respective responsibilities. Also, since the Nuclear Security Summit (NSS) process ended in 2016, a new challenge confronts the world in terms of how to carry forward the outcomes and lessons learned from the summit process in order to strengthen the international nuclear security framework.

These were the subjects of particular attention in the nuclear security area in 2017. Through the NSS process from 2010 to 2016, with high-level participation of more than 50 concerned states, efforts to strengthen nuclear security in each country were reported the form of statements and documents. A number of joint proposals for strengthening nuclear security in the form of the "gift basket" method were launched and political commitments made. With the end of the NSS process, there is concern that nuclear security itself will no longer be an outstanding issue of the international community. In particular, the decline of momentum in implementing nuclear security-related measures in each country must be avoided.

Recognizing this need, a large number of experts from universities, research institutes and civil society, along with high-level officials from governments and regulatory bodies as well as practitioners, participated in the International Conference on Nuclear Materials and Nuclear Facilities organized by the IAEA in Vienna, Austria in November 2017, presenting their past nuclear security efforts and discussing technical challenges.[2] This initiative was highly evaluated as progress after the end of the NSS process.

An additional issue came to the fore over the interpretation of the Amendment of the Convention of Physical Protection of Nuclear Material (CPPNM Amendment), which after several years finally came into force in 2016 as a result of outreach activities through the NSS. Relatedly, questions arose operation of the CPPNM review conference.[3] Furthermore, the implementation of the Ministerial Declaration[4] of the second International Conference on Nuclear Security organized by the IAEA in December 2016, which was held in parallel with the NSS in Washington, was considered to be an important step in the efforts of the international community to tackle nuclear security challenges. In fact, at the 61st IAEA General Conference in 2017, several countries mentioned the

[1] This chapter is written by Sukeyuki Ichimasa.

[2] "International Conference on Physical Protection of Nuclear Material and Nuclear Facilities," IAEA website, November 13–17, 2017, https://www.iaea.org/events/physical-protection-of-nuclear-material-conference-2017/programme.

[3] Kenneth C. Brill and John H. Bernhard, "Preventing Nuclear Terrorism: Next Steps in Building a Better Nuclear Security Regime," *Arms Control Today*, Vol.47, No.8, October 2017, pp. 6-11.

[4] "Ministerial Declaration, International Conference on Nuclear Security: Commitments and Actions," December 5-9, 2016, https://www.iaea.org/sites/default/files/16/12/english_ministerial_declaration.pdf.

importance of fulfilling the Ministerial Declaration. [5]

The mandate entrusted to the IAEA is not limited to hosting international conferences on physical protection of nuclear materials and nuclear-related facilities. Today, the role that the IAEA plays in the nuclear security field is expanding further, and the presence of the IAEA is increasing, especially in the areas of nuclear security advisory services and peer reviews. [6] In fact, "nuclear security plan 2018-2021" submitted to the IAEA General Conference in 2017 clearly stated details regarding the IAEA's nuclear security activities from 2018 to 2021 including the approaches to the information management, security of nuclear materials and facilities, nuclear security of materials out of regulatory control, and outreach activities to support member states to be carried out. With regard to the expanding nuclear security-related mission of the IAEA, the international community has come to the stage of concrete policy debate about how to construct and maintain an international nuclear security framework, including discussions on financial aspects.[7] In particular, one of the areas of focus is on how to replace the NSS Sherpa meetings, which played an important role, including in setting the NSS agendas. In this connection, the nuclear security contact group, which has newly changed its presidency from Canada to Jordan,[8] has been drawing attention from the international community.

As symbolized by the rise of international terrorist threats, the international community needs to keep constant vigilance regarding the emergence of new threats to nuclear security. Also, as can be seen in recent cases such as cyber threats and the spread of the drone technologies, attention must also be paid to possible new vulnerabilities introduced by technological advances. In this sense, national regulatory authorities and contractors in each state must maintain a prompt and sustainable response to these new emerging vulnerabilities.[9] Although there is a premise that each country is responsible for its own nuclear security, there is also room for multilateral cooperation. Indeed, many countries hope to strengthen nuclear security through collaboration with international organizations such as the IAEA and regional organizations.

Against this backdrop, the trends of international conferences related to nuclear security, such as the 7th Review Meeting of the Contracting Parties of the Convention on Nuclear Safety (March 27-April 7, Vienna)[10], the International Ministerial Conference on "Nuclear Power in the 21st Century", organized by the IAEA (October 30-November 1, Abu Dhabi, UAE) [11] and the technical meeting of the Representatives of

[5] 2017 IAEA General Conference Remarks as Prepared for Delivery Secretary Rick Perry, https://www.iaea.org/sites/default/files/gc61-usa-statement.pdf.; Australian National Statement by Ambassador Brendon Hammer, Governor and Permanent Representative to the IAEA, 61st Regular Session of the IAEA General Conference, September 2017, https://www.iaea.org/sites/default/files/gc61-australia-statement.pdf.

[6] "Nuclear Security after the Summits," Vienna Center for Disarmament and Non-Proliferation, October 18, 2016, http://vcdnp.org/nuclear-security-after-the-summits/.

[7] "Director General's Statement to Sixty-First Regular Session of IAEA General Conference," IAEA website, September 18, 2017, https://www.iaea.org/newscenter/statements/statement-to-sixty-first-regular-session-of-iaea-general-conference-2017.

[8] Canadian Statement at the IAEA 61th General Conference, https://www.iaea.org/sites/default/files/gc61-canada-statement.pdf.

[9] Matthew Bunn, Martin B. Malin, Nickolas Roth and William H. Tobey, "Project on Managing the Atom: Preventing Nuclear Terrorism Continuous Improvement or Dangerous Decline?" Harvard Kennedy School Belfer Center for Science and International Affairs, March 2016, p. i.

[10] Convention on Nuclear Safety: 7th Review Meeting of the Contracting Parties, March 27-April 7, 2017, http://www-pub.iaea.org/iaeameetings/49023/Convention-on-Nuclear-Safety-7th-Review-Meeting-of-the-Contracting-Parties.

[11] Nuclear Power in the 21st Century—International Ministerial Conference, October 30-November 1, 2017, Abu Dhabi, United Arab Emirates, https://www.iaea.org/events/nuclear-power-conference-2017/statements.

States Parties to the CPPNM and the CPPNM Amendment (November 9 - November 10, Vienna)[12], attracted attention in 2017.

In addition to this, the IAEA reported on various nuclear security-related efforts. As outlined below by item, events related to nuclear security were held around the world from a developed country to a developing country on a wide range of topics, and efforts to improve the level of nuclear security were promoted.

- Regarding physical protection of nuclear material
  - A regional training course on the use of Threat Based Risk—Informed Approach for Protection of Materials and Facilities (July, Niamey, Niger). [13]
  - A regional workshop on Threat Assessment and Development of a Design Basis Threat (October, Accra, Ghana).[14]
- Prevention of acts of sabotage
  - A regional training course on Protection and Prevention Measures against Sabotage of Nuclear Facilities (March, Lima, Peru).[15]
- Nuclear security regulatory framework
  - A regional workshop to launch a Project on Enhancing National Regulatory Frameworks for Nuclear Security in Africa (April, Rabat, Morocco).[16]
  - An international training course on Regulations and Associated Administrative Measures for Nuclear Security (April, Vienna).[17]
  - A regional training course on the Development and Drafting of Regulation to Support National Nuclear Security Regimes (May, Livingston, Zambia).[18]
  - A regional training course on the Development and Drafting of Regulation to Support National Nuclear Security Regimes (May, Niamey, Niger).[19]
- Framework of information exchange on nuclear security
  - The 13th Nuclear Security Information Exchange Meeting (April, Vienna).[20]
  - A regional meeting (Balkan Region) on

[12] Technical Meeting of the Representatives of States Parties to the Convention on the Physical Protection of Nuclear Material (CPPNM) and the CPPNM Amendment, November 9-10, 2017, https://www.iaea.org/events/technical-meeting-of-the-representatives-of-states-parties-to-the-convention-on-the-physical-protection-of-nuclear-material-cppnm-and-the-cppnm-amendment.

[13] Regional Training Course on the use of Threat Based Risk-Informed Approach for Protection of Materials and Facilities, July 24-27, 2017, https://www.iaea.org/events/regional-training-course-on-the-use-of-threat-based-risk-informed-approach-for-protection-of-materials-and-facilities-0.

[14] Regional Workshop on Threat Assessment and Development of a Design Basis Threat, October 2-5, 2017, https://www.iaea.org/events/regional-workshop-on-threat-assessment-and-development-of-a-design-basis-threat.

[15] Regional Training Course on Protection and Prevention Measures against Sabotage of Nuclear Facilities, March 31, 2017, https://www.iaea.org/events/regional-training-course-on-protection-and-prevention-measures-against-sabotage-of-nuclear-facilities-0.

[16] Regional Workshop to Launch a Project on Enhancing National Regulatory Frameworks for Nuclear Security in Africa, April 3-7, 2017, https://www.iaea.org/events/regional-workshop-to-launch-a-project-on-enhancing-national-regulatory-frameworks-for-nuclear-security-in-africa.

[17] International Training Course on Regulations and Associated Administrative Measures for Nuclear Security, April 17-20, 2017, https://www.iaea.org/events/international-training-course-on-regulations-and-associated-administrative-measures-for-nuclear-security.

[18] Regional Training Course on the Development and Drafting of Regulations to Support National Nuclear Security Regimes, May 8-10, 2017, https://www.iaea.org/events/regional-training-course-on-the-development-and-drafting-of-regulations-to-support-national-nuclear-security-regimes.

[19] Regional Training Course on the Development and Drafting of Regulations to Support National Nuclear Security Regimes, May 22-26, 2017, https://www.iaea.org/events/regional-training-course-on-the-development-and-drafting-of-regulations-to-support-national-nuclear-security-regimes-0.

[20] 13th Nuclear Security Information Exchange Meeting, April 6-7, 2017, https://www.iaea.org/events/13th-nuclear-security-information-exchange-meeting.

Nuclear Security Information Exchange and Coordination (August, Tirana, Albania).[21]

- ✧ The 14th Nuclear Security Information Exchange Meeting (October, Vienna).[22]
- ✧ A subregional meeting on Nuclear Security Information Exchange and Coordination (October, Manama, Bahrain).[23]
- ✧ A regional meeting on Nuclear Security Information Exchange and Coordination (November, Mexico City, Mexico).[24]

➢ Effort to combat illegal transfer

- ✧ An international coordination meeting on Developing a Defense in Depth Approach for the Detection of Illicit Movement of Nuclear and Radioactive Material out of Regulatory Control (April, San Jose, Costa Rica).[25]
- ✧ An international training course of New and Prospective Points of Contact for the Incident and Trafficking Database (ITDB) (July, Vienna).[26]

➢ Computer security related to prevention of nuclear terrorism

- ✧ A regional workshop on the Development of National Training Program for Advanced Topics in Computer Security (July, Hanoi, Vietnam).[27]
- ✧ A regional training course on Conducting Computer Security Assessments at Nuclear and Other Radioactive Material Facilities (September, Helsinki, Finland).[28]
- ✧ A regional training course on Information and Computer Security for Awareness for Nuclear Security Regimes (September, Rabat, Morocco).[29]

➢ International Nuclear Security Review Missions by the IAEA

- ✧ A Technical Meeting to Assess the Overall Structure, Effectiveness and Efficiency of Peer Review and Advisory Services in the Areas of Nuclear Safety and Security (August, Vienna).[30]
- ✧ An international workshop on the International Physical Protection Advisory Service (IPPAS) for Potential Team Members

[21] Regional Meeting on Nuclear Security Information Exchange and Coordination (Balkan Region), August 28-31, 2017, https://www.iaea.org/events/regional-meeting-on-nuclear-security-information-exchange-and-coordination-balkan-region.

[22] 14th Nuclear Security Information Exchange Meeting, October 12, 2017, https://www.iaea.org/events/14th-nuclear-security-information-exchange-meeting.

[23] Subregional Meeting on Nuclear Security Information Exchange and Coordination, October 24-26, 2017, https://www.iaea.org/events/subregional-meeting-on-nuclear-security-information-exchange-and-coordination.

[24] Regional Meeting on Nuclear Security Information Exchange and Coordination, November 14-16, 2017, https://www.iaea.org/events/regional-meeting-on-nuclear-security-information-exchange-and-coordination-0.

[25] International Coordination Meeting on Developing a Defence in Depth Approach for the Detection of Illicit Movement of Nuclear and Radioactive Material out of Regulatory Control, April 24-28, 2017, https://www.iaea.org/events/international-coordination-meeting-on-developing-a-defence-in-depth-approach-for-the-detection-of-illicit-movement-of-nuclear-and-radioactive-material-out-of-regulatory-control.

[26] International Training Course of New and Prospective Points of Contact for the Incident and Trafficking Database (ITDB), July 24-28, 2017, https://www.iaea.org/events/international-training-course-of-new-and-prospective-points-of-contact-for-the-incident-and-trafficking-database-itdb.

[27] Regional Workshop on the Development of National Training Programme for Advanced Topics in Computer Security, July 10-14, 2017, https://www.iaea.org/events/regional-workshop-on-the-development-of-national-training-programme-for-advanced-topics-in-computer-security.

[28] Regional Training Course on Conducting Computer Security Assessments at Nuclear and Other Radioactive Material Facilities, September 4-8, 2017, https://www.iaea.org/events/regional-training-course-on-conducting-computer-security-assessments-at-nuclear-and-other-radioactive-material-facilities.

[29] Regional Training Course on Information and Computer Security Awareness for Nuclear Security Regimes, September 11-15, 2017, https://www.iaea.org/events/regional-training-course-on-information-and-computer-security-awareness-for-nuclear-security-regimes.

