ESI-CIL Nuclear Governance Project
A multidisciplinary research project by the Energy Studies Institute & Centre for International Law

Event Reports of the ESI-CIL Nuclear Governance Project Conference Series

Nuclear Off-Site Emergency Preparedness and Response in the Aftermath of Fukushima

Singapore, 10 July 2018

Recommended citation:
ESI-CIL Nuclear Governance Project, *Event Reports of the ESI-CIL Nuclear Governance Project Conference Series: Nuclear Off-Site Emergency Preparedness and Response in the Aftermath of Fukushima* (Singapore: Energy Studies Institute, 2019).

Keywords
Nuclear governance; nuclear energy; emergency preparedness and response; EPR; Fukushima Daiichi nuclear accident; nuclear safety; ASEAN

ESI/RR-03/2019-02

Energy Studies Institute
29 Heng Mui Keng Terrace
Block A, #10-01
Singapore 119620
Singapore
www.esi.nus.edu.sg

Editorial correspondence should be addressed to Ms Becky Rush (becky.rush@nus.edu.sg).

CONTENTS

This page has been intentionally left blank.

ABOUT THE PROJECT

The Energy Studies Institute (ESI) and the Centre for International Law (CIL) of the National University of Singapore are undertaking a three-year Nuclear Governance Project, beginning on 4 January 2016 and now extended until 30 June 2019. The Project is staffed by a multidisciplinary academic team carrying out research and capacity building in the governance of nuclear safety, security and civil liability for nuclear damage.

Growing interest in the use of nuclear energy world-wide and particularly in Asia raises a number of safety and security concerns. Some of these concerns arise in part from an apparent lack of a unified global governance regime and complexities due to multiple levels of governance in Asia. At present, Singapore is seeking to gain further knowledge and expertise in order to play a part in strengthening nuclear governance. The project aims to carry out multidisciplinary research into the international, regional and national governance regimes for the safe and secure uses of nuclear energy, with an aim of proposing recommendations for strengthening current regimes.

Dr Philip Andrews-Speed, Senior Principal Fellow at ESI is the principal investigator for the project. Associate Professor Robert Beckman, Head of Ocean Law and Policy at CIL, is the co-principal investigator.

For more information on the project, see the Project website at http://www.nucleargovernance.sg/.

ABBREVIATIONS

ASEAN	Association of Southeast Asian Nations
ASEANTOM	ASEAN Network of Regulatory Bodies on Atomic Energy
CIL	Centre for International Law, National University of Singapore
CNS	Convention on Nuclear Safety
EPR	Emergency Preparedness and Response
ESI	Energy Studies Institute, National University of Singapore
EU	European Union
IAEA	International Atomic Energy Agency

ESI-CIL NUCLEAR GOVERNANCE PROJECT CONFERENCE SERIES

NUCLEAR OFF-SITE EMERGENCY PREPAREDNESS AND RESPONSE IN THE AFTERMATH OF FUKUSHIMA

Singapore, 10 July 2018

SUMMARY OF DISCUSSIONS

A. Introduction

The Energy Studies Institute (ESI) and the Centre for International Law (CIL) co-organised a half day conference in Singapore titled 'Nuclear Off-Site Emergency Preparedness and Response in the Aftermath of Fukushima' on Tuesday, 10 July 2018, as part of the ESI-CIL Nuclear Governance Project. Close to 50 local participants attended the event, representing government agencies, academe, the nuclear industry and other private sector participants, as well as interested members of the public. Discussions took place under the Chatham House Rule.

Nuclear emergency preparedness and response (EPR) is likely to become a crucial issue in the future for Singapore, given a number of countries in the Association for Southeast Asian Nations (ASEAN) region are actively pursuing nuclear power programmes. The 2011 Fukushima Daiichi nuclear accident demonstrated that, despite the serious thinking and effort that has gone into continuously improving the safety of nuclear power plants since the 1986 Chernobyl nuclear accident, it would be in the interest of Singapore and its ASEAN neighbours to always be prepared for any such eventualities. The Fukushima Daiichi nuclear accident highlighted the critical role of properly planned and implemented on- and off-site EPR. The purpose of this conference was to discuss the lessons learned from the Fukushima Daiichi nuclear accident and how to incorporate international best practices, specifically on off-site EPR, in a future nuclear-powered ASEAN region.

