The impact of the major nuclear power plant accidents on the international legal framework for nuclear power

*by Stephen G. Burns**

Over time, numerous events and developments have shaped the utilisation of nuclear energy as well as the approach to its regulation. For example, the Three Mile Island (TMI) accident in 1979 was a significant event affecting the nuclear power industry in the United States (US) and the US Nuclear Regulatory Commission's (NRC) regulatory programme, yet other incidents or "near misses" at facilities, scientific and engineering assessments of reactor technology, and changes to enhance the NRC's organisational effectiveness have also shaped the framework for regulation.[1] Nonetheless, in public consciousness, three major nuclear power accidents have arguably dominated the debate over the safety and regulation of nuclear power operations: the TMI accident, the 1986 Chernobyl accident in Ukraine, then part of the Union of Soviet Socialist Republics (USSR), and the multi-plant Fukushima Daiichi accident in Japan in 2011. Having worked on the response to all three accidents at the NRC and to the Fukushima Daiichi accident at the Organisation for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA), I thought it worth reflecting on the impact of those accidents on nuclear law and particularly the international dimensions of the field. For each accident, there are certainly impacts that the events have had on national legislation pertaining to nuclear energy, whether in the country where the accident occurred or in others. This article focuses on the international dimension by considering commentary and analysis contemporaneous with the events as well as reflections made some decades after the accidents occurred. And though each accident has had an impact, the Chernobyl accident has clearly been the most significant driver of change in the international legal regime.

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1. See Fewell, J.B., D. Ferraro and D. Reddick (2017), "Accidents and Innovation Shaping the Nuclear Regulatory Landscape", *Infrastructure*, Vol. 56, No. 4, ABA Publishing, pp. 3-13. The World Nuclear Association (WNA) lists historical nuclear reactor accidents on its website and notes the more serious toll non-nuclear energy accidents have exacted on human life. WNA (2017), *Safety of Nuclear Power Reactors*: *Appendices*, www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/appendices/safety-of-nuclear-power-reactors-appendix.aspx (accessed 5 Dec. 2018).

I. Three Mile Island

The Three Mile Island Nuclear Station, located near Harrisburg, Pennsylvania, had two licensed units. Unit 2 had been licensed to operate since February 1978. At about 4:00 a.m. on Wednesday, 28 March 1979, Unit 2 experienced equipment failure on the plant's secondary side that prevented the main feed water pumps from sending water to the steam generators, which would remove heat from the core.[2] The turbine generator and then the reactor itself began to shut down and thereby increase the pressure in the reactor's primary system. Per design, the pilot-operated relief valve opened to help control pressure, but the valve failed to close and stuck open when pressure fell to an acceptable level. Moreover, the control room's instrumentation erroneously indicated that the valve had closed so that the operating crew was unaware that coolant in the form of steam was pouring out of the open valve. As a consequence, the crew did not understand that the plant was experiencing a severe loss-of-coolant accident. Other instrumentation readings also led the crew to incorrectly assume that the water level was adequate to cover the reactor core. The operators then took steps that exacerbated the situation and consequently led to a drop in water level in the reactor pressure vessel and overheating of the core.

Some 3 hours and 20 minutes after the accident began, the operators started the emergency core cooling system again. The core began to cool. By 8:00 a.m., the transient was over, but the sequence of events caused a partial meltdown of the reactor core and a small offsite release of radioactivity (equivalent to a dose of about 100 millirem or 1 millisievert (mSv) above background at the site boundary). However, for several days uncertainty about the possibility of a hydrogen explosion in the reactor vessel dominated the technical assessment of the plant's status. In the face of this uncertainty, Pennsylvania Governor Richard Thornburgh advised on Friday, 30 March 1979, that persons within a five-mile (eight kilometres (km)) radius of the plant should stay indoors and that pregnant women and preschool-age children should evacuate the area. On Sunday, 1 April 1979, President Jimmy Carter, First Lady Rosalynn Carter, and Governor Thornburgh visited the plant with NRC's lead official Harold Denton. At this point, the reactor's condition was considered to be relatively stable and to no longer pose a significant danger. The Governor's precautionary advisory to pregnant women and preschool-aged children was lifted within two weeks.