[30] Technical Meeting to Assess the Overall Structure, Effectiveness and Efficiency of Peer Review and Advisory Services in the Areas of Nuclear Safety and Security, August 30-31, 2017, http://www.ursjv.gov.si/fileadmin/ujv.gov.si/pageuploads/Info_sredisce/Tecaji_konference_seminarji/tecaji_MAAE/Peer_Review_2017_InfoSheet.pdf.

of Future IPPAS Missions (October, Vienna).[31]

- International capacity-building support for nuclear security
  - A regional Train the Trainers Course on the Development of Nuclear Security Training and Support Center Capabilities in Nuclear Security Detection (September, Kuala Lumpur, Malaysia).[32]
- International efforts to promote nuclear security culture
  - A regional workshop on Nuclear Security Culture in Practice (September, Rabat, Morocco).[33]
- Other nuclear security related events
  - The 29th meeting of the Advisory Group on Nuclear Security (April, Vienna).[34]
  - An international workshop on the Essential Elements of Nuclear Security (May, Argonne, U.S.).[35]
  - The first plenary meeting of the International Project on Demonstration of the Operational and Long-Term Safety of Geological Disposal Facilities for Radioactive Waste (May, Vienna).[36]
  - A domestic workshop on Emergency Preparedness and Response for Japan (July, Fukushima, Japan).[37]
  - A regional training course on Threat Assessment and a Risk Informed Approach for Nuclear and Other Radioactive Material out of Regulatory Control (July, Asuncion, Paraguay).[38]
  - A regional workshop on Security in Practice for the Uranium Ore Concentrate Industry Including during Transport (July, Lubumbashi, Democratic Republic of the Congo).[39]
  - An international training course on Nuclear Material Accounting and Control for Nuclear Security at Facilities (August, Vienna).[40]
  - A regional workshop on Developing and Implementing Nuclear Security Systems and Measures for Major Public Events (August,

[31] International Workshop on the International Physical Protection Advisory Service (IPPAS) for Potential Team Members of Future IPPAS Missions, October 23-27, 2017, https://www.iaea.org/events/international-workshop-on-the-international-physical-protection-advisory-service-ippas-for-potential-team-members-of-future-ippas-missions.

[32] Regional Train the Trainers Course on the Development of Nuclear Security Training and Support Centre Capabilities in Nuclear Security Detection, September 4-8, 2017, https://www.iaea.org/events/regional-train-the-trainers-course-on-the-development-of-nuclear-security-training-and-support-centre-capabilities-in-nuclear-security-detection.

[33] Regional Workshop on Nuclear Security Culture in Practice, September 11-14, 2017, https://www.iaea.org/events/regional-workshop-on-nuclear-security-culture-in-practice.

[34] 29th Meeting of the Advisory Group on Nuclear Security, April 18-21, 2017, https://www.iaea.org/events/29th-meeting-of-the-advisory-group-on-nuclear-security.

[35] International Workshop on the Essential Elements of Nuclear Security, May 15-26, 2017, https://www.iaea.org/events/international-workshop-on-the-essential-elements-of-nuclear-security.

[36] First Plenary Meeting of the International Project on Demonstration of the Operational and Long-Term Safety of Geological Disposal Facilities for Radioactive Waste, May 22-26, 2017, https://www.iaea.org/events/first-plenary-meeting-of-the-international-project-on-demonstration-of-the-operational-and-long-term-safety-of-geological-disposal-facilities-for-radioactive-waste.

[37] Domestic Workshop on Emergency Preparedness and Response for Japan, July 18-21, 2017, https://www.iaea.org/events/domestic-workshop-on-emergency-preparedness-and-response-for-japan.

[38] Regional Training Course on Threat Assessment and a Risk Informed Approach for Nuclear and Other Radioactive Material out of Regulatory Control, July 24-28, 2017, https://www.iaea.org/events/regional-training-course-on-threat-assessment-and-a-risk-informed-approach-for-nuclear-and-other-radioactive-material-out-of-regulatory-control.

[39] Regional Workshop on Security in Practice for the Uranium Ore Concentrate Industry Including during Transport, July 24-28, 2017, https://www.iaea.org/events/regional-workshop-on-security-in-practice-for-the-uranium-ore-concentrate-industry-including-during-transport.

[40] International Training Course on Nuclear Material Accounting and Control for Nuclear Security at Facilities, August, 21-25, 2017, https://www.iaea.org/events/international-training-course-on-nuclear-material-accounting-and-control-for-nuclear-security-at-facilities.

Tokai, Japan).[41]

- ✧ A regional workshop on Developing a Road Map for Building a Nuclear Security Detection Architecture for Material out of Regulatory Control (September, Ouagadougou, Burkina Faso).[42]
- ✧ An international training course on the Development of a Nuclear Security Regime for Member States with Nuclear Power Program (September, St. Petersburg, Russia).[43]
- ✧ A regional coordination meeting on Nuclear Security Implementation Strategy in Latin America and the Caribbean (October, Montevideo, Uruguay).[44]
- ✧ An international training course on Regulations and Associated Administrative Measures for Nuclear Security (October, Cairo, Egypt).[45]
- ✧ A regional training course on Nuclear Security in Practice: Field Training for University Students (October, Obninsk, Russia).[46]
- ✧ A regional training course on Development of a Nuclear Security Detection Architecture Design Plan (November, Vienna).[47]
- ✧ A regional workshop and tabletop exercise on Management of the Response to a Nuclear Security Event at a Nuclear Power Plant (December, Vienna).[48]

➢ Nuclear safety and security interface

- ✧ A technical meeting to Review and Revise IAEA Safety Guides and Related Reports on Leadership Management for Safety and Safety Culture (July, Vienna).[49]
- ✧ An international workshop on Nuclear Security Measures and Emergency Response Arrangements for Ports (November, Las Vegas, USA).[50]
- ✧ The 12th meeting of the Nuclear Security

[41] Regional Workshop on Developing and Implementing Nuclear Security Systems and Measures for Major Public Events, August 28-September 1, 2017, https://www.iaea.org/events/regional-workshop-on-developing-and-implementing-nuclear-security-systems-and-measures-for-major-public-events.

[42] Regional Workshop on Developing a Road Map for Building a Nuclear Security Detection Architecture for Material out of Regulatory Control, September 11-15, 2017, https://www.iaea.org/events/regional-workshop-on-developing-a-road-map-for-building-a-nuclear-security-detection-architecture-for-material-out-of-regulatory-control.

[43] International Training Course on the Development of a Nuclear Security Regime for Member States with Nuclear Power Programme, September 25-29, 2017, https://www.iaea.org/events/international-training-course-on-the-development-of-a-nuclear-security-regime-for-member-states-with-nuclear-power-programme.

[44] Regional Coordination Meeting on Nuclear Security Implementation Strategy in Latin America and the Caribbean, October 2-4, 2017, https://www.iaea.org/events/regional-coordination-meeting-on-nuclear-security-implementation-strategy-in-latin-america-and-the-caribbean.

[45] International Training Course on Regulations and Associated Administrative Measures for Nuclear Security, October 16-19, 2017, https://www.iaea.org/events/international-training-course-on-regulations-and-associated-administrative-measures-for-nuclear-security-0.

[46] Regional Training Course on Nuclear Security in Practice: Field Training for University Students, October 16-27, 2017, https://www.iaea.org/events/regional-training-course-on-nuclear-security-in-practice-field-training-for-university-students.

[47] Regional Training Course on Development of a Nuclear Security Detection Architecture Design Plan, November 13-17, 2017, https://www.iaea.org/events/regional-training-course-on-development-of-a-nuclear-security-detection-architecture-design-plan.

[48] Regional Workshop and Tabletop Exercise on Management of the Response to a Nuclear Security Event at a Nuclear Power Plant, December 4-8, 2017, https://www.iaea.org/events/regional-workshop-and-tabletop-exercise-on-management-of-the-response-to-a-nuclear-security-event-at-a-nuclear-power-plant.

[49] Technical Meeting to Review and Revise IAEA Safety Guides and Related Reports on Leadership Management for Safety and Safety Culture, July 10-12, 2017, https://www.iaea.org/events/technical-meeting-to-review-and-revise-iaea-safety-guides-and-related-reports-on-leadership-management-for-safety-and-safety-culture.

[50] International Workshop on Nuclear Security Measures and Emergency Response Arrangements for Ports, November 6-10, 2017, https://www.iaea.org/events/international-workshop-on-nuclear-security-measures-and-emergency-response-arrangements-for-ports.

Guidance Committee (November, Vienna).[51]

- ✧ The 11th meeting of the Steering Committee of the Global Nuclear Safety and Security (GNSSN) Network (November, Vienna).[52]
- ✧ A technical meeting to evaluate the ConvEx-3 (2017)[53] Exercise (December, Vienna).[54]

As described above, even though the NSS process came to an end in 2016, a number of nuclear security-related events, especially the IAEA conference, were implemented and various steps related to strengthening the nuclear security system were somehow maintained in many countries. From the viewpoint of strengthening sustainable nuclear security, such steady efforts should receive appropriate appraisals. With this regard, in contrast to the former U.S. President Barack Obama, who led the nuclear security summit process, international community's attention gathered the new nuclear security policy of the U.S. Trump administration. However, so far no announcement has been made that will change a major policy in the field of nuclear security.

In view of the factors mentioned above, this report surveys the following items to evaluate the implementation of nuclear security-related measures of each country. In order to assess the nuclear security risks of each country, this report considers: indicators of the presence of nuclear material that may be "attractive" for malicious intent, facilities that produce such material, and related activities. It also examines the accession status to nuclear security-related international conventions, the implementation status of existing nuclear security measures and proposals to enhance them, and official statements related to nuclear security approaches, in order to evaluate the nuclear security performance and status of each county.

(1) PHYSICAL PROTECTION OF NUCLEAR MATERIALS AND FACILITIES

According to the IAEA definition, a nuclear security threat is "a person or group of persons with motivation, intention and capability to commit criminal or intentional unauthorized acts involving or directed at nuclear material, other radioactive material, associated facilities or associated activities or other acts determined by the state to have an adverse impact on nuclear security."[55] The IAEA recommends that the state's physical protection requirements for nuclear material and nuclear facilities should be based on a Design Basis Threat (DBT), specifically for unauthorized removal of Category I nuclear material, sabotage of nuclear material and nuclear facilities that have potentially high radiological consequences.[56] Furthermore, the IAEA recommended that security requirements for radioactive material "should be adopted depending on whether the radioactive material concerned is sealed source, unsealed source,

[51] Twelfth Meeting of the Nuclear Security Guidance Committee, November 27-30, 2017, https://www.iaea.org/events/twelfth-meeting-of-the-nuclear-security-guidance-committee.

[52] GNSSN: 11th Meeting of the Steering Committee of the Global Nuclear Safety and Security Network, December 11-12, 2017, https://www.iaea.org/events/gnssn-11th-meeting-of-the-steering-committee-of-the-global-nuclear-safety-and-security-network.

[53] Technical Meeting to Evaluate the ConvEx-3 (2017) Exercise, December 18-19, 2017, https://www.iaea.org/events/technical-meeting-to-evaluate-the-convex-3-2017-exercise.

[54] "ConvEx-3 exercise in Hungary," Hungarian Atomic Energy Authority website, June 21, 2017, http://www.oah.hu/web/v3/HAEAPortal.nsf/web?OpenAgent&article=news&uid=38478E6895D11956C1258146004DD488.

[55] IAEA Nuclear Security Series No.20, "Objective and Essential Elements of a State's Nuclear Security Regime," 2013, http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1590_web.pdf.

[56] IAEA Nuclear Security Series No.13, "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5)," 2011, p. 13.

disused sealed source or waste, and should cover transport."[57]

The latest version of the IAEA's "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities" (INFCIRC/225/Rev.5) was revised and published in 2011. In this revised edition, the IAEA recommends that requirements for physical protection should be based on a graded approach, taking into account the current evaluation of the threat, the relative attractiveness, the nature of the nuclear material and potential consequences associated with the unauthorized removal of nuclear material and with the sabotage against nuclear material or nuclear facilities.[58] The IAEA also suggests that the physical protection system should be designed to deny unauthorized access of persons or equipment to the targets, minimize opportunity of insiders, and protect the targets against possible stand-off attacks—an attack, executed at a distance from the target nuclear facility or transport, which does not require adversary hands-on access to the target, or require the adversary to overcome the physical protection system—consistent with the state's threat assessment or DBT.[59] The objectives of the state's physical protection regime, which is an essential component of the state's nuclear security regime, should be to protect against unauthorized removal, locate and recover missing nuclear material, protect against sabotage, and mitigate or minimize effects of sabotage.[60]

The nuclear material itself is the primary factor for determining the physical protection measures against unauthorized removal. Therefore, categorization based on the different types of nuclear material in terms of element, isotope, quantity and irradiation is the basis for a graded approach for protection against unauthorized removal of "attractive" nuclear material that could be used in a nuclear explosive device, which itself depends on the type of nuclear material, isotopic composition, physical and chemical form, degree of dilution, radiation level, and quantity (see Table 3-1).[61]

Generally, plutonium with an isotopic concentration of Pu-239 of 80% or more is more attractive than other plutonium isotopes from a standpoint of manufacturing nuclear explosive devices by terrorists. Weapons-grade highly enriched uranium (HEU) is usually enriched to 90% or higher levels of U-235. Both of these high-grade nuclear materials require high-level protection measures. In assessing the importance of preventing illegal transfers and sabotage, even if countries do not possess weapon-grade HEU or plutonium, they are at risk if they possess a uranium enrichment facility or a nuclear reactor and a plutonium reprocessing facility. The number of such sensitive facilities in a country will be the subject of assessment for a state's effort in enhancing nuclear security. Of course, the level of these protection measures will vary depending on the geopolitical circumstance or the domestic security situation. Table 3-2 shows the latest evaluations made by the International Panel on Fissile Material (IPFM) and by other relevant research bodies including the Nuclear Threat Initiative (NTI) in its "Civilian HEU Dynamic Map," of fissile material holdings.

Even today, HEU and plutonium equivalent to nearly

[57] IAEA Nuclear Security Series No.14, "Nuclear Security Recommendations on Radioactive Material and Associated Facilities," 2011, p. 14.

[58] IAEA Nuclear Security Series No.13, "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev.5)," 2011, paragraph 3.37.

[59] Ibid., paragraph 5.14.

[60] Ibid., paragraph 2.1.

[61] Ibid., paragraph 4.5.

Table 3-1: Categorization of Nuclear Material*

Material	Form	Category I ← High	Category II Attractiveness	Category IIIc) → Low
1. Plutonium[a]	Unirradiated[b]	≧ 2kg	2kg > > 500g	500g ≧ > 15g
2. Uranium-235 (^{235}U)	Unirradiated[b] — Uranium enriched to 20% ^{235}U or more	≧ 5kg	5kg > > 1kg	1kg ≧ > 15g
	— Uranium enriched to 10% ^{235}U but less than 20% ^{235}U	------	≧ 10kg	10kg > > 1kg
	— Uranium enriched above natural, but less than 10% ^{235}U	------	------	≧ 10kg
3. Uranium-233 (^{233}U)	Unirradiated[b]	≧ 2kg	2kg > > 500g	500g ≧ > 15g
4.Irradiated fuel**			Depleted or natural uranium, thorium or low enriched fuel (less than 10% fissile content) [d/e]	

*: This is “special fissionable material” or “source material” that is defined in Statute of the IAEA. The Statute defines “special fissional material” as plutonium-239; uranium-233; uranium enriched in the isotopes 235 or 233; any material containing one or more of the foregoing; any such other fissionable material as the Board of Governors shall from time to time determine; but the term “special fissionable material” does not include source material. It also defines “source material” as uranium containing the mixture of isotopes occurring in nature; uranium depleted in the isotope 235; thorium; any of the foregoing in the form of metal, alloy, chemical compound, or concentrate; any other material containing one or more of the foregoing in such concentration as the Board of Governors shall from time to time determine; and such other material as the Board of Governors shall from time to time determine. International Atomic Energy Agency (IAEA), “Statute,” As Amended up to 23 February 1989.