Specifically, this conference addressed some of the major international public policy and legal challenges in nuclear EPR. Mr. Bojan Tomic, Principal Consultant at ENCO, a leading consulting firm in the fields of nuclear safety, nuclear operation and technical support, kicked off the event by talking about the challenges of off-site EPR in the period since the Fukushima Daiichi nuclear accident. Professor Günther Handl, the Eberhard P. Deutsch Professor of Public International Law at Tulane Law School, USA, and Senior Research Consultant to the Project, then outlined the normative setting for nuclear EPR in international law. He focused principally on the IAEA-centred framework and relevant rules of customary international law**.** This was followed by a presentation by Mr. João Oliveira Martins, Head of the EPR Unit at the Portuguese Environment Agency, on the practical arrangements for nuclear emergency assistance at the global, regional and bilateral levels. Lastly, Dr. Yutthana Tumnoi, Senior Radiation Biologist at the Office of Atoms for Peace in Thailand, reported on current developments in nuclear EPR cooperation in the ASEAN region**.** The Office of Atoms for Peace represents Thailand in the ASEAN Network of Regulatory Bodies for Atomic Energy (ASEANTOM).

The conference concluded with a review of the present status of and future prospects for transboundary cooperation on nuclear EPR in the ASEAN region, chaired by Dr. Philip Andrews-Speed, Principal Investigator of the ESI-CIL Nuclear Governance Project. The panel involved all four speakers as well as Dr. Alistair Cook, Research Fellow and Coordinator of the Humanitarian Assistance and Disaster Relief Programme at the Centre for Non-Traditional Security Studies, Nanyang Technological University, who provided insights on disaster relief cooperation efforts more broadly in the ASEAN region.

B. Summary of Discussions

It was discussed that safety is the highest priority when it comes to nuclear power plants. The cost of building a nuclear power plant roughly averages USD 4-8 billion (SGD 5.5-11 billion), and of this, about 70 per cent is devoted to safety. The 2011 accident at the Fukushima Daiichi nuclear power plant, much like the Chernobyl nuclear accident before it, is a stark reminder of the critical role of off-site EPR. Notwithstanding continuous improvements in nuclear safety worldwide, EPR is a matter of intrinsic global concern, as shortcomings in EPR anywhere tend to undermine confidence in nuclear safety everywhere. Off-site EPR has therefore been a special focal point of international regulatory attention in the period since the Fukushima Daiichi nuclear accident.

B.1. Off-site Emergency Preparedness and Response

This conference focused on off-site rather than on-site EPR. Off-site EPR refers to safety actions taken outside the nuclear power plant site. This includes protecting the population from radiation, reducing the stochastic effects of a nuclear accident, and reducing the psychological, economic and sociological effects of a nuclear accident through engagement with the public.

Several considerations were highlighted during the discussion:

- Role of the global regime: The important role of the International Atomic Energy Agency (IAEA) in setting international EPR safety standards and in assisting countries to develop off-site EPR was recognised.

- National implementation: Yet, it was also agreed that as concerns preparing for and responding to nuclear accidents, countries must take into account their own specific risks and risk tolerance. For example, many of the studies on EPR are comparisons of different European Union (EU) States and cannot be adopted indiscriminately outside the EU. Another example is that there remains considerable disagreement as to how large an Emergency Planning Zone needs to be, for historical, cultural, technological or other reasons. The Fukushima Daiichi nuclear accident was highlighted as an example of how many factors determined the size of the various Emergency Planning Zones as well as the differing off-site EPR responses that were put in place for each particular zone. The population in the smallest Emergency Planning Zone radius of 3 km was evacuated immediately after the accident had occurred. Those in the 20 km radius were evacuated some time later, while persons living beyond the 20 km zone were evacuated almost a month later when the Japanese authorities realised they were at risk of nuclear radiation exposure.

- Response to a nuclear accident: Specifically, in the case of a nuclear accident, there is the need to promptly identify the release, then activate the resources required to take action and address it. Depending on the circumstances, unscheduled releases, even large ones, are not necessarily a significant cause of casualties. As a recent example, the 2202 deaths resulting from the Fukushima Daiichi nuclear accident were attributable to evacuation stress, interruption to medical care and suicides. Yet, as one cannot smell or taste radiation, there is huge and irrational fear of it. It is a significant psychological effect that must be addressed as part of adequate preparation and response to a nuclear emergency.