**: The categorization of irradiated fuel in the table is based on international transport considerations. The State may assign a different category for domestic use, storage and transport taking all relevant factors into account.

a) All plutonium except that with isotopic concentration exceeding 80% in plutonium-238.

b) Material not irradiated in a reactor or material irradiated in a reactor but with a radiation level equal to or less than 1 Gy/h. (100 rad/h) at 1 m unshielded.

c) Quantities not falling in Category III and natural uranium, depleted uranium and thorium should be protected at least in accordance with prudent management practice.

d) Although this level of protection is recommended, it would be open to States, upon evaluation of the specific circumstances, to assign a different category of physical protection.

e) Other fuel which by virtue of its original fissile material content is classified as Category I or II before irradiation may be reduced one category level while the radiation level from the fuel exceeds 1 Gy/h (100 rad/h) at one metre unshielded.

Source: IAEA, “Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5),” IAEA Nuclear Security Series No. 13, 2011. This table was originally shown in the “Hiroshima Report-Evaluation of Achievement in Nuclear Disarmament, Non-Proliferation and Nuclear Security: 2014,” March 2014, p.68.

200,000 nuclear weapons exist in the whole world.[62] Furthermore, more than 90% of the global HEU and weapon-grade plutonium stockpile is possessed by the United States and Russia. For terrorist's intent on acquiring material for a nuclear weapons, these and other fissile material holdings can be considered to present the most attractive targets. While the global stockpile of HEU and separated plutonium has been occupying the attention of the international community and civil society, there is little officially disclosed information about stockpiles of HEU and weapon-grade plutonium by individual states, due to the sensitivity of these materials.

In spite of these constraints, transparency of nuclear material holdings is important, in principle. According to the NTI's "Civilian HEU Dynamic Map,"[63] the estimated holdings of HEU and plutonium of some countries other than the ones in Table 3-2 are estimated as follows:

- Countries assumed to retain approximately 1 ton of HEU (category I is 5 kg and more): Kazakhstan (10,470-10,770kg), Canada (1,038kg*)
- Countries assumed to retain 1 kg and more but less than 1 ton of HEU：Australia (2kg), Iran (8kg), the Netherlands (730-810kg), Nigeria (less than 1 kg*), Norway (1～9kg), South Africa (700-750 kg (unspecified)*), Syria (less than 1 kg*)

*: Updated figures in 2017.

As a result of activities of the recent Global Threat Reduction Initiative (GTRI), the number of countries that completely removed HEU has increased in recent years. Mexico, Jamaica, Colombia, Chile, Argentina, Brazil, Sweden, Denmark, Spain, Portugal, Switzerland, Austria, Czech Republic, Poland, Hungary, Romania, Bulgaria, Greece, Ukraine, Turkey, Georgia, Iraq, Uzbekistan, Latvia, Ghana, Thailand, Vietnam, Indonesia, the Philippines, South Korea, etc. are cited as countries that achieved complete removal of such HEU.[64] For reference information, estimated holdings of HEU and plutonium of some countries not in the list of this survey are as follows:

- Countries assumed to retain 1 kg and more but less than 1 ton of HEU: Belarus (80-280 kg), Italy (100-119 kg)[65]

Any operating reactor or facility for handling spent fuel presents a potential risk of illicit transfer of fissile material or sabotage against facility. Research reactors can pose a greater risk if they utilize HEU fuel and if they are associated with spent-fuel reprocessing facilities or even unsecured storage of spent fuel.

The IAEA's Research Reactor Database (RRDB)[66] shows that 221 out of a total of 787 research reactors are currently in operation (137 in developed countries, 84 in developing countries). Another 20 reactors (11 in developed countries, nine in developing countries) are temporarily shut down, seven reactors (four in developed countries, three in developing countries) are under construction, 12 reactors (three in developed countries, nine in developing countries) are scheduled for construction, 111 reactors (97 in developed countries, 14 in developing countries) have been shut down, 352 reactors (336 in developed countries, 26 in developing countries) are decommissioned, and construction of 15 reactors (11 in developed countries, four in developing countries) have been canceled. Compared with the previous year,

[62] Zia Mian and Alexander Glaser, "Global Fissile Material Report 2015: Nuclear Weapon and Fissile Material Stockpile and Production," NPT Review Conference, May 8, 2015, http://fissilematerials.org/library/ipfm15.pdf. While HEU stocks are decreasing, plutonium stocks are increasing, mainly due to increased inventory of civilian plutonium.

[63] NTI, "Civilian HEU Dynamic Map," Nuclear Threat Initiative website, December 2017, http://www.nti.org/gmap/other_maps/heu/index.html.

[64] Ibid.

[65] Ibid.

[66] IAEA, Research Reactor Data Base, IAEA website, https://nucleus.iaea.org/RRDB/RR/ReactorSearch.aspx?rf=1.

Table 3-2: Stockpiles of fissile material usable for weapons

[Metric Tons]

	China	France	Russia	U.K.	U.S.	India
HEU	**18 ± 4**	**(max) 30.6**	**679**	**21.2**	**599**	**3.2 ±1.1**
Stockpile available for weapons		26, or maximum 10±2, minimum 6±2	650	19.8	253	
Naval (fresh)			20		152	
Naval (irradiated)					31	
Civilian Material	1*	4.8*	4.9+3*	1.4	8.4*	4.5
Excess (mostly for blend-down)			2.9*		6.3*	
Weapon Pu	**1.8**	**6**	**128 ±8**	**3.2**	**87.6**	**5.7**
Military stockpile	1.8	6	88	3.2	38.3	0.4
Excess military material			34	0	49.3	
Additional strategic stockpile			6			5.1*
Civilian use Pu	**0.04***	**81.7***	**57.2***	**129.4***	**49.4***	**0.4**
Civilian stockpile, stored in country		65.4*				0.4*
Civilian stockpile, stored outside country		16.3*		23.2*		

	Israel	Pakistan	Belgium	Germany	Japan	Switzerland	N. Korea	Others
HEU	**0.3**	**3.1 ± 0.4**	**0.7-0.727**	**1.23***	**1.2-1.8**	**0**	**0**	**15**
Stockpile available for weapons								
Naval (fresh)								
Naval (irradiated)								
Civilian Material	0.034*	0.017*					0.042	15
Excess (mostly for blend-down)								
Weapon Pu	**0.86**	**0.19**					**0.03**	
Military stockpile	0.86	0.19					0.03	
Excess military material								
Additional strategic stockpile								
Civilian use Pu			**< 0.05***	**2.5-3.5***	**47***	**< 0.002***		**52.8**
Civilian stockpile, stored in country				0.5*	9.9*			
Civilian stockpile, stored outside country				2-3*	37.1*			

Sources: International Panel on Fissile Materials, "Fissile Materials Stocks," International Panel on Fissile Materials, July 29, 2016; International Panel on Fissile Materials, "Global Fissile Material Report 2015: Nuclear Weapon and Fissile Material Stockpiles and Production," International Panel on Fissile Materials, December 2015; "Civilian HEU Dynamic Map," Nuclear Threat Initiative website, December 2017, http://www.nti.org/gmap/other_maps/heu/; Document distributed at the 24th session of the Japan Atomic Energy Commission, July 27, 2016, http://www.aec.go.jp/jicst/NC/iinkai/teirei/siryo2016/siryo24/siryo1.pdf; "2016 civilian plutonium reports submitted to IAEA," IPFM Blog, October 21, 2017, http://fissilematerials.org/blog/2017/10/2016_civilian_plutonium_r.html.

*: Updated figures in 2017.

the number of research reactors increased by 13 in the whole world, while the number of research reactors with shutdown (closed) status decreased to 24 in developed countries and six in developing countries. In addition, the number of research reactors that were decommissioned increased by six in total. It is also noteworthy that the number of research reactors whose construction has been canceled has increased to seven in developed countries.

According to the IAEA, 20,663 spent fuel assemblies from research reactors are enriched to levels above 20% and 9,532 of these stored fuel assemblies are enriched to levels at or above 90%.[67] In terms of geographical distribution: 10,627 spent HEU fuel assemblies, which are over half of the total, are currently stored in Eastern Europe, 572 are located in Africa and Middle East, 3,492 in Asia, 4,273 in Western Europe, 85 in Latin America and 1,614 in North America.[68] In this way, in view of the regional distribution of substances with a high attractiveness to terrorists, prevention of illegal transfers and sabotage against facilities becomes critically important as a measure against nuclear security risk, regardless of whether or not the reactor is in operation.

Table 3-3 outlines the presence of nuclear power plants, research reactors, uranium enrichment facilities, and reprocessing facilities in surveyed countries, as risk indicators.

The IAEA recommends that a state defines the risk based on the amount, forms, composition, mobility, and accessibility of nuclear and other radioactive material and takes prospective measures against the defined risk. In terms of unauthorized removal, nuclear or other radioactive material and related production facilities are also potential targets.[69] To reduce the potential for sabotage within a plant, the IAEA recommends that a state "establishes its threshold(s) of unacceptable radiological consequences" and identifies the vital areas where risk associated materials, devices, and functions are located are designated "in order to determine appropriate levels of physical protection taking into account existing nuclear safety and radiation protection."[70]

In recent years, efforts are also being made on nuclear security of radioactive sources (RI security). In this field, the IAEA publishes "Nuclear Security Series No.11, Security of Radioactive Sources (2009)"[71] and "Nuclear Security Series No.14, Nuclear Security Recommendations on Radioactive Material and Associated Facilities (2011)".[72] Also, at the Washington Nuclear Security Summit in 2016, 28 countries and INTERPOL jointly released a "Gift Basket" statement on strengthening the security of high activity sealed radioactive sources, reflecting the IAEA's code of conduct on the safety and security of radioactive sources.[73] Regarding the individual efforts of each country related to RI security, in March 2017, a regional training course on the Security of

[67] IAEA, Worldwide HEU and LEU assemblies by Enrichment, IAEA website, https://nucleus.iaea.org/RRDB/Reports/Container.aspx?Id=C2.

[68] IAEA, Regionwise distribution of HEU and LEU, IAEA website, https://nucleus.iaea.org/RRDB/Reports/Container.aspx?Id=C1.

[69] IAEA Nuclear Security Series No. 14, "Nuclear Security Recommendations on Radioactive Material and Associated Facilities," 2011, http://www-pub.iaea.org/MTCD/publications/PDF/Pub1487_web.pdf.

[70] Ibid., p. 14.

[71] IAEA Nuclear Security Series No. 11, "Security of Radioactive Sources," 2009, http://www-pub.iaea.org/MTCD/publications/PDF/Pub1387_web.pdf.

[72] IAEA Nuclear Security Series No. 14, "Nuclear Security Recommendations on Radioactive Material and Associated Facilities," 2011, http://www-pub.iaea.org/MTCD/publications/PDF/Pub1487_web.pdf.

[73] "Joint Statement Strengthening the Security of High Activity Sealed Radioactive Sources (HASS)," 2016 Washington Nuclear Security Summit, March 11, 2016, https://static1.squarespace.com/static/568be36505f8e2af8023adf7/t/57050be927d4bd14a1daad3f/1459948521768/Joint+Statement+on+the+Security+of+High+Activity+Radioactive+Sources.pdf.

Table 3-3: Nuclear fuel cycle facilities

	China	France	Russia	U.K.	U.S.	India	Israel	Pakistan	Australia	Austria	Belgium	Brazil
Nuclear Power Plant	○	○	○	○	○	○		○			○	○
Research Reactor	○	○	○	○	○	○	○	○	○	○	○	○
Uranium Enrichment Facility	○	○	○	○	○	○[a]	?	○[a]				○
Reprocessing Facility	○	○	○[b]	○	○	○[b]	○[a]	○[a]				

	Canada	Chile	Egypt	Germany	Indonesia	Iran	Japan	Kazakhstan	South Korea	Mexico	Netherlands	New Zealand
Nuclear Power Plant	○			○		○	○	○	○	○	○	
Research Reactor	○	○	○	○	○	○	○	○	○	○	○	
Uranium Enrichment Facility				○		○	○				○	
Reprocessing Facility							△[e]					

	Nigeria	Norway	Philippines	Poland	Saudi Arabia	South Africa	Sweden	Switzerland	Syria	Turkey	UAE	North Korea
Nuclear Power Plant						○	○	○			△[c]	
Research Reactor	○	○		○	△[c]	○	△[df]	○	○	○		○[a]
Uranium Enrichment Facility						△[c]						△[c]
Reprocessing Facility												△[af]

○: Currently operated, △: Un-operated

a) Military use/ b) Military and civilian use/ c) Under construction/ d) Under shut down and decommissioning/ e) Under test operation / f) Stand-by

Sources: IAEA, Research Reactor Database, IAEA Website, https://nucleus.iaea.org/RRDB/RR/ReactorSearch.aspx?filter=0; IAEA, Nuclear Fuel Cycle Information System, IAEA Website, http:// infcis.iaea.org/NFCIS/About.cshtml; IAEA, Power Reactor Information System, IAEA Website, https://www.iaea.org/PRIS/home.aspx.

Radioactive Sources was held in Obninsk, Russia.[74] In April, a meeting of the Working Group Meeting on Radioactive Source Security was held in Vienna.[75] In addition, in July the international training course on the Security of Radioactive Sources was held in Vienna[76] and in the same month the regional training course on Security of Radioactive Material in Transport for French-speaking African Countries was held in Dakar, Senegal.[77]

(2) STATUS OF ACCESSION TO NUCLEAR SECURITY AND SAFETY-RELATED CONVENTIONS, PARTICIPATION IN NUCLEAR SECURITY-RELATED INITIATIVES, AND APPLICATION TO DOMESTIC SYSTEMS

A) Accession status to nuclear security-related conventions

This section examines the accession status of each country to the following nuclear security and safety-related conventions that are mentioned in the Nuclear Security Summit communiqué,[78] namely: the Convention on the Physical Protection of Nuclear Material (CPPNM); Amendment to CPPNM (CPPNM Amendment); the International Convention for the Suppression of Acts of Nuclear Terrorism (Nuclear Terrorism Convention); the Convention on Nuclear Safety (Nuclear Safety Convention); the Convention on Early Notification of a Nuclear Accident; the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management; and the Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency.

- The CPPNM became effective in 1987. As of January 2018, 156 countries have signed and 44 countries have ratified this treaty.[79] The CPPNM requires its party states to take appropriate protection measures for international transfer of nuclear material used for peaceful purposes, and not permit its transfer in the case that such measures are not in place. It also calls for the criminalization of acts including unauthorized receipt, possession, use, transfer, alteration, disposal or dispersal of nuclear material, and which cause damage to any person or property, as well as theft or robbery of nuclear material.
- The CPPNM Amendment became effective in 2016. As of January 2018, 116 states have approved the Amendment.[80] The Amendment makes it legally binding for states to establish, implement and maintain an appropriate physical protection regime applicable to nuclear material and nuclear facilities under their jurisdiction. It provides for the criminalization of new and extended specified acts, and requires countries to put in place measures to protect nuclear material and nuclear facilities against sabotage. In this

[74] Regional Training Course on the Security of Radioactive Sources, March 13-17, 2017, https://www.iaea.org/events/regional-training-course-on-the-security-of-radioactive-sources-0.

[75] Meeting of the Working Group on Radioactive Source Security, April 24-27, 2017, https://www.iaea.org/events/meeting-of-the-working-group-on-radioactive-source-security.

[76] International Training Course on the Security of Radioactive Sources, July 3-7, 2017, https://www.iaea.org/events/international-training-course-on-the-security-of-radioactive-sources.

[77] Regional Training Course on Security of Radioactive Material in Transport for French-speaking African Countries, July 3-7, 2017, https://www.iaea.org/events/regional-training-course-on-security-of-radioactive-material-in-transport-for-french-speaking-african-countries.

[78] "Nuclear Security Summit 2016 Communiqués," 2016 Washington Nuclear Security Summit, April 1, 2016.

[79] Convention on the Physical Protection of Nuclear Material, January 11, 2018, http://www.iaea.org/Publications/Documents/Conventions/cppnm_status.pdf.

[80] Amendment to the Convention on the Physical Protection of Nuclear Material, January 11, 2018, https://www.iaea.org/Publications/Documents/Conventions/cppnm_amend_status.pdf.

sense, the Amendment expands the existing offences identified in the CPPNM, including the theft and robbery of nuclear material, and establishes new ones, such as the smuggling of nuclear material and the actual or threatened sabotage of nuclear facilities. A number of the offences were also expanded to include substantial damage to the environment. As the key legally binding international undertaking in the area of physical protection of nuclear material, ratification of the Amendment should be continuously promoted.

- The Nuclear Terrorism Convention, which entered into force in 2007, requires party states to criminalize acts of possession and use of radioactive material[81] or nuclear explosive devices with malicious intent, and against those seeking to use and damage nuclear facilities in order to cause radioactive dispersal. The convention and the CPPNM Amendment are mutually necessary to support a legal framework for nuclear security.
- The Nuclear Safety Convention became effective in 1996. This treaty is aimed at ensuring and enhancing the safety of nuclear power plants. Party states of this Convention are required to take legal and administrative measures, report to the review committee established under this convention, and accept peer review in order to ensure the safety of nuclear power plants under their jurisdiction.
- The Convention on Early Notification of a Nuclear Accident entered into force in 1986. It obligates its party states to immediately report to the IAEA when a nuclear accident has occurred, including the type, time, and location of the accident and relevant information.
- The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management became effective in 2001. It calls for its member states to take legal and administrative measures, report to its review committee, and undergo peer review by other parties, for the purpose of ensuring safety of spent fuel and radioactive waste.
- The Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency entered into force in 1987. This convention establishes the international framework that enables equipment provision and dispatch of experts with the goals of preventing and/or minimizing nuclear accidents and radioactive emergencies.

Some, if not all, of these nuclear safety-related conventions can be interpreted as providing protective measures for nuclear security purposes, and thus could be listed as nuclear security-related international conventions. Table 3-4 summarizes the signature and ratification status of each country to these conventions.

B) INFCIRC/225/Rev.5

In 2011, the IAEA published a fifth revision of the "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev.5)" in 2011. In comparison with the INFCIRC/225/Rev.4, this latest revision introduced new measures on nuclear security: inter alia, creation of limited access areas, graded approaches, the enhancement of defense-in-depth, and protection against "Stand-off Attack" and airborne threat, counter measures against insider threat, development of nuclear security culture as a preventive measure against security breaches by insiders, and the provision of redundancy measures to ensure the functions of the central response station during an emergency. Implementation of the protective measures in accordance with the recommendation made by this fifth revision has

[81] International Convention for the Suppression of Acts of Nuclear Terrorism, United Nations, 2005, https://treaties.un.org/doc/db/terrorism/english-18-15.pdf, Article 1.

Table 3-4: Signature and ratification status for major nuclear security- and safety-related conventions

	China	France	Russia	U.K.	U.S.	India	Israel	Pakistan	Australia	Austria	Belgium	Brazil
CPPNM	○	○	○	○	○	○	○	○	○	○	○	○
CPPNM Amendment	○	○	○	○	○	○	○	○	○	○	○	
Nuclear Terrorism Convention	○	○	○	○	○	○	△		○	○	○	○
Nuclear Safety Convention	○	○	○	○	○	○	△	○	○	○	○	○
Convention on Early Notification of a Nuclear Accident	○	○	○	○	○	○	○	○	○	○	○	○
Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	○	○	○	○	○				○	○	○	○
Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency	○	○	○	○	○	○	○	○	○	○	○	○

	Canada	Chile	Egypt	Germany	Indonesia	Iran	Japan	Kazakhstan	South Korea	Mexico	Netherlands	New Zealand
CPPNM	○	○	△	○	○		○	○	○	○	○	○
CPPNM Amendment	○	○		○	○		○	○	○	○	○	○
Nuclear Terrorism Convention	○	○	△	○	○		○	○	○	○	○	○
Nuclear Safety Convention	○	○	△	○	○		○	○	○	○	○	
Convention on Early Notification of a Nuclear Accident	○	○	○	○	○	○	○	○	○	○	○	○
Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	○	○		○	○		○	○	○		○	
Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency	○	○	○	○	○	○	○	○	○	○	○	○

	Nigeria	Norway	Philippines	Poland	Saudi Arabia	South Africa	Sweden	Switzerland	Syria	Turkey	UAE	North Korea
CPPNM	○	○	○	○	○	○	○	○		○	○	
CPPNM Amendment	○	○		○	○		○	○		○	○	
Nuclear Terrorism Convention	○	○	△	○	○	○	○	○	△	○	○	
Nuclear Safety Convention	○	○	△	○	○	○	○	○	○*	○	○	
Convention on Early Notification of a Nuclear Accident	○	○	○	○	○	○	○	○	△	○	○	△
Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	○	○	△	○	○	○	○	○			○	
Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency	○	○	○	○	○	○	○	○	△	○	○	△

○: Ratification, acceptance, approval, and accession
△: Signature
*: Updated figures in 2017.

been encouraged internationally, with a view to establishing a stronger nuclear security system. Furthermore, this revision stipulates a number of state responsibilities for establishing a contingency plan, including interfaces with safety, as appropriate, ensuring that operator prepares contingency plans to effectively counter the threat assessment or DBT taking actions of the response forces into consideration, evaluating effectiveness of the physical protection system through exercises, and determining the trustworthiness policy.

Since the INFCIRC/225/Rev.5 was released at the same time as the start of the nuclear security summit, when participating in the Summit, countries tended to announce the introduction of physical protection measures in accordance with the fifth revision of the recommendation. This trend continued until the last nuclear security summit in 2016[82] and confirms the high-level attention that countries gave to introducing the IAEA's recommended measures.

In this regard, the application status of the recommended measures of INFCIRC/225/Rev.5 can serve as a significant indicator to assess the nuclear security system of this report's surveyed countries. This report refers to official statements made available in the 61st IAEA General Conference and 10th Plenary Meeting of the Global Initiative to Combat Nuclear Terrorism (GICNT), as well as other opportunities to evaluate the national nuclear security stance and performance of each state.

APPLICATION STATUS OF EACH COUNTRY OF THE MEASURES RECOMMENDED IN INFCIRC/225/REV.5

As a result of the end of the nuclear security summit, held four times over seven years, opportunities for disseminating information on the introduction and application of the recommendation measures of INFCIRC/225/Rev.5 are gradually decreasing. The reason for the reduction of information dissemination is not entirely clear. It may be because there are few items to be newly added in each country with regard to INFCIRC/225/Rev.5, which, at the time of preparing this report, had been announced seven years earlier. Or it may be because opportunities to mention the application of the recommendation measures themselves have diminished as a result of shrinking occasions to disseminate information. The cases where there were statements on the introduction of recommendation measures of INFCIRC225/Rev.5 directly or indirectly in the surveyed country are as follows.

In the field of the development of legal instruments, China's National People's Congress adopted a Nuclear Safety Act in 2017.[83] In addition, China is in the stage of completing a public comment on the Regulation on Nuclear Security (2016) and measures necessary for adopting the bill are finally in place.[84] In the United Kingdom, the Office of Nuclear Regulation established Security Assessment Principles[85] in 2017, as a new regulatory framework for contractors.[86] Nigeria drafted the Nigerian Regulations on the Physical

[82] "Highlights of National Progress Reports," 2016 Washington Nuclear Security Summit, April 5, 2016, http://www.nss2016.org/news/2016/4/5/highlights-from-national-progress-reports-nuclear-security-summit.

[83] China National Statement at the 61th General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-china-final-stat.pdf.

[84] Jia Jinlei, "The Legal and Regulatory Systems for Nuclear Security in China," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, Austria.

[85] "New Internal Guidance - Security Assessment Principles (SyAPs)," Department for Business, Energy & Industrial Strategy-Office for Nuclear Regulation, April 2017, http://www.onr.org.uk/documents/2017/rpc-3625-1-decc-onr.pdf.

[86] UK National Statement at the 61th General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-uk-statement.pdf.

Protection of Nuclear Material and Nuclear Facilities based on the INFCIRC/225/Rev.5 in 2015.[87] Also, Nigeria established an autonomous Regulatory and Nuclear Safety Authority (ARSN) and adopted the law on security and peaceful use of the Atomic Energy.[88] Saudi Arabia will set up an independent regulatory authority on the safety of nuclear and radioactive materials by the third quarter of 2018 and will prepare relevant domestic laws based on a review by the IAEA.[89] UAE established a Regulation for Physical Protection of Nuclear Material and Nuclear Facilities-FANR-REG-08 based on INFCIRC225/Rev.5 in 2010 and revised it in 2016.[90] Pakistan has introduced a comprehensive nuclear security regime and regularly reviews it according to IAEA guidance documents and best practices.[91] Although it is not directly related to application of the measures recommended in INFCIRC/225/Rev.5, France adopted the law on the use of drone in 2016 in the context of nuclear security. [92] It was a remarkable new movement for the drone flight problem near the nuclear facilities, which is a concern of recent years in physical protection of nuclear material.

Regarding the field of strengthening physical protection of nuclear material, Russia's ROSATOM established guidelines for evaluating the effectiveness of nuclear material protection systems at nuclear facilities in 2015. It introduced computer programs called "Vega-2" and "Polygon" as a means of evaluating the effectiveness of these guidelines.[93] Israel has taken measures under the guidelines of the IAEA for the protection of nuclear facilities, and the protection of nuclear material used for research and application.[94] Belgium temporarily placed its nuclear facilities under army protection, to compensate for the delayed implementation of resident measures of a specially formed armed policy unit.[95] In Pakistan, regulations for the protection of nuclear materials and nuclear-related facilities are underway, and it is expected that final approval will be obtained after review processes at relevant ministries and

[87] Nasiru-Deen A. Bello, "Legislative and Regulatory Framework for the Physical Protection of Nuclear Material and Nuclear Facilities in Nigeria," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, Austria, https://www.iaea.org/sites/default/files/17/11/cn-254-bello2-presentation.pdf.

[88] Republic of Niger National Statement at the 61th General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-niger-statement_fr.pdf.

[89] Kingdom of Saudi Arabia, Statement by HE Dr. Hashim Yamani, President, King Abdullah City for Atomic and Renewable Energy, at the Nuclear Power in the 21st Century – International Ministerial Conference, Abu Dhabi, United Arab Emirates, October 30-November 1, 2017, https://www.iaea.org/sites/default/files/cn-247-saudi-arabia-statement_ar.pdf.

[90] Sara Al Saadi, "Nuclear Security Regulatory Authorization and Assessment Process for Barakah NPP in United Arab Emirates," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, Austria, https://www.iaea.org/sites/default/files/17/11/cn-254-alsaadi-presentation.pdf.

[91] Statement by Khalil Hashmi, Director General (Disarmament), MFA Head of Pakistan Delegation at the 10th Plenary Meeting of the GICNT, June 2, 2017, http://www.gicnt.org/statements/documents/2017-plenary/Pakistan.pdf.

[92] "National Statement by France" at the 10th Plenary Meeting of the GICNT, June 1, 2017, http://www.gicnt.org/statements/documents/2017-plenary/France.pdf.

[93] Alexander Izmaylov, "Systematic Aspects of High Effective Physical Protection Systems Design for Russian Nuclear Sites," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, Austria, https://www.iaea.org/sites/default/files/17/11/cn-254-izmaylov-presentation.pdf.

[94] Statement by Mr. Zeeb Snir, Head, Israel Atomic Energy Commission at the 61th General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-israel-statement.pdf.

[95] Declaration Nationale Belge, Intervention de Monsieur Jan Bens, Directeur Général de l'Agence Fédérale de Contrôle Nucléaire, 61ème Session De La Conférence Générale De L'AIEA, Septembre 20, 2017, https://www.iaea.org/sites/default/files/gc61-belgium-statement.pdf.

agencies.[96] In connection with this issue, a regional training course on Introduction to Physical Protection System Effectiveness Evaluation was held in October 2017 in Daejeon, South Korea.[97]

Protection measures for sabotage actions against nuclear materials and related facilities are as follows. Pakistan launched an independent nuclear security special unit consisting of land, sea and air components. Pakistan also established an early warning system dedicated to nuclear security.[98] In France, the Ministry of the Interior launched the Specialized Command for Nuclear Security (CoSSeN) and is promoting safety of transportation and physical protection of nuclear material.[99] In South Korea, the Korea Institute of Nuclear Nonproliferation and Control (KINAC) is using virtual reality to develop an evaluation system for sabotage acts on nuclear facilities.[100] China launched a nuclear emergency rescue team, capable of immediate response.[101]

Regarding response to cyber threats, the U.K. Office for Nuclear Regulation in 2017 announced a new regulatory framework called Security Assessment Principles, and strengthened measures against cyber threats in the domestic nuclear industry.[102] Belgium established a center for cyber security in 2014 and is expected to strengthen further collaboration with the nuclear safety authorities.[103] Germany held an international conference on computer security in 2015. After holding this conference, Germany has made some progress as a result of continuing to create additional computer security guidance for this field.[104] In connection with these cyber threat issues, a regional training course on Computer Security for Industrial Control Systems at Nuclear Facilities was held in Rio de Janeiro, Brazil in April 2017.[105] In May, a technical meeting on Engineering and Design Aspects of Computer Security in Instrumentation and Control Systems for Nuclear Power Plants was held in

[96] Syed Majid Hussain Shah, "Development of Physical Protection Regulatory Requirements in Pakistan," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, Austria, https://www.iaea.org/sites/default/files/17/11/cn-254-shah-presentation.pdf.