- Further, urgent protective actions, such as evacuation, should be undertaken. In this regard, participants agreed that the role of the authorities to provide immediate information to the public is crucial; as is their role to manage emergency medical response, such as protecting emergency workers from radiation and distributing iodine tablets.

- Another important EPR countermeasure that participants agreed upon is to ensure that all imported and exported goods circulating during the time of the accident meet international standards. The example of the circumstances following the Fukushima Daiichi nuclear accident was again given where there were issues with the acceptance of produce originating from the disaster area. Non-radiological consequences were also flagged as an area requiring immediate attention.

- Singapore's needs: Some participants were of the view that Singapore's primary area of concern in the case of a nuclear accident ought to be food and water security, given that most is imported.

- ASEAN's needs: Participants discussed the need for regional cooperation in the field of nuclear EPR.

B.2. International Legal Framework for Emergency Preparedness and Response

Participants agreed that while off-site EPR remains predominantly a matter of national responsibility, a nuclear accident has clear international ramifications, such as the spread of radiation which can easily cross national boundaries. Thus, countries that fail to carry out effective EPR are undermining the efforts of countries who do. This reality became more pronounced in the aftermath of the Fukushima Daiichi nuclear accident. Extraordinary meetings were held by parties to the Convention on Nuclear Safety (CNS)[1] calling for the strengthening of nuclear safety measures, highlighting the critical role of off-site EPR. This led to the IAEA revising the safety requirements governing EPR[2].

The international treaty-based legal framework for EPR demands compliance by nuclear and non-nuclear States. The international normative landscape comprises customary international law, the IAEA framework, and other international and regional EPR efforts, such as in Europe. Those in the nuclear industry, for example, the World Association of Nuclear Operators and Institute of Nuclear Power Operations, also developed their own guidelines for accident management, specifically in response to the Fukushima Daiichi nuclear accident. However, it was underscored that the focus of the international regime should be on the IAEA-centred legal and regulatory framework.

Key instruments mentioned included the CNS, the Convention on Early Notification of a Nuclear Accident[3], the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention)[4], and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention)[5]. Specifically, Article 16 of the CNS was highlighted. It provides that all CNS Contracting Parties, be it those with or without nuclear power plants, insofar as they are likely to be affected by a nuclear accident, must have an EPR framework in place. It was also highlighted that the Early Notification Convention requires the accident State to promptly notify affected States, directly or indirectly, and the IAEA itself.

---

[1] Convention on Nuclear Safety (adopted under IAEA auspices on 17 June 1994, opened for signature 20 September 1994 and entered into force 24 October 1996), INFCIRC/449, 5 July 1994 (CNS).

[2] International Atomic Energy Agency, Preparedness and Response for a Nuclear or Radiological Emergency, GSR Part 7 (IAEA 2015).

[3] Convention on Early Notification of a Nuclear Accident (adopted 26 September 1986, opened for signature at Vienna 26 September 1986 and at New York 6 October 1986 and entered into force 27 October 1986), INFCIRC/335, 18 November 1986 (Early Notification Convention).

[4] Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (adopted 26 September 1986, opened for signature at Vienna 26 September 1986 and at New York 6 October 1986 and entered into force 26 February 1987), INFCIRC/336, 18 November 1986 (Assistance Convention).

[5] Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (adopted 5 September 1997, opened for signature 29 September 1997 and entered into force 18 June 2001), INFCIRC/546, 24 December 1997 (Joint Convention).

Special mention of the role of the IAEA in imposing safety standards was also discussed, including the relevant safety requirements, GSR Part 7, which has been recently revised, and is of considerable importance in the context of off-site EPR. While IAEA safety standards are binding for the IAEA, they are formally non-binding for IAEA Member States. Yet, they have also been recognised as possessing normative significance. This means, to the extent that a country requests for IAEA assistance in a nuclear project, the country must accept the binding nature of the safety standards. International organisations sponsoring a safety standard are also bound by its content.