[97] Regional Training Course on Introduction to Physical Protection System Effectiveness Evaluation, October 16-20, 2017, https://www.iaea.org/events/regional-training-course-on-introduction-to-physical-protection-system-effectiveness-evaluation.

[98] Statement by the Leader of the Pakistan Delegation, 61th Annual General Conference of the IAEA, September 18-22, 2017, https://www.iaea.org/sites/default/files/gc61-pakistan-statement.pdf.

[99] S. Basille, "Specialized Command for Nuclear Security: Coordinate the Response of State Security Forces to Nuclear Threats and Breaches," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, Austria,https://www.iaea.org/sites/default/files/17/11/cn-254-basille-presentation.pdf.

[100] Yeonwook Kang, "TESS: Tool for evaluation security system Introduction and Development status, paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities," November 13-17, Vienna, Austria, https://www.iaea.org/sites/default/files/17/11/cn-254-kang2-presentation.pdf.

[101] Remarks by Chinese Delegation at the 10th Plenary Meeting of the GICNT, June 1, 2017, http://www.gicnt.org/statements/documents/2017-plenary/China.pdf.

[102] UK National Statement at the 61th General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-uk-statement.pdf.

[103] Declaration Nationale Belge, Intervention de Monsieur Jan Bens, Directeur Général de l'Agence Fédérale de Contrôle Nucléaire, 61ème Session De La Conférence Générale De L'AIEA, Septembre 20, 2017, https://www.iaea.org/sites/default/files/gc61-belgium-statement.pdf.

[104] Germany Statement at the 61th General Conference of the IAEA, September 19, 2017, https://www.iaea.org/sites/default/files/gc61-germany-statement.pdf.

[105] Regional Training Course on Computer Security for Industrial Control Systems at Nuclear Facilities, April 24-28, 2017, https://www.iaea.org/events/regional-training-course-on-computer-security-for-industrial-control-systems-at-nuclear-facilities.

Gloucester, the United Kingdom.[106] Regarding cyber security in nuclear facilities, information disclosure in each country regarding cases occurred in the past was limited, so it was extremely difficult to grasp the essence of the problem. Therefore, it is pointed out that the contractors of each country may not have adequate risk assessment and response.[107] In any case, cyber security is considered to be a new issue in strengthening nuclear security in each country.

Regarding the safety of transportation, in October 2017, an international training course on Security of Nuclear Material in Transport was held in Karlsruhe, Germany.[108] In December, the 35th Technical Meeting of the Transport Safety Standards was held in Vienna.[109]

In the field of countermeasures against insider threats, although it does not impose a legal obrigation, Japan introduced the revision of related Nuclear Regulation Authority Ordinances Publishing Guideline for Trustworthiness Check in 2016, and announced strengthening measures to monitor suspicious acts of insiders within protected areas.[110] As an event related to this field, a regional training course on Preventive and Protective Measures against Insider Threats was conducted in Tokai, Japan from 27th February to 3rd March 2017.[111] The importance of internal threats is a new point raised at INFCIRC/225/Rev.5, and legislation for countermeasures against internal threats is also a subject to be considered in each country. However, it should be noted that experts point out that internal threats can not be prevented only by determining the trustworthiness of indivisuals.[112]

Regarding nuclear security culture, in India, the Homi Bhabha National Institute (HBNI) conducts nuclear security culture education through one year of training for scientists and engineers.[113] In addition, as an event on this field, a technical meeting to Share Experiences Related to Activities under the Coordinated Research Project Development of Nuclear Security Culture Enhancement Solutions was held in Vienna in October 2017.[114]

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[106] Technical Meeting on Engineering and Design Aspects of Computer Security in Instrumentation and Control Systems for Nuclear Power Plants, May 8-12, 2017, https://www.iaea.org/events/technical-meeting-on-engineering-and-design-aspects-of-computer-security-in-instrumentation-and-control-systems-for-nuclear-power-plants.

[107] Caroline Baylon, Roger Brunt and David Livingstone, "Chatham House Report Cyber Security at Civil Nuclear Facilities: Understanding the Risks," September 2015, https://www.chathamhouse.org/sites/files/chathamhouse/field/field_document/20151005CyberSecurityNuclearBaylonBruntLivingstone.pdf.

[108] International Training Course on Security of Nuclear Material in Transport, October 9-13, 2017, https://www.iaea.org/events/international-training-course-on-security-of-nuclear-material-in-transport.

[109] 35th Technical Meeting of the Transport Safety Standards, December 11-15, 2017, https://www.iaea.org/events/35th-technical-meeting-of-the-transport-safety-standards.

[110] Naohito Uetake, "Current Nuclear Security Regime and Regulatory Framework in Japan-Efforts for Compliance with NSS-13 and CPPNM Amendment-," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, Austria, https://www.iaea.org/sites/default/files/17/11/cn-254-uetake-presentation.pdf.

[111] Regional Training Course on Preventive and Protective Measures against Insider Threats, February 27-March 3, 2017, https://www.iaea.org/events/regional-training-course-on-preventive-and-protective-measures-against-insider-threats.

[112] Matthew Bunn and Scott D. Sagan, "A Worst Practices Guide to Insider Threats: Lessons from Past Mistakes," American Academy of Arts & Sciences, 2014, https://www.amacad.org/multimedia/pdfs/publications/researchpapersmonographs/insiderThreats.pdf, p. 4.

[113] Jayarajan Kutuvan, Building Robust Nuclear Security Culture in Nuclear Research Centers, paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, Austria, https://www.iaea.org/sites/default/files/17/11/cn-254-kutuvan-presentation.pdf.

[114] Technical Meeting to Share Experiences Related to Activities under the Coordinated Research Project Development of Nuclear Security Culture Enhancement Solutions, October 23-25, 2017, https://www.iaea.org/events/technical-meeting-to-share-experiences-related-to-activities-under-the-coordinated-research-project-development-of-nuclear-security-culture-enhancement-solutions.

Table 3-5: Application status and efforts for recommended measures of INFCIRC/225/Rev.5

	China	France	Russia	U.K.	U.S.	India	Israel	Pakistan	Australia	Austria	Belgium	Brazil
Application Status and Efforts for Recommended Measures	○	○	○	○	○	○	○	○	○		○	○

	Canada	Chile	Egypt	Germany	Indonesia	Iran	Japan	Kazakhstan	South Korea	Mexico	Netherlands	New Zealand
Application Status and Efforts for Recommended Measures	○	○		○	○	○	○	○	○	○	○	○

	Nigeria	Norway	Philippines	Poland	Saudi Arabia	South Africa	Sweden	Switzerland	Syria	Turkey	UAE	North Korea
Application Status and Efforts for Recommended Measures	○		○	○	○*	○	○	○		○	○	

"○" is shown for only the countries for which the related information is available or that have made official remarks about their effort for INFCIRC/225/Rev.5.
*: Updated figures in 2017.

(3) EFFORTS TO MAINTAIN AND IMPROVE THE HIGHEST LEVEL OF NUCLEAR SECURITY

A) Minimization of HEU and plutonium stockpile in civilian use

Since HEU, in addition to fueling some research reactors, can also be used for the manufacture of nuclear explosive devices, it is regarded as "two sides of the same coin" for weapons and civilian use. Therefore, from the viewpoint of "attractiveness" to terrorists, it is difficult to deny the possibility that fissile materials will pose a nuclear security risk to the country holding such nuclear material. HEU has long been considered to pose a proliferation risk in terms of state-to-state technology transfers. More recently, the "9.11" terrorist attacks in the United States triggered nuclear security concerns regarding the spread of fissile material to non-state actors, including international terrorists.[115] To address this particular concern, the United States in 2004 introduced the Global Threat Reduction Initiative (GTRI), to manage the return of Russian and U.S.-origin HEU located in civilian sites to its country of origin, and the conversion of research reactors to operate with low enriched uranium (LEU).

It can be said that GTRI raised a caution for the international community about the risk of "attractive" fissile material being stolen for terrorist use, and encouraged concrete counter measures. However, it was then U.S. President Barack Obama's "Prague speech" in April 2009 that was a major factor in raising world public awareness, including international media, about the importance of nuclear security. Then, as a measure to pursue strengthening of nuclear security, the need to minimize HEU and plutonium became better understood in concerned countries.[116]

Throughout the Nuclear Security Summit process, minimization of HEU in civilian use had been treated as one of the top priority issues. The 2014 Hague Nuclear Security Summit Communiqué stipulates keeping state stockpiles of separated plutonium to the minimum level consistent with national requirements.[117] According to the U.S. fact sheet published at the Washington Nuclear Security Summit in March 2016, HEU and plutonium have been removed or down-blended at 50 facilities in 30 countries.[118] In addition, as a result of Indonesia completing the withdrawal of domestic HEU in 2017,[119] Southeast Asia, following South America and Central Europe, has become a region where there is no nuclear material attractive for terrorists.

Meanwhile, there was a discussion at the 61st IAEA General Conference in 2017 about the need to give a high level of protection to nuclear materials used for military purposes. Specifically, it was suggested that nuclear security should not be isolated from wider efforts to promote nuclear disarmament, non-proliferation and peaceful uses of nuclear energy. In particular, from the viewpoint of realizing a sustainable global nuclear security strategy, it was pointed out that the security measures that are applied to civil-use nuclear materials should also

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[115] "Past and Current Civilian HEU Reduction Efforts," Nuclear Threat Initiative website, December 20, 2017, http://www.nti.org/analysis/articles/past-and-current-civilian-heu-reduction-efforts/.

[116] Remarks By President Barack Obama in Prague as Delivered, The White House Office of the Press Secretary, April 5, 2009, https://www.whitehouse.gov/the-press-office/remarks-president-barack-obama-prague-delivered.

[117] "Hague Communiqué," 2014 Hague Nuclear Security Summit, March 25, 2014.

[118] The White House Office of the Press Secretary, "Fact Sheet: The Nuclear Security Summits: Securing the World from Nuclear Terrorism," March 29, 2016, https://obamawhitehouse.archives.gov/the-press-office/2016/03/29/fact-sheet-nuclear-security-summits-securing-world-nuclear-terrorism.

[119] NTI, "Civilian HEU Dynamic Map," Nuclear Threat Initiative website, December 2017, http://www.nti.org/gmap/other_maps/heu/index.html.

be applied to the vast stocks of HEU and separated plutonium in states possessing nuclear weapons.[120] It was also noted that fissile material used for military purposes, which accounts for 85% of the existing nuclear material in the world, represents a risk factor for peace and international security, and that these substances should also be treated as subjects for nuclear security protection.[121] Although it is an issue beyond the category of civilian use, it can be said that these are points to be noticed when considering the direction of arguments over future nuclear security. In another development at the conference, Kazakhstan expressed an intention to hold a Global Summit on Nuclear Security in its capital Astana.[122] Since this proposal was made by Kazakhstan, the host country of the IAEA's LEU bank, attention needs to be paid to how this initiative develops.

In the above regard, at the 61th IAEA General Conference, International Conference on Physical Protection of Nuclear Material and Nuclear Facilities organized by the IAEA, and on other occasions, the following updates on commitments to minimize HEU and plutonium use were made:

- China promoted the conversion of Ghana's Miniature Neutron Source Reactor (MNSR) to an LEU fuel system in cooperation with the IAEA, the US and Ghana, and the conversion work was completed in August 2017.[123]
- Poland completed the removal of HEU fuel for research reactors by the end of 2016. As a result all research reactors in Poland operate with LEU.[124]
- In Belgium, conversion of the HEU-type research reactor "BR 2" to an LEU fuel system continued.[125]
- Canada promotes the reliable management and removal of high-level radioactive material derived from Canada in Brazil under the cooperation of the IAEA.[126]
- Indonesia is implementing a process of down-blending nuclear fuel from HEU to LEU.[127]
- Norway will host the 3rd International Symposium on HEU Minimization in June next year, in cooperation with the IAEA.[128]
- The U.S. Senate and House Armed Services Committees completed on November 9, 2017 their work on the policy framework relating to military activities in the form of a Conference Report on the Fiscal Year 2018 National Defense Authorization Act (NDAA). The report discussed the development of LEU fuel

[120] Statement by H. E. Ambassador Marcel Biato, Permanent Representative of Brazil to the IAEA at the 61st IAEA General Conference, Vienna, September 18-22, 2017, https://www.iaea.org/sites/default/files/gc61-brazil-statement.pdf.

[121] Chile Declaration of the Permanent Representative Ambassador Armin Andereya at the 61th General Conference of the IAEA, September 20, 2017, https://www.iaea.org/sites/default/files/gc61-chile-final-statement.pdf.

[122] Statement of the Minister of Energy of the Republic of Kazakhstan K.A Bozumbayev at the 61st Session of the IAEA General Conference, September 2017, https://www.iaea.org/sites/default/files/gc61-kazakhstan-statement.pdf.

[123] Statement at the 61th IAEA General Conference by TANG Dengjie, Head of the Chinese Delegation, September 2017, https://www.iaea.org/sites/default/files/gc61-china-final-statement.pdf.

[124] Statement By Andrzej J. Piotrowski, Undersecretary of State Ministry of Energy Poland on the occasion of the 61th Session of the General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-statement-poland-final.pdf.

[125] Declaration Nationale Belge, Intervention de Monsieur Jan Bens, Directeur Général de l'Agence Fédérale de Contrôle Nucléaire, 61ème Session De La Conférence Générale De L'AIEA, Septembre 20, 2017, https://www.iaea.org/sites/default/files/gc61-belgium-statement.pdf.

[126] Canadian Statement at the IAEA 61th General Conference, https://www.iaea.org/sites/default/files/gc61-canada-statement.pdf.

[127] Statement by His Excellency Ambassador Dr. Darmansjah Djumala, Ambassador Extraordinary and Plenipotentiary/ Permanent Representative of the Republic of Indonesia Head of Delegation of the Republic of Indonesia At the 61st General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-indonesia-statement-final.pdf.

[128] Norway National Statement at the 61th General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-norway-statement.pdf.

for naval reactors and the disposition of excess weapons plutonium.[129]

- Japan Nuclear Fuel Ltd, operator of the Rokkasho reprocessing plant, in December 2017 announced that the opening of the facility was again delayed, this time for about three years. Japan Nuclear Fuel does not expect operations of the plant to begin earlier than the first half of 2021 fiscal year.[130] Also, the fast breeder reactor "Monju", whose decommissioning was decided in December 2016, was completely closed in December 2017.[131] In this connection, as a result of the revision of the Spent Nuclear Fuel Reprocessing Fund Act in 2016, the nuclear reprocessing business became a project matter to be approved by the Minister of Economy, Trade and Industry.[132] In addition, it was also decided by a supplementary resolution at the National Diet that the Minister of Economy, Trade and Industry had to seek advice of the Atomic Energy Commission about the plutonium balance.[133]

B) Prevention of illicit trafficking

Nuclear detection, nuclear forensics, research and development of new technologies to strengthen enforcement capacity of law enforcement machinery and customs department, participation for the IAEA's Incident and Trafficking Base (ITDB) have been regarded as important measures for preventing illicit trafficking of nuclear materials. In particular, the IAEA ITDB is the database on incidents related to unauthorized possession, illicit trafficking, illegal dispersal of radioactive material, and discovery of nuclear and other radioactive material out of regulatory control. The ITDB has been regarded not only as an essential component of the information platform supporting the IAEA's Nuclear Security Plan, but also in terms of statistics, which bring to light the real existence of a nuclear security threat.[134]

As of 31 December 2016, 134 states participate in the ITDB program.[135] According to the latest IAEA Annual Report 2016, states confirmed 189 incidents during 2016.[136] Considering that the number of reports to ITDB was 226 in 2015,[137] the number of cases decreased by 37 in 2016.

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[129] Frank von Hippel, "Fissile Material Issues in the U.S. National Defense Authorization Act for Fiscal Year 2018," IPFM Blog, December 17, 2017, http://fissilematerials.org/blog/2017/12/fissile_material_issues_i.html.

[130] "Rokkasho Plant will not start until 2021," *IPFM Blog*, December 22, 2017, http://fissilematerials.org/blog/2017/12/rokkasho_plant_will_not_s.html.

[131] "Monju Reactor is Finally Shut Down," *IPFM Blog*, December 13, 2017, http://fissilematerials.org/blog/2017/12/monju_reactor_is_finally_.html.

[132] "Saisyori Tou Kyosyutsu Kin Hou Ga Kakugi Kettei Saremasita" (Cabinet decision on "Spent Nuclear Fuel Reprocessing Fund Act" was decided), METI website, http://www.meti.go.jp/press/2015/02/20160205001/20160205001.html.

[133] "Dai 190 Kai Kokkai Kakuhou Dai 17 Gou Hutai ketsugi" (The 190th National Diet Cabinet Law No.17 Supplementary Resolution) House of Councilors website, http://www.shugiin.go.jp/internet/itdb_rchome.nsf/html/rchome/Futai/keizaiA434A071B3E18FCE49257F9C00271C6D.htm.

[134] IAEA, "ITDB: Incident and Trafficking Database," https://www.iaea.org/sites/default/files/16/12/16-3042_ns_to_itdb_web-20160105.pdf.

[135] IAEA, "IAEA Incident and Trafficking Database (ITDB) Incidents of Nuclear and Other Radioactive Material Out of Regulatory Control," IAEA Website, https://www.iaea.org/sites/default/files/17/12/itdb-factsheet-2017.pdf.

[136] IAEA Annual Report 2016, GC(61)/3, https://www.iaea.org/sites/default/files/publications/reports/2016/gc61-3.pdf, p. 86.

[137] IAEA Annual Report 2015, GC(60)/9, https://www.iaea.org/About/Policy/GC/GC60/GC60Documents/English/gc60-9_en.pdf, pp. 90-91.

On the other hand, the IAEA Nuclear Security Report[138] specifies the following details. During the reporting period, states reported, or otherwise confirmed to the ITDB program, a total of 162 incidents. Of these, 115 occurred between 1 July 2016 and 30 June 2017, and the remaining cases had occurred prior to 1 July 2016 but were not reported by that date. Of the 162 newly reported incidents, four were related to trafficking, two related to attempted malicious use and one was a scam. All of the material involved in these incidents was seized by the relevant competent authorities within the reporting state. No incident involved high enriched uranium, plutonium or Category I sources. On the other hand, there were 30 reported incidents in which the intent to conduct trafficking or malicious use could not be determined. These included 13 thefts and 17 incidents of missing materials. In 19 incidents the materials were not recovered, including one incident relating to Category II and Category III radioactive sources. In addition to this, there were also 125 reported incidents in which the material was out of regulatory control, but not related to trafficking, malicious use or scams. Most of these incidents involved unauthorized disposal, unauthorized shipments and unexpected discoveries of material such as previously lost radioactive sources.

As of 31 December 2016, the ITDB contained a total of 3,068 confirmed incidents reported by participating states since 1993. Of these 3,068 confirmed incidents there are 270 incidents that involved a confirmed or likely act of trafficking or malicious use (Group I), 904 incidents for which there is insufficient information to determine if it is related to trafficking or malicious use (Group II), and 1,894 incidents that are not related to trafficking or malicious use (Group III).[139]

In order to protect sensitive information, detailed information on incidents and illicit trafficking is not published.[140] Therefore, as it is not possible to assess the involvement of the surveyed countries, this report considers only their respective participation status.

Preventive measures against illicit trafficking of nuclear and other radiological material include the development of legal instruments for export control and enforced detection capability, such as the installation of sensing devices for radiological material at national borders and reinforcing nuclear forensic capabilities. The following describe some of efforts taken from 2016 to 2017 as preventive measures against illicit trafficking of nuclear and other radiological material:

- Canada provided assistance to Jordan for strengthening illegal transfer detection and prevention capacity of nuclear materials.[141]
- The Chilean Nuclear Energy Commission promotes the nuclear material detection project near the border. In September 2017, Chile conducted an emergency management exercise (Paihuen II) on radioactive materials in collaboration with Argentina, and verified their responses in their respective territories and countermeasures against nuclear terrorism threats between the two countries.[142]
- Egypt introduced into the penal code sanctions

[138] IAEA, Nuclear Security Report 2017, GOV/2017/31-GC(61)/14, July 25, 2017, https://www.iaea.org/About/Policy/GC/GC61/GC61Documents/English/gc61-14_en.pdf, p. 3.

[139] IAEA, IAEA Incident and Trafficking Database (ITDB) Incidents of Nuclear and Other Radioactive Material out of Regulatory Control 2017 Fact Sheet, https://www.iaea.org/sites/default/files/17/12/itdb-factsheet-2017.pdf, p. 2.

[140] Ibid., p. 1.

[141] Canadian Statement at the IAEA 61th General Conference, https://www.iaea.org/sites/default/files/gc61-canada-statement.pdf.

[142] Chile Declaration of the Permanent Representative Ambassador Armin Andereya at the 61th General Conference of the IAEA, September 20, 2017, https://www.iaea.org/sites/default/files/gc61-chile-final-statement.pdf.

Table 3-6: The implementation status of the minimization of HEU and Plutonium Stockpile for peaceful purposes and measures for the prevention of illegal transfer

	China	France	Russia	U.K.	U.S.	India	Israel	Pakistan	Australia	Austria	Belgium	Brazil
HEU and Plutonium stockpile minimization for peaceful purposes	○	○	○	○	○	○	○		○	○	○	○
Participation in the ITDB	○	○	○	○	○	○	○	○	○	○	○	○
Preventive measures against illegal transfer	○	○	○	○	○	○	○	○	○	○	○	○

	Canada	Chile	Egypt	Germany	Indonesia	Iran	Japan	Kazakhstan	South Korea	Mexico	Netherlands	New Zealand
HEU and Plutonium stockpile minimization for peaceful purposes	○	○		○	○*		○	○	○	○	○	○
Participation in the ITDB	○	○		○	○	○	○	○	○	○	○	○
Preventive measures against illegal transfer	○	○	○	○	○		○	○	○	○	○	○

	Nigeria	Norway	Philippines	Poland	Saudi Arabia	South Africa	Sweden	Switzerland	Syria	Turkey	UAE	North Korea
HEU and Plutonium stockpile minimization for peaceful purposes	○	○	○	○		○	○	○	○	○		
Participation in the ITDB	○	○	○	○	○	○	○	○		○	○	
Preventive measures against illegal transfer	○	○	○	○		○	○	○		○	○	

"○" is provided to the countries for which public information on the effort in these areas is obtained.

*: Updated figures in 2017.

that severely punish illegal acts on nuclear materials and other radioactive materials.[143]

- Indonesia has installed a radiation measurement portal monitor at major domestic ports.[144]
- Pakistan has set up radiation monitoring posts at the entry and departure points as part of a nuclear detection architecture.[145]

In terms of international and regional organization efforts, INTERPOL provides a forum for collecting data on prevention of nuclear terrorism, supporting investigation, and confidence building and coordination among national law enforcement agencies. In accordance with the INTERPOL report, radiological and nuclear investigations-related courses and counter illicit trafficking exercises were held in Ukraine and Tanzania (July), in Panama (August) and in the Czech Republic (November) respectively.[146] These exercises and training initiatives are intended to expand the recognition of illegal transfers of nuclear materials as nuclear security measures of INTERPOL.[147] The exercises include: Operation STONE (Stop Trafficking Of Nuclear Elements), which is aimed at strengthening the nuclear and nuclear detection and deterrence capacity of law enforcement agencies; Operation Conduit, which is carried out at international airports and seaports, and aims to improve the ability of police, customs and border security agencies to coordinate cross-border investigations into the smuggling of nuclear materials; a workshop on countermeasures against smuggling of nuclear materials; and radioactive/nuclear-related investigation courses, or table top exercises.

Table 3-6 shows the implementation status regarding the minimization of HEU for peaceful purposes, participation status for the ITDB and measures for the prevention of illegal transfer of nuclear material and other radiological materials, based on official statements made at the Washington Nuclear Security Summits, IAEA Nuclear Security Conference in 2016, and any other opportunities.

C) Acceptance of international nuclear security review missions

The International Physical Protection Advisory Service (IPPAS) provides recommendations to improve the physical protection system of nuclear material, associated facilities, and transport systems of the state, upon the request of a member state. In IPPAS missions, an IPPAS team, consisting of physical protection experts organized by the IAEA, visits government organizations and nuclear facilities in a state, reviews the physical protection system of the facility in detail, and conducts hearing investigations, in order to assess whether or not the reviewed physical protection system is in line with the recommendations of the IAEA INFCIRC/225, and to provide advice where necessary for its improvement. As was pointed in the previous issue of this report,[148]

[143] Fathi Elsisi, "Sanctions as a Legal Deterrence Mean in the National Physical Protection Regime," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, Austria, https://www.iaea.org/sites/default/files/17/11/cn-254-elsisi-presentation.pdf.

[144] Statement by His Excellency Ambassador Dr. Darmansjah Djumala, Ambassador Extraordinary and Plenipotentiary/ Permanent Representative of the Republic of Indonesia Head of Delegation of the Republic of Indonesia At the 61st General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-indonesia-statement-final.pdf.

[145] Statement by Khalil Hashmi, Director General (Disarmament), MFA Head of Pakistan Delegation at the 10th Plenary Meeting of the GICNT, June 2, 2017, http://www.gicnt.org/statements/documents/2017-plenary/Pakistan.pdf.

[146] "News and Events," INTERPOL website, https://www.interpol.int/Crime-areas/CBRNE/News-and-Events.

[147] Radiological and Nuclear Terrorism, INTERPOL website, March 2017, https://www.interpol.int/en/content/download/34610/453663/version/5/file/Radnuc-trifold-EN-web.pdf.

[148] Center for the Promotion of Disarmament and Non-Proliferation, The Japan Institute of International Affairs ed., *2016 Edition Hiroshima Report: Evaluation of Achievement in Nuclear Disarmament, Non-Proliferation and Nuclear Security in 2015*, Hiroshima Prefecture, March 2016, http://www.pref.hiroshima.lg.jp/uploaded/attachment/206407.pdf, p.133.

acceptance of the IAEA missions is a valuable opportunity for member states to have an authoritative third-party peer review of their national nuclear security systems. Of course, there are various nuclear security-related treaties and guidelines. However, since the details of concrete implementation will ultimately be left to the governments of each country, measures to strengthen nuclear security tend to be self-righteous in some cases. For this reason, the peer review process that points out the items and methods to be improved mutually by external organizations is useful for implementing nuclear security related measures. In this sense, the external evaluation and recommendations obtained from the IPPAS mission are useful for reviewing the policy of future nuclear security enhancement in the host country. According to the nuclear security-related events list released by the IAEA in 2017, there were 14 events related to international evaluation missions.[149] Since the number of events in the previous year was 26,[150] the number in 2017 decreased by 12.

In 2017 the IAEA announced the completion of an IPPAS mission in China in September,[151] Germany in October[152] and Australia in November.[153] Outside the surveyed countries, the IAEA announced that IPPAS missions were completed in Hungary in July 2017,[154] in Lithuania in October[155] and in the Democratic Republic of Congo in December.[156] In addition, at the IAEA General Conference in 2017, New Zealand announced acceptance of an IPPAS mission.[157] In this regard, Turkey has announced that it intends to accept an IPPAS mission in 2018.[158] Also, Switzerland announced its intention to accept an IPPAS mission in 2018 at the GICNT Plenary Meeting in 2017.[159] Japan announced that it is in talks with the IAEA over the acceptance of an IPPAS follow-up mission in 2018.[160]

Apart from the IPPAS missions, the IAEA also provides the International Nuclear Security Advisory Service (INSServ) and the Integrated Nuclear Security Support Plan (INSSP), for the sake of developing nuclear security systems and capabilities. In accordance with the IAEA, the INSServ provides

[149] "Meetings, Conferences and Symposia: Meetings on Nuclear Safety and Security," IAEA website, http://www-ns.iaea.org/meetings/default.asp?tme=ns&yr=2017&s=10&l=79&submit.x=7&submit.y=7.

[150] "Meetings, Conferences and Symposia: Meetings on Nuclear Safety and Security," IAEA website, http://www-ns.iaea.org/meetings/default.asp?tme=ns&yr=2016&s=10&l=79&submit.x=5&submit.y=7.

[151] IAEA Completes Nuclear Security Advisory Mission in China, September 8, 2017, https://www.iaea.org/newscenter/pressreleases/iaea-completes-nuclear-security-advisory-mission-in-china.

[152] IAEA Completes Nuclear Security Advisory Mission in Germany, October 6, 2017, https://www.iaea.org/newscenter/pressreleases/iaea-completes-nuclear-security-advisory-mission-in-germany.

[153] IAEA Completes Nuclear Security Advisory Mission in Australia, November 10, 2017, https://www.iaea.org/newscenter/pressreleases/iaea-completes-nuclear-security-advisory-mission-in-australia.