Safety conventions also refer to internationally formulated or endorsed standards and criteria, which are an indirect validation of legally-binding international standards and treaties. This is operationally significant because of the review processes of both the CNS and the Joint Convention. The Conventions' peer review mechanisms were credited as having led to enhanced transparency and accountability, given that there now exists greater pressure to make these reports public through mediums such as the IAEA website. In this way, a non-binding standard, as a form of good practice and guidance, could arguably take shape through its presence in the reports of regular meetings, thereby acquiring de facto normativity. It was further mentioned during the conference that, because there is a plan of introducing the legal obligation of having an EPR notification system, IAEA safety standards will henceforth become increasingly significant. Some participants were hopeful that these new measures would require countries to then report on their progress on compliance with the safety standards at regular peer review meetings, further ensuring that these safety standards would acquire de facto normativity.

B.2.(a) Emergency Preparedness and Response Governance Issues: Lessons from Fukushima Daiichi and Other Nuclear Accidents

B.2.a.(i) Cross-border Coordination, Shared Understandings and Mutual Trust of EPR, Bilaterally and Regionally

The initial impetus for nuclear EPR came about in response to the consequences of the 1986 Chernobyl nuclear accident. The ecological and environmental effects of that event, in particular the widespread dispersion of radioactive contamination across Central Europe and even northern England, as well as the deleterious impact of the nuclear disaster on food imports, caught European countries unprepared. The impact of the Chernobyl nuclear accident arguably underscored the need for EPR measures governing both the immediate area surrounding nuclear power plants as well as areas situated further away.

It was further recognised that, following the Fukushima Daiichi nuclear accident, there were various policy challenges at hand that required attention, such as cross-border harmonisation. While complete harmonisation of EPR governance standards is impossible and indeed undesirable, conference participants recognised that there had to be a certain convergence in standards, as emphasised in the latest meeting of the 7th Review Meeting of the CNS.

B.2.a.(ii) Early Notification and Information Sharing

Another key policy challenge that conference participants raised involved transboundary event reporting and information exchange pursuant to the Early Notification Convention. Again, reference was made to the Chernobyl nuclear accident, where the situation had been exacerbated by the fact that the Soviet Union did not report the accident until some 72 hours later. It was discussed that the main problem with the reporting obligations found in the Early Notification Convention lay with the three subjective elements which determine whether a country should inform other countries of a nuclear accident. It was posited that improvements in notification and information sharing were needed.

Suggestions were made for bilateral or regional agreements that provided for the automatic sharing of information and reporting of events without the need for the subjective elements currently in place. It was further proposed that there should be automatic sharing of comprehensive real-time information on critical parameters. Nevertheless, participants were cognisant of the difficulties in implementing such arrangements, as evidenced by the recent agreement between the Norwegian Radiation Protection Authority and the Russian State nuclear energy company, Rosatom. Although the agreement was signed in 2015, the parties involved are still determining whether there is a legal obligation to notify and share information.

It was noted that the abovementioned proposals on reporting and information exchange constitute part of the IAEA's Incident and Emergency System. The Incident Emergency Centre, which forms a part of the Incident and Emergency System, acts as an information clearing house, reflecting IAEA's expanded role in EPR. It was reiterated that although EPR remains a national responsibility, it is increasingly becoming international in nature. In a situation like that of the Fukushima Daiichi nuclear accident, where the plant operator and the government did not fully understand the gravity of the situation and leading to conflicting decisions and information being released, it was suggested that the Incident Emergency Centre could step in to monitor the situation and provide a single stream of information to the public, thereby avoiding any confusion through a reverse flow of information.

Regional EPR standards, while commendable, should not be inconsistent with global standards. Participants noted the increasing concentration of EPR functions in the IAEA, as well as improvements on the cross-border communications front, from a bilateral to a multilateral approach. It was envisioned that under this multilateral approach, the incident State would go to the Incident Emergency Centre to obtain an accident prognosis, thereby allowing the incident State to inform other States and receive assistance while doing so. Despite these proposals, conference participants accepted that much work remains to be done.

B.2.a.(iii) International and Regional Emergency Assistance

The discussion highlighted the importance of having arrangements for the provision of assistance in the event of a nuclear accident because very few countries in the world are currently able to deal with such accidents on their own. Presently, the IAEA is the main body that facilitates the provision of assistance to countries. The main documents relating to the provision of assistance are the IAEA Statute[6], the Assistance Convention, internal policy documents and operational tools, particularly the Response and Assistance Network.