[154] IAEA Completes Nuclear Security Advisory Mission in Hungary, July 7, 2017, https://www.iaea.org/newscenter/pressreleases/iaea-completes-nuclear-security-advisory-mission-in-hungary.

[155] IAEA Completes Nuclear Security Advisory Mission in Lithuania, October 20, 2017, https://www.iaea.org/newscenter/pressreleases/iaea-completes-nuclear-security-advisory-mission-in-lithuania.

[156] IAEA Completes Nuclear Security Advisory Mission in the Democratic Republic of the Congo, December 15, 2017, https://www.iaea.org/newscenter/pressreleases/iaea-completes-nuclear-security-advisory-mission-in-the-democratic-republic-of-the-congo.

[157] New Zealand Statement Delivered by H.E. Nicole Roberton, New Zealand Ambassador at the 61th General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-new-zealand-statement.pdf.

[158] Republic of Turkey Statement Delivered by Ambassador Birnur Fertekligil at the IAEA 61st General Conference, September 18-22, 2017, https://www.iaea.org/sites/default/files/gc61-turkey-statement.pdf.

[159] Statement by Minister Peter Nelson, Deputy Head of Mission of the Embassy of Switzerland in Japan at the 10th Plenary Meeting of the GICNT, June 1, 2017, http://www.gicnt.org/statements/documents/2017-plenary/Switzerland.pdf.

[160] Naohito Uetake, "Current Nuclear Security Regime and Regulatory Framework in Japan:Efforts for Compliance with NSS-13 and CPPNM Amendment," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, Austria, https://www.iaea.org/sites/default/files/17/11/cn-254-uetake-presentation.pdf.

recommendations to improve a broad spectrum of nuclear security activities of the state, by reviewing its nuclear security system and requirements.[161] Also, INSSP provides a platform for nuclear security work to be implemented over a period of time, thus ensuring sustainability. INSSP review missions enable the IAEA, the state concerned, and any donors financing the work, to plan and coordinate activities from both a technical and a financial point of view—optimizing the use of resources and avoiding duplications.[162]

Regarding advisory services by IAEA other than IPPAS, a Topical Meeting on INSSPs: Benefits to Members States from their Development to their Implementation was held in Vienna in January 2017.[163] In March, a regional coordination meeting on Integrated Nuclear Security Support Plans for Southern African Development Community was held in Gaborone, Botswana.[164]

D) Technology development — nuclear forensics

Since the first Washington Nuclear Security Summit in 2010, it has been recommended at each summit to build nuclear forensic capability and multilateral cooperation for that purpose. [165] In fact, at the fourth Washington Nuclear Security Summit in 2016, 30 concerned states issued a Joint Statement on Forensics in Nuclear Security, reflecting the growing awareness of the international community about the importance of nuclear forensics.[166] In accordance with the "IAEA Nuclear Security Series No.2-G (Rev.1) Nuclear Forensics Support (2006)"[167] definition, nuclear forensics is the technological method for the investigation of nuclear and other radiological material that has been removed without authorization from regulatory control and seized by a law enforcement authority of state. Following the increased threat perception of nuclear terrorism, technological development of nuclear forensics has been required so as to complement existing efforts to strengthen nuclear security. In particular, analysis on intercepted illicit nuclear or radioactive material and any associated material, to provide evidence for nuclear attribution, is the subject matter of nuclear forensics. Therefore, nuclear forensic analysis includes the characterization of the material and correlation with its production history.[168]

As initiatives on nuclear forensics conducted in 2017, a regional training course on Introduction to Nuclear Forensics was held in Pretoria, South Africa in April,[169] and the JAEA/ISCN International Symposium on

[161] International Nuclear Security Advisory Service (INSServ), IAEA website, https://www.iaea.org/services/review-missions/international-nuclear-security-advisory-service-insserv.

[162] Integrated Nuclear Security Support Plan (INSSP), IAEA website, http://www-ns.iaea.org/security/inssp.asp?s=4.

[163] Topical Meeting on INSSPs: Benefits to Member States from their Development to their Implementation, January 23, 2017, https://www.iaea.org/events/topical-meeting-on-inssps-benefits-to-member-states-from-their-development-to-their-implementation.

[164] Regional Coordination Meeting on Integrated Nuclear Security Support Plans for Southern African Development Community States, March 6–10, 2017, https://www.iaea.org/events/regional-coordination-meeting-on-integrated-nuclear-security-support-plans-for-southern-african-development-community-states.

[165] The White House, Office of the Press Secretary, "Work Plan of the Washington Nuclear Security Summit," April 13, 2010.

[166] "Joint Statement on Forensics in Nuclear Security," 2016 Washington Nuclear Security Summit, April 5, 2016, http://www.nss2016.org/document-center-docs/2016/4/1/joint-statement-on-forensics-in-nuclear-security.

[167] IAEA Nuclear Security Series No.2-G (Rev.1), "Nuclear Forensics Support," 2006, http://www-pub.iaea.org/books/IAEABooks/10797/Nuclear-Forensics-in-Support-of-Investigations.

[168] Ibid., p. 3.

[169] Regional Training Course on Introduction to Nuclear Forensics, April 3-6, 2017, https://www.iaea.org/events/regional-training-course-on-introduction-to-nuclear-forensics.

Nuclear Forensics and Regional Cooperation was held in Tokyo, Japan in June.[170] In July 2017, the technical meeting on Nuclear Forensics Peer Review Advisory Missions[171] and Technical Meeting on Nuclear Forensics and Cooperation with African States[172] were held in Vienna. In September 2017, a regional seminar on Introduction to Nuclear Forensics was held in Moscow, Russia,[173] and in October an international training course on Practical Introduction to Nuclear Forensics was held in Budapest, Hungary.[174]

As for a case of multilateral cooperation on nuclear forensics, the Nuclear Forensics International Technical Working Group (ITWG), was established in 1996 under the auspices of the G8 Non-Proliferation Expert Group (NPEG), for the purpose of addressing the issue of illegal transfers following the end of the Cold War. The ITWG serves as the platform to support the technological development and sharing of nuclear forensic methods. Over the past few years, it has pursued a number of activities. These include conducting comparative nuclear material exercises (CMX) that socialize nuclear forensic techniques and identify best practices. Also, ITWG conducted exercises that clarify the uses and utility of national nuclear forensic libraries in helping identify the origin of nuclear or other radioactive material found outside regulatory control.[175] The ITWG has been focusing on the promotion of nuclear forensic best practice through the development of guidelines for forensic analysis of nuclear, radioactive, and radiologically contaminated materials, and published "Guidelines for Evidence Collection in a Radiological or Nuclear Contaminated Crime Scene (2011)"[176] and "Proposed Framework for National Nuclear Forensics Libraries and International Directories (2011)."[177] In 2017 the 22nd ITWG annual meeting was held in Karlsruhe, Germany.[178] At the annual meeting, reviews on the outcomes and lessons of CMX-5, discussions on the nuclear forensics library exercise (Galaxy Serpent) in progress, and new CMX planned to be implemented in 2018 were conducted. The 2018 annual meeting of ITWG will be held in Switzerland.[179]

Another international cooperation initiative, the Nuclear Forensic Working Group (NFWG), has been established under the framework of the GICNT, which actively organized a number of workshops and

[170] "ITWG Nuclear Forensics Update," No.3, June 2017, https://www.nf-itwg.org/newsletters/ITWG_Update_no_3.pdf, p. 5.

[171] Technical Meeting on Nuclear Forensics Peer Review Advisory Missions, July 11-13, 2017, https://www.iaea.org/events/technical-meeting-on-nuclear-forensics-peer-review-advisory-missions.

[172] Technical Meeting on Nuclear Forensics and Cooperation with African States, July 11-13, 2017, https://www.iaea.org/events/technical-meeting-on-nuclear-forensics-and-cooperation-with-african-states.

[173] Regional Seminar on Introduction to Nuclear Forensics, September 4-8, 2017, https://www.iaea.org/events/regional-seminar-on-introduction-to-nuclear-forensics.

[174] International Training Course on Practical Introduction to Nuclear Forensics, October 2-6, 2017, https://www.iaea.org/events/international-training-course-on-practical-introduction-to-nuclear-forensics.

[175] "EU-US Nuclear Forensics International Technical Working Group (ITWG) Joint Statement," 2016 Washington Nuclear Security Summit, April 1, 2016, http://www.nss2016.org/document-center-docs/2016/4/1/eu-us-nuclear-forensics-international-technical-working-group-itwg-joint-statement.

[176] ITWG "Guideline," ITWG website, http://www.nf-itwg.org/sites/default/files/pdfs/ITWG_Guideline_for_RN_Evidence_Collection_FINAL.pdf.

[177] "Nuclear Forensics Libraries," ITWG website, http://www.nf-itwg.org/sites/default/files/pdfs/National_Nuclear_Forensic_Libraries_TOR_FINAL.pdf.

[178] "Nuclear Forensics Practitioners Strengthen Best Practices and International Cooperation," U.S. Department of State, Bureau of International Security and Nonproliferation website, July 12, 2017, https://www.state.gov/t/isn/rls/other/2017/272553.htm.

[179] Ibid.

tabletop exercises.[180] In June 2017 the 10th senior-level Plenary Meeting of GICNT was held in Tokyo.[181] In relation to NFWG, Australia announced that it is implementing nuclear forensics-related activities with Southeast Asian countries from 2017 to 2018.[182]

As part of the countermeasures against nuclear terrorism, the importance of nuclear forensics is definitely increasing. However, public information on the nuclear forensics capabilities of each country has been limited. For reference, Table 3-7 below outlines the nuclear forensics capabilities of the surveyed countries (based on the reports made at the ITWG-17 in 2012, and as posted in a previous edition of the Hiroshima Report).[183]

E) Capacity building and support activities

Around the time when the Nuclear Security Summit process started, in many states and regions, capacity in nuclear security also began to be built up and international cooperation efforts for nuclear security were actively promoted. As an example of these efforts, in 2017, Canada announced the implementation of financial support for the IAEA's activities to enhance regulatory capacity in Africa and South America.[184] These activities included developing teaching and training in nuclear security, for example, by setting up training courses in that field, and establishing Centers of Excellence (COE) for experts from these states and regions, to improve their capacity in nuclear security. In particular, it is remarkable that many states concerned with this issue established COEs. In this regard, trends in 2017 on the development of COEs for nuclear security are as follows. China expressed its intention to utilize the COE set up in 2016 for nuclear security education and training in the Asia-Pacific region.[185] The Pakistan Center of Excellence for Nuclear Security COE (PCENS) carries out education for domestic and foreign experts on nuclear safety, nuclear security, cyber security, insider threats, nuclear material accounting and control. In addition, the Pakistan National Security and Security Research Institute (NISAS) and Engineering Applied Science Institute (PIEAS) conduct similar training for domestic and foreign experts.[186] Canada has implemented international cooperation on physical protection of nuclear material in nuclear facilities for Malaysia, Thailand and the Philippines.[187] Indonesia has established its COE (I-CoNSEP) for nuclear security and emergency response.[188] Via the Asian Regional Network (ARN) that was established with each COE within the region, Japan has strengthened

[180] "Key Multilateral Events and Exercises," GICNT website, http://www.gicnt.org/documents/GICNT_Past_Multilateral_Events_June2015.pdf.

[181] "ITWG Nuclear Forensics Update," No.3, June 2017, https://www.nf-itwg.org/newsletters/ITWG_Update_no_3.pdf, p. 5.

[182] Australia Statement at the 10th Plenary Meeting of the GICNT, June 1-2, 2017, http://www.gicnt.org/statements/documents/2017-plenary/Australia.pdf.

[183] This table was originally shown in the "Hiroshima Report-Evaluation of Achievement in Nuclear Disarmament, Non-Proliferation and Nuclear Security: 2014," March 2014, p. 82.

[184] Canadian Statement at the IAEA 61th General Conference, https://www.iaea.org/sites/default/files/gc61-canada-statement.pdf.

[185] Statement at the 61th IAEA General Conference by Tang Dengjie, Head of the Chinese Delegation, September 2017, https://www.iaea.org/sites/default/files/gc61-china-final-statement.pdf.

[186] Statement by the Leader of the Pakistan Delegation, 61st Annual General Conference of the IAEA, September 18-22, 2017, https://www.iaea.org/sites/default/files/gc61-pakistan-statement.pdf.

[187] Canadian Statement at the IAEA 61th General Conference, https://www.iaea.org/sites/default/files/gc61-canada-statement.pdf.

[188] Statement by His Excellency Ambassador Dr. Darmansjah Djumala, Ambassador Extraordinary and Plenipotentiary/Permanent Representative of the Republic of Indonesia Head of Delegation of the Republic of Indonesia At the 61st General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-indonesia-statement-final.pdf.

Table 3-7: Nuclear forensics capabilities that were reported at the ITWG-17

	Uranium	Plutonium	Other radioactive material*	Evidence contaminated by radiological material
Categorization	France U.K. U.S. Australia Canada Japan South Korea Sweden Switzerland	France U.K. U.S. Canada South Korea Sweden 	 Canada Japan South Korea Sweden Switzerland	 U.S. Canada
Characterization	France U.K. U.S. Canada Japan South Korea Switzerland EC-JRC(ITU)	France U.K. U.S. Canada Japan South Korea Switzerland EC-JRC(ITU)	 U.K. U.S. Canada Japan South Korea Switzerland EC-JRC(ITU)	 U.S. Canada EC-JRC(ITU)
Interpretation	France U.S. Canada Japan Switzerland EC-JRC(ITU)	France U.S. Canada Japan Switzerland EC-JRC(ITU)	 U.S. Japan EC-JRC(ITU)	 U.S. Canada EC-JRC(ITU)

*: Irradiated fuel, Th, Cm, Cs, Am, Industrial radiation source, Sealed source

interagency exchanges between the JAEA-ISCN, SNSTC in China and INSA in Korea.[189] JAEA-ISCN also holds joint seminars with countries including Bangladesh, Kazakhstan, Mongolia, Malaysia, Vietnam, Jordan, Turkey and Saudi Arabia.[190] Egypt implemented training that leads to the promotion of nuclear security culture and technical cooperation to relevant organizations in the country by utilizing the Egypt Nuclear Security Support Center (ENSSC) established in 2012. In cooperation with the IAEA, Egypt is also strengthening its capacity on radiation detection and physical protection of nuclear material.[191] Russia has established the Institute for Global Nuclear Safety & Security (GNSSI) under the ROSATOM Technical Academy, and is implementing education and training related to nuclear security. As of 2017, 896 people from 54 countries participate in this training.[192] Each country's efforts, to set up the COE and implement training as described above, not only helps capacity building related to global nuclear security, but also contributes to promoting understanding of nuclear security to regional experts, operators and related organizations. Moreover, strengthening cooperation with each country's COE has advantages such as mutual exchange of instructors among COEs. At the same time, it is an important task to avoid duplication in the activities of each COE that has been installed in each region during the past several years, to promote efficient cooperation and closer information sharing. These tasks include building a broad network around the IAEA and strengthening education and training through international support.

To maintain and further facilitate exchange of experts, information and training material, the International Network for Nuclear Security Training and Support Centres (NSSC Network) was established in 2012 under the leadership of the IAEA. In this relationship, in February 2017, the Annual Meeting of the NSSC Network was held in Vienna.[193] In addition, as an approach of the same kind, there is the activity of the International Nuclear Security Education Network (INSEN network) by IAEA, to further advance technology development and information sharing related to nuclear security education. In July 2017, the Annual Meeting of the INSEN was also held in Vienna.[194]

F) IAEA Nuclear Security Plan and Nuclear Security Fund

The IAEA's fifth Nuclear Security Plan covering the period 2018-2021,[195] was approved in September 2017 and has been executed. For the sake of successful implementation of this plan, since 2002, when the

[189] Naoko Noro, "ISCN's Activities to Promote Universalization of INFCIRC/225/Rev.5 (NSS 13)," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, https://www.iaea.org/sites/default/files/17/11/cn-254-noro-presentation.pdf.

[190] Nobumasa Akiyama, "Japan's Commitment to the Universalization of CPPNM and Its Amendment," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, https://www.iaea.org/sites/default/files/17/11/cn-254-akiyama-presentation.pdf.

[191] Mohamed Helmyhazzaa, "A Proposal for the Role of Nuclear Security Support Center to Sustain a National Nuclear Security Regime," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, https://www.iaea.org/sites/default/files/17/11/cn-254-hazzaa-presentation.pdf.

[192] A. Kuskov, "Training and additional professional education of the specialists in the field of nuclear security in RF," paper presented at the International Conference on Physical Protection of Nuclear Material and Nuclear Facilities, November 13-17, Vienna, Austria, https://www.iaea.org/sites/default/files/17/11/cn-254-kuskov-presentation.pdf.

[193] Annual Meeting of the International Network for Nuclear Security Training and Support Centres (NSSC Network), February 20–24, 2017, https://www.iaea.org/events/annual-meeting-of-the-international-network-for-nuclear-security-training-and-support-centres-nssc-network.

[194] Annual Meeting of the International Nuclear Security Education Network (INSEN), July 24–28, 2017, https://www.iaea.org/events/annual-meeting-of-the-international-nuclear-security-education-network-insen.

[195] Nuclear Security Plan 2018-2021, GC(61)/24, September 14, 2017, https://www.iaea.org/About/Policy/GC/GC61/GC61Documents/English/gc61-24_en.pdf.

IAEA established the Nuclear Security Fund (NSF) as a voluntary funding mechanism to prevent, detect, and respond to nuclear terrorism, the Agency has been calling on member states to make voluntary contributions to the Fund. According to the 2016 IAEA Annual Report (the latest at the time of writing this report), the countries that declared financial commitment to NSF are as follows. Belgium, Canada, China, Estonia, Finland, France, Germany, India, Italy, Japan, South Korea, New Zealand, Romania, Russia, Spain, Switzerland, UAE, the United Kingdom and the United States. Actual NSF revenue for FY 2016 was €47.4 million.[196] It is an increase of €17 million compared with the previous year.

In this regard, the state of commitments to the NSF by the surveyed countries, which was clarified from the statements at the 61st IAEA General Conference and GICNT plenary meeting in 2017, is as follows. The United Kingdom expressed a contribution of £8.5 million to the NSF.[197] Pakistan did not mention the amount, but expressed its willingness to contribute to the NSF in 2018.[198] The Netherlands declared a contribution of €1 million to NSF for the implementation of a new Nuclear Security Plan.[199] New Zealand also pledged to contribute $150,000 to NSF in the future.[200] Belgium, for its part, revealed that its contributions to NSF since 2010 have exceeded $ 2 million.[201]

G) Participation in international efforts

The international efforts on nuclear security that this report draws attention to are not limited to the IAEA's International Conference on Nuclear Security, the NSS process that ended in 2016, UN Security Council Resolution 1540[202] and various contributions made by INTERPOL. In the present circumstances, various other multilateral frameworks relevant to nuclear security are operating around the world. The establishment of a "Global Partnership against the Spread of Weapons and Materials of Mass Destruction" (G8GP) was agreed at the G8 Kananaskis Summit in 2002. It committed the G8 to raising up to $20 billion over the next 10 years to fund nonproliferation projects, principally in Russia but also in other nations. The so-called "10 plus 10 over 10" initiative called for the United States to contribute $10 billion, and the other original G7 nations a combined $10 billion to help the projects.[203]

In addition to the G8 member states (including France, Germany, Japan, the U.K., the U.S. and Russia), other donor participants (Australia, South Korea, Sweden, Switzerland, etc.) have participated in the G8GP and carried out various projects, in particular denuclearization cooperation in Russia. This work also includes destruction of chemical weapons,

[196] IAEA, "IAEA Annual Report 2016," https://www.iaea.org/About/Policy/GC/GC61/GC61Documents/English/gc61-3_en.pdf, p. 87.

[197] UK National Statement at the 61th General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-uk-statement.pdf.

[198] Statement by the Leader of the Pakistan Delegation, 61st Annual General Conference of the IAEA, September 18-22, 2017, https://www.iaea.org/sites/default/files/gc61-pakistan-statement.pdf.

[199] Statement by Ms Anke ter Hoeve-van Heek, Deputy Permanent Representative of the Kingdom of the Netherlands to the IAEA, September 20, 2017, https://www.iaea.org/sites/default/files/gc61-netherlands-statement.pdf.

[200] New Zealand Statement Delivered by H.E. Nicole Roberton, New Zealand Ambassador at the 61th General Conference of the IAEA, September 2017, https://www.iaea.org/sites/default/files/gc61-new-zealand-statement.pdf.

[201] Belgium Statement at the 10th Plenary Meeting of the GICNT, June 1-2, 2017, http://www.gicnt.org/statements/documents/2017-plenary/Belgium.pdf.

[202] Joint Statement on Promoting Full and Universal Implementation of UNSCR 1540 (2004), 2016 Washington Nuclear Security Summit, April 5, 2016, http://www.nss2016.org/document-center-docs/2016/4/1/joint-statement-on-1540-committee.

[203] NTI, "Global Partnership Against the Spread of Weapons and Materials of Mass Destruction ("10 Plus 10 Over 10 Program")," June 20, 2017, http://www.nti.org/learn/treaties-and-regimes/global-partnership-against-spread-weapons-and-materials-mass-destruction-10-plus-10-over-10-program/.

secure dismantling and transport of decommissioned nuclear powered submarines, improved detection of nuclear and radiological materials, re-employment of former WMD scientists and technicians to civilian programs, and the removal and safe transportation of nuclear material in Kazakhstan. In relation to nuclear security, the Nuclear Safety and Security Group (NSSG) has been established under the G8GP and has been working with nuclear security summits and the IAEA's international conferences on nuclear security. However, due to the Russian annexation of Crimea in March 2014, the leaders of the G-7 collectively decided to expel Russia from the G8 as a punitive measure.[204] As a result, the former G8 initiative has officially changed the name to "G7 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction."[205]

In May 2017, on the premise of global expansion of peaceful use of nuclear energy, the Communiqué of the Taormina Summit in Italy pointed out the importance of nuclear security along with nuclear safety and nonproliferation.[206] Besides this, the G7GP, on the initiative of the Presidency of Italy, launched a new policy focusing on Africa, as well as responding to potential threats that chemical and biotechnology are diverted to malicious actions.[207] In the NSSG report, a policy was stated for avoiding overlap with existing international nuclear security measures, such as the IAEA, United Nations, INTERPOL and GICNT, and to strengthen the global nuclear security system by effectively managing the limited resources of the NSSG.[208]

On the other hand, GICNT, which was agreed by the U.S.-Russia initiative at the St. Petersburg Summit in 2006, is another important international effort in the field of nuclear security. GICNT is a framework of voluntary international cooperation by concerned states. As mentioned in the previous section on nuclear forensics technology development, the presence of multilateral activities by GICNT for strengthening nuclear security has greatly increased in recent years. The GICNT now includes participation from 88 partner countries (including Australia, China, France, Germany, India, Israel, Japan, South Korea, Pakistan, Russia, Sweden, Switzerland, the U.K. and the U.S.) and five international organizations as official observers.[209] All partner nations have voluntarily committed to implementing the GICNT Statement of Principles (SOP), a set of broad nuclear security goals encompassing a range of deterrence, prevention, detection, and response objectives.[210] The eight principles contained within the SOP aim to improve accounting, control, and protection of nuclear/radiological material, enhance security of civilian nuclear facilities, detect and suppress illicit trafficking of nuclear/radiological material, assure denial of safe haven and resources from terrorists seeking to acquire or use nuclear/radiological material, and so on. Since 2010, the Implementation and Assessment Group (IAG) was established as a working arm of the GICNT partnership. IAG has several priority functional areas with working groups, such as the Nuclear Detection Working Group (NDWG, chaired by the U.K.), the Nuclear Forensic Working Group (NFWG, chaired by

[204] Ibid.

[205] "G7 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction," G7 2017 Italy website, http://www.g7italy.it/it/node/190.

[206] G7 Taormina Leaders' Communiqué, http://www.g7italy.it/sites/default/files/documents/G7%20Taormina%20Leaders%27%20Communique_27052017_0.pdf.

[207] Ibid.

[208] "Italian G7 Presidency 2017 Report," Nuclear Safety and Security Group (NSSG), http://www.g7italy.it/sites/default/files/documents/NSSG-Report_FINAL_0.pdf.

[209] "Global Initiative to Combat Nuclear Terrorism Partner Nations List," June 2017, http://www.gicnt.org/documents/GICNT_Partner_Nation_List_June2017.pdf.

[210] "Overview," GICNT website, http://www.gicnt.org/index.html.

Canada) and Response and the Mitigation Working Group (RMWG, chaired by Argentina).[211]

Individual efforts concerning GICNT are as follows. In January 2017 a workshop entitled "Vigilant Marmot," organized by Canada, the United Nations Drug and Criminal Offices (UNODC) and Slovakia, was held in Bratislava, Slovakia. In this workshop, issues related to reviewing the legal framework of nuclear security in each country were examined.[212] In addition, a workshop called "Magic Maggiore," aimed at enlightenment and promotion of nuclear material detection architecture, was held by EC-JRC in March in Ispra, Italy.[213] In May, the workshop "Sentinel" was held, with the cooperation of the United Kingdom and Bulgaria, on the theme of preparing nuclear security exercise plans at the national level, to maintain the nuclear security capacity of each country.[214] In June 2017, the 10th Senior Level GICNT Plenary Meeting was held in Japan and agreed on the GICNT plan for 2017 to 2019, including priority issues in NDWG, NFWG and RMWG.[215] Regarding the plan after 2017, China shows the intention to host a regional seminar on nuclear emergency response and a regional workshop on the safety of radioactive sources from 2018 to 2019.[216] Likewise, the United Kingdom expressed its intention to hold a GICNT workshop focusing on recovery systems and resource management in preparing for recovering from terrorist attacks involving nuclear or radioactive materials in February 2018.[217]

In this report, it is expected that the acceptance of international nuclear security review missions such as IPPAS by the IAEA, national efforts regarding nuclear forensics, and commitments to nuclear security capacity-building and support will contribute to enhancing surveyed countries' nuclear security-related capabilities and performances, and make more effective their respective nuclear security systems. Furthermore, the contributions to the IAEA NSF, and participation in the G8GP (G7GP) and the GICNT are indicators of the desire of states to enhance their commitment to nuclear security and can be used to undertake an overall evaluation of each country's nuclear security system. Table 3-8 below shows the participation status and efforts regarding these nuclear security initiatives.

[211] "Global Initiative to Combat Nuclear Terrorism Fact Sheet," GICNT website, November 2017, http://www.gicnt.org/documents/GICNT_Fact_Sheet_Nov2017.pdf.

[212] "Global Initiative to Combat Nuclear Terrorism 2017 Plenary Meeting Joint Co-Chair Statement," http://www.mofa.go.jp/files/000261774.pdf.

[213] Ibid.

[214] Ibid.

[215] Statement by Japan at the 61th IAEA General Conference, Minister of State Masaji Matsuyama, September 18, 2017, https://www.iaea.org/sites/default/files/gc61-japan-statement_v2.pdf.

[216] Remarks by Chinese Delegation at the 10th Plenary Meeting of the GICNT, June 1, 2017, http://www.gicnt.org/statements/documents/2017-plenary/China.pdf.

[217] UK National Statement at the 10th Plenary Meeting of the GICNT, June 1-2, 2017, http://www.gicnt.org/statements/documents/2017-plenary/UK.pdf.

Table 3-8: The participation status in and effort for nuclear security initiatives

	China	France	Russia	U.K.	U.S.	India	Israel	Pakistan	Australia	Austria	Belgium	Brazil
IPPAS	○*	○		○	○				○			
Nuclear Forensics	○	○	○	○	○		○	○	○		○	
Capacity Building & Support Activities	○	○	○	○	○	○		○	○	○		○
Nuclear Security Fund	○	○	○	○	○	○	○	○	○	○	○	
G8 Global Partnership	△	○	○	○	○	△			○	△	○	△
GICNT	○	○	○	○	○	○	○	○	○	○	○	

	Canada	Chile	Egypt	Germany	Indonesia	Iran	Japan	Kazakhstan	South Korea	Mexico	Netherlands	New Zealand
IPPAS	○	○	○	○*	○	○	○	○	○	○	○	○
Nuclear Forensics	○	○		○			○		○		○	
Capacity Building & Support Activities	○	○	○*	○	○		○	○	○		○	
Nuclear Security Fund	○			○		○	○	○	○		○	○
G8 Global Partnership	○			○			○	○	○	○	○	○
GICNT	○	○		○			○	○	○	○	○	○

	Nigeria	Norway	Philippines	Poland	Saudi Arabia	South Africa	Sweden	Switzerland	Syria	Turkey	UAE	North Korea
IPPAS		○	○	○*			○	○		○	○*	
Nuclear Forensics		○				○	○	○		○		
Capacity Building & Support Activities	○	○	○		○	○	○	○			○	
Nuclear Security Fund		○					○	○*		○	○*	
G8 Global Partnership		○	○	○	△	△	○	○		△	△	
GICNT	○*	○	○	○	○*		○	○		○	○	

IPPAS: "△" is assigned for the countries that are planning to accept IPPAS or have held a related workshop.
G8 Global Partnership: "△" is assigned for the countries that are considering of the participation in it.

*: Updated figures in 2017.