The opportunity was taken to highlight the role of the IAEA in greater detail. The IAEA is the main channel through which States can request for assistance or offer to provide assistance. However, the IAEA can only intervene when a country requests assistance. If a country does not do so, the IAEA cannot unilaterally provide any assistance.

Once such a request has been made, the IAEA may send an 'Offer of Good Offices' to notify the Requesting State that the IAEA will offer its services for the purposes of assistance. The request for assistance from a Requesting State must come from either a Competent Authority or its Permanent Mission to the IAEA. The request for assistance must provide information on the event and specify the type of assistance required, and it must be done formally in any of the following three ways: i) through a submission of the Request for Assistance form on the Unified System for Information Exchange in

[6] Statute of the International Atomic Energy Agency (adopted 23 October 1956 and entered into force 29 July 1957), 276 UNTS 3 (IAEA Statute).

Incidents and Emergencies; ii) faxing the Incident and Emergency Centre; or iii) telephoning the Incident and Emergency Centre.

Upon receiving the request for assistance, on-call staff of the Incident and Emergency Centre will authenticate and verify the request. Depending on the initial assessment of the urgency of the request, resources may be deployed immediately. The Incident and Emergency Centre will also make an internal assessment as to the scope and objective of the mission, and identify resources internal and external to the Requesting State that are available for the mission.

Conference participants next discussed the role of the Response and Assistance Network, which was established in 2000 and is a practical operational tool addressing requests for and the provision of assistance in the case of a nuclear accident or radiological emergency. The functional areas of the Response and Assistance Network include: Source Search and Recovery; Radiation Survey; Environmental Sampling and Analysis; Radiological Assessment and Advice; Nuclear Installation Assessment and Advice; Decontamination; Medical Support; and Dose Assessment.

A State may only register in the Response and Assistance Network if it is a Party to the Assistance Convention. States that are part of the Response and Assistance Network are to declare their means and capabilities to provide assistance and the Response and Assistance Network would then use this information to quickly and effectively coordinate States in the event of an emergency. State Parties can register two types of capabilities on the Response and Assistance Network: (i) Field Assistance Teams; and/or (ii) External Based Support.

During discussion, the issue of inadequate financial resources in the provision of assistance was raised since IAEA is limited financially and will not always be able to finance the assistance mission. While the IAEA can usually cover basic expenses for deployment, accommodation and daily allowance, it was recognised that it had difficulties covering mitigation measures such as medical treatment or cover for complex and large emergencies. Some participants felt that the Requesting State should thus budget for the assistance provided, although it was acknowledged that, based on negotiations between the Requesting and Assisting States, the Assisting State may provide its services at little to no cost.

Concerns were also raised regarding the length of time required to draw up an Assistance Action Plan for a major accident like the Fukushima Daiichi nuclear disaster, given that it usually takes 48 hours for simple incidents. The IAEA's *Fukushima Daiichi Accident*[7], in particular, expressly recommends that countries that foresee themselves requiring external assistance should make prior preparations on the specific type of aid they need, given that they might not be able to deal with such issues when an emergency does occur.

At present, there are 33 State Parties to the Response and Assistance Network (registering capabilities for Field Assistance Teams, External Based Support, or both) but some participants considered this to be insufficient and felt that more States needed to register under the network. Participants actively debated and discussed the issue of non-membership of the Response and Assistance Networkin ASEAN, notwithstanding that seven out of ten ASEAN Member States had already ratified the Assistance Convention.

[7] International Atomic Energy Agency, *The Fukushima Daiichi Accident*, STI/PUB/1710 (IAEA 2015).

B.2.a.(iv) International Validation of Emergency Preparedness and Response through Emergency Exercises and Peer Reviews

Discussions next considered the issue of peer review of EPR practices, which is voluntary, unlike the testing of EPR. This means countries are not obliged to submit to the review mechanism. Reference was made to the EU which changed its laws after the Fukushima Daiichi nuclear accident such that, if there is a significant risk, then an EU country is now subject to a mandatory review of its existing EPR. Furthermore, it was noted that the peer review mechanism in itself adopts a broader, macro-based perspective of EPR plans given the impossibility of scrutinising every single aspect of EPR.

B.3. Cooperation on Emergency Preparedness and Response in the Association of Southeast Asian Network Region

Participants considered EPR approaches in the broader Asian region. China and India together have 60 operational nuclear reactors in total (China has 38 nuclear reactors with 18 under construction, while India has 22 reactors with 6 under construction). It was acknowledged by some participants that China's EPR is extremely robust and comparable to European standards in terms of planning and resource allocation. However, there were concerns that the aforementioned subjective elements in the Early Notification Convention could hinder the effective fulfilment of obligations of States to notify and to exchange information in the case of a nuclear accident. Specifically, China is constructing and operating nuclear power plants a mere 30 km away from Vietnam's northern border. Bangladesh is currently also constructing Rooppur nuclear power plant, some 500 km away from Myanmar's western border.

Participants also took the opportunity to address the issue of nuclear power in ASEAN countries in the near future. While noting that no nuclear power plants have been built in the region thus far, the Philippines is currently considering restarting its nuclear programme. Participants also considered the prospects of Viet Nam, Indonesia, Thailand and Malaysia implementing nuclear programmes of their own. These nuclear frontrunners all possess nuclear research reactors, which arguably already constitute a potential transboundary regional nuclear risk.

The discussion centred on the efforts of all ten ASEAN countries to improve their capabilities to react to nuclear disasters in the wake of the Fukushima Daiichi nuclear accident. Measures discussed included implementing radioactivity measurements in food to ensure that food imported from the disaster area remained safe for consumption, as well as developing national EPR arrangements. Participants also discussed the increased emphasis on upgrading online gamma radiation monitoring systems, which can transmit real-time information on radioactivity and assist countries in making decisions in the event of a nuclear accident. Detailed accounts were given of the various ASEAN countries' efforts to install greater numbers of online monitoring systems since the Fukushima Daiichi nuclear accident. Singapore, for example, did not have any monitoring stations before the accident, but the National Environment Agency has since undertaken to install 40 stations across the island by 2019. Thailand had four monitoring stations before the Fukushima Daiichi nuclear accident while it presently has 22 stations. It was further mentioned that Thailand is also the first country to install underwater detectors, which was acknowledged to be a difficult system to maintain because the detector operates in harsher conditions.

It was highlighted that several ASEAN documents have been drafted, though not yet publicly available, including *A Review of the Nuclear and Radiological Hazard Assessment in the ASEAN Region*, the *Draft Concept of National and Regional Monitoring in Countries within the ASEAN*, *A Concept of the ASEAN Assessment and Decision-Making Protocol on Protective and Other Response Actions in a Nuclear or Radiological Emergency*, and the *ASEAN Protocol for Preparedness and Response to a Nuclear or Radiological Emergency*. To ensure harmonisation, the *ASEAN Protocol for Preparedness and Response*

to a Nuclear or Radiological Emergency was drafted with the ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management in mind.

Participants also discussed the efforts made by ASEAN countries in sharing their own monitoring data with the International Radiation Monitoring Information System, a monitoring system which allows countries to share information with the IAEA on a voluntary basis. Under the system, the IAEA collects and displays radiation monitoring data, enabling countries to respond rapidly to nuclear accidents. It was noted that only Indonesia has successfully shared its data with the International Radiation Monitoring Information System, while Thailand, Malaysia and the Philippines have encountered technical issues arising from different interfaces, since their respective local monitoring systems were installed before the International Radiation Monitoring Information System was set up. It was further observed that without a regional data centre, the monitoring data cannot be shared between all ASEAN countries. It would thus be ideal for all the data from all ASEAN countries to be compiled in a single data centre such that a single set of data can be sent to the IAEA. Given that data sharing within the ASEAN region is presently not possible, some participants suggested that some ASEAN countries pool their data together first to generate greater support for ongoing data sharing efforts. With ASEANTOM's involvement in the new data sharing project, it was contended that the first set of data could be shared by 2022.

Conference participants also took the opportunity to discuss the nature and work of ASEANTOM which was formed to 'strengthen nuclear safety, security and safeguards within the ASEAN community by enhancing cooperation and complementing the work among Member States with the existing mechanisms at the national, regional, and international levels'. The recoginition of ASEANTOM by many international organisations, including the IAEA, was further noted, as was ASEANTOM's work involving regular annual meetings and the hosting of technical meetings and workshops.

It was highlighted that ASEANTOM's current priority concerns the development of an EPR framework at the national and regional levels. In this regard, it has started its first technical cooperation project with the IAEA, namely, 'Supporting Regional Nuclear Emergency Preparedness and Response in the Member States of ASEAN Region (RAS/9/077)'.

ASEANTOM and the EU also commenced a study in 2013, which resulted in the *ASEAN Strategy for Regional Cooperation on Radiological and Nuclear Emergency Preparedness and Response and an Action Plan for its Implementation.*[8] A second study conducted by ASEANTOM-EU started in 2018 with the objective of installing Decision Support Systems in six countries, namely, Indonesia, Malaysia, the Philippines, Singapore, Thailand and Viet Nam. The systems are meant to give additional information on the movement of radiation based on factors such as wind, thus facilitating decisions on evacuation zones and where best to relocate the evacuees. A third project aims to install an Early Warning Radiation Monitoring Network which can provide information on radiation data. An ASEAN Data Centre will receive information from the various monitoring stations and the Early Warning Network and will also have the Decision Support System installed.

The discussion finally shifted to the topic of harmonisation of EPR measures in the ASEAN region. It was noted that major discrepancies in EPR have the potential to further undermine public confidence in existing nuclear EPR efforts, which is already low in most ASEAN countries due to a range of other factors. Some participants were therefore desirous of seeing the development of a harmonised regional protocol, an enhanced Early Warning Radiation Monitoring Network, an ASEAN data centre, and envisaged a role for the the ASEAN Coordinating Centre for Humanitarian Assistance on Disaster

[8] See European Union, 'Enhancing Emergency Preparedness and Response in ASEAN: Technical Support for Decision Making' (12 February 2018) <https://eeas.europa.eu/headquarters/headquarters-homepage/39692/enhancing-emergency-preparedness-and-response-asean-technical-support-decision-making_en> accessed 13 December 2018.

Management Centre in the future, while hopeful that existing radiation data from monitoring centres can be made compatible with the above-mentioned International Radiation Monitoring Information System.

Challenges highlighted include the difficulty of working amongst different countries with different internal processes. There are also often delays in the decision-making process among Member States, which makes it a lengthy process to obtain consensus on issues. Other participants highlighted that different countries may have different risk appetite and tolerance, as evidenced by the differences in Emergency Planning Zones between countries.

It was suggested, however, that in the ASEAN region, the regional perception of risk and safety amongst Member States is better aligned than globally. It was felt that while global EPR standards should remain the focal point, it should be left to regional institutions to implement them. It was suggested that technical cooperation within the region and with international organisations, such as the IAEA, is also of considerable importance. Further, it was submitted that the use of the IAEA's safety standards would mitigate major inconsistencies between Member States during an emergency.

GLOSSARY

Border	In relation to a nuclear power plant located close to a national border and up to 30 km away from the risk-exposed neighbour.
Close Proximity	In relation to a nuclear power plant located up to 100 km away from the risk-exposed neighbour.
Frontrunner	A nuclear newcomer with a steady progress in undertaking various activities within Phase 1 of the IAEA Milestones Approach.
IAEA Milestones Approach[1]	Refers to a phased comprehensive method for the International Atomic Energy Agency (IAEA) to assist countries that are considering or planning their first nuclear power plant.
Incident State[2]	The State within whose territory a nuclear incident has occurred. The territory of the incident State also includes any exclusive economic zone as long as the Depositary has been notified of such an area prior to the nuclear incident.[3]
Installation State[4]	In relation to a nuclear installation, installation State means the Contracting Party within whose territory that installation is situated or, if it is not situated within the territory of any State, the Contracting Party by which or under the authority of which the nuclear installation is operated.
Joint Protocol[5]	Is designed to establish treaty relations between the Contracting Parties to the Vienna Convention and the Contracting Parties to the Paris Convention, and to eliminate conflicts that may arise from the simultaneous application of both Conventions to the same nuclear incident.
New build	Refers to new nuclear power plants that are built, and applies both to new nuclear power plants that are built by States embarking on a nuclear programme (e.g., Bangladesh), or by States that currently generate nuclear power but are revamping their programme.
Newcomer[6]	Refers to a State introducing nuclear power for the first time.

[1] International Atomic Energy Agency, 'Milestones Approach' <https://www.iaea.org/topics/infrastructure-development/milestones-approach> accessed 8 November 2018.

[2] Based on the Convention on Supplementary Compensation for Nuclear Damage (adopted 12 September 1997 and entered into force 15 April 2015) INFCIRC/567 22 July 1998 (CSC), Article XIII (Jurisdiction). See also Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (adopted 12 September 1997, opened for signature 29 September 1997 and entered into force 4 October 2003) INFCIRC/566, 22 July 1998 (1997 Vienna Convention), Article XI.

[3] International Atomic Energy Agency, The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage — Explanatory Texts, STI/PUB/1768 (IAEA 2017) 53.

[4] CSC (n2), Article I(e). See also 1997 Vienna Convention (n2), Article 1(d).

[5] International Atomic Energy Agency, 'Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention', <https://www.iaea.org/topics/nuclear-liability-conventions/joint-protocol-relating-to-application-of-vienna-convention-and-paris-convention> accessed 8 November 2018.

[6] May Fawaz-Huber, 'How the IAEA Assists Newcomer Countries in Building Their Way to Sustainable Energy' (IAEA 30 January 2017) <https://www.iaea.org/newscenter/news/how-the-iaea-assists-newcomer-countries-in-building-their-way-to-sustainable-energy> accessed 8 November 2018.

Nuclear incident[7]	Any occurrence or series of occurrences having the same origin which causes nuclear damage or, but only with respect to preventive measures, creates a grave and imminent threat of causing such damage.
Nuclear material[8]	Refers to: 1) nuclear fuel, other than natural uranium and depleted uranium, capable of producing energy by a self-sustaining chain process of nuclear fission outside a nuclear reactor, either alone or in combination with some other material; and 2) radioactive products or waste.
Nuclear power plant[9]	Refers to a facility that converts atomic energy into usable power. In a nuclear electric power plant, heat produced by a reactor is generally used to drive a turbine which in turn drives an electric generator.
Party[10]	Refers to a State which has consented to be bound by the treaty and for which the treaty is in force
Ratification[11]	The international act whereby a State indicates its consent to be bound to a treaty. The period of time between signature and ratification grants countries the necessary opportunity to seek the required approval for the treaty on the domestic level and to enact the necessary legislation to give domestic effect to that treaty. Also called 'acceptance', 'approval' or 'accession' to a treaty.
Regulatory Body[12]	An authority or a system of authorities designated by the government of a State as having legal authority for conducting the regulatory process, including issuing authorizations, and thereby regulating the safety of nuclear installations, radiation safety, the safety of radioactive waste management and safety in the transport of radioactive material.
Safety[13]	Safety refers to the protection of people and the environment against radiation risks, and the safety of facilities and activities that give rise to radiation risks. It is concerned with both radiation risks under normal circumstances and radiation risks as a consequence of accidents and incidents, as well as with other possible direct consequences of a loss of control over a nuclear reactor core, nuclear chain reaction, radioactive source or any other source of radiation.

[7] CSC (n2), Article I(i). See also 1997 Vienna Convention (n2), Article 1(l).
[8] CSC (n2), Annex Article 1(c). See also 1997 Vienna Convention (n2), Article 1(h).
[9] Organization for Economic Co-operation and Development, 'Glossary of Statistical Terms' <https://stats.oecd.org/glossary/detail.asp?ID=1858> accessed 13 September 2018.
[10] 1997 Vienna Convention (n2), Article 2.
[11] See also Vienna Convention on the Law of Treaties (adopted on 23 May 1969, entered into force 27 January 1980) 1155 UNTS 331, Articles 2(1)(b), 14, 16, 18.
[12] International Atomic Energy Agency, *IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection: 2016 Revision* (IAEA 2016), 146.
[13] International Atomic Energy Agency (n12), 155.

Security[14]	The prevention and detection of, and response to, theft, sabotage, unauthorised access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities.
Signature[15]	A means of authentication, also expressing the willingness of the signatory State to continue the treaty-making process. The signature qualifies the signatory State to proceed to ratification, acceptance or approval. It also creates an obligation to refrain, in good faith, from acts that would defeat the object and the purpose of the treaty.

[14] International Atomic Energy Agency (n12), 179.
[15] See also Vienna Convention on the Law of Treaties (n11), Articles 10, 14 and 18.