The Three Mile Island accident had a significant impact on the US nuclear industry and the NRC.[3] Official reports on the accident, one by a Presidential Commission and the other an inquiry sponsored by the NRC itself, contain blistering criticism of the NRC and the industry.[4] For example, the Presidential Commission's report concluded, "With its present organization, staff, and attitudes, the NRC is unable to fulfil its responsibility for providing an acceptable level of safety for nuclear power plants."[5] Both reports even called for the reconfiguration of the NRC (then barely into its fourth year of existence) into an agency headed by a single administrator, a step that President Carter ultimately rejected in favour of a reorganisation plan intended to enhance the role of the Chairman in an emergency

2. The description of the event is taken from the factsheet posted on NRC (2018), "Backgrounder on the Three Mile Island Accident", www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html (accessed 5 Dec. 2018).
3. For an overview of the impacts of the accident on nuclear regulation in the United States, see NRC, Office of Nuclear Regulatory Research (2016), *Three Mile Island Accident of 1979 Knowledge Management Digest – Overview*, NUREG/KM-0001, Rev. 1.
4. See Report of the President's Commission on the Accident at Three Mile Island (1979), *The Need for Change: The Legacy Of Three Mile Island*; NRC Special Inquiry Group (1980), *Three Mile Island: A Report to the Commissioners and to the Public*, NUREG/CR1250, Vols. 1-3.
5. Report of the President's Commission (1979), *supra* note 4, p. 56.

and improve NRC's organisation.[6] The accident had also revealed significant weaknesses in emergency planning and response capabilities. President Carter consolidated federal responsibility for offsite emergency planning and response to radiological incidents in the Federal Emergency Management Agency, which had been established by his administration before the Three Mile Island accident. The NRC required utilities to develop, maintain and exercise emergency response plans, including integration with offsite responders.[7]

Other regulatory actions included a vast array of initiatives aimed at improving the safety of design and operation of nuclear stations as well as mitigating the consequences of events when things went awry. The NRC staff issued to licensees and licence applicants in 1980 the consolidated recommendations from its "TMI Action Plan", which the Commission had approved for implementation.[8] The new requirements were reflected in the outcome of licensing reviews, orders to operating licensees and changes to the NRC's regulations. Within the nuclear industry itself, the Institute of Nuclear Power Operations (INPO) was established to improve the safety focus of power operations and the accountability of plant operating organisations.[9] Through INPO, the industry established standards of excellence against which it would hold its members accountable – a measure of self-policing through inspection and evaluation.

For the United States, historian J. Samuel Walker observes, "The dual legacy of the [Three Mile Island] crisis was, on the one hand, to galvanize regulatory and operational improvements that reduced the risks of another severe accident and, on the other hand, to increase opposition to the expansion of nuclear power".[10] That conclusion holds true outside the United States as well. For example, France, with currently the largest operating fleet in Europe, implemented improvements to plant design, operating procedures and emergency preparedness.[11] But the accident also proved to be a catalyst for anti-nuclear sentiment, as reflected in a 1980 referendum and resulting change to national law in Sweden that froze its nuclear energy programme and set a long-term phase-out of the existing Swedish reactor fleet.[12] Given the broad attention to the accident, did Three Mile Island have a more global effect on international nuclear law and regulation? We know that no new international conventions or legal instruments resulted directly from the accident at Three Mile Island. Nonetheless, the accident did provide further impetus for sharing information on operational experience and laid the groundwork for bilateral and multilateral approaches to providing assistance during an emergency. Moreover, the accident helped prompt the initiation of the international safety inspections of

6. Reorganization Plan No. 1 of 1980, 45 *Federal Register* (Fed. Reg.) 40561 (16 June 1980), codified in 5 United States Code (USC) Appendix.
7. NRC's rules are reflected in 10 Code of Federal Regulations (CFR) 50.47 and in Appendix E to 10 CFR Part 50 and were adopted in 1980 after consideration of lessons learnt from the Three Mile Island accident. Emergency Planning, Final Rule, 45 Fed. Reg. 55402 (19 Aug. 1980).
8. NRC, Office of Nuclear Reactor Regulation (1980), *Clarification of TMI Action Plan Requirements*, NUREG-0737.
9. On INPO's development, see Rees, J.V. (1994), *Hostages of Each Other: The Transformation of Nuclear Safety since Three Mile Island*, University of Chicago Press, Chicago.
10. Walker, J. S. (2004), *Three Mile Island: A Nuclear Crisis in Historical Perspective*, University of California Press, Berkeley, California, p. 244.
11. See Institut de Radioprotection et de Sûreté Nucléaire (2015), *Nuclear Power Reactor Core Melt Accidents*, chap. 7.1.5, pp. 350-56; Tanguy, P. (1983), "The French Approach to Nuclear Safety", *Nuclear Safety*, Vol. 24, No. 5, US Department of Energy Technical Information Center, Oak Ridge, pp. 589, 594-95.
12. See NEA (1980), "Sweden, Nuclear Legislation, Bill concerning the future energy policy (1980)", *Nuclear Law Bulletin*, No. 26, OECD, Paris, p. 23; *ibid*., Sandstrom, S., "After the Referendum", pp. 53-57.

nuclear power plants through the International Atomic Energy Agency's (IAEA) Operational Safety Review Team (OSART) programme that continues to this day.[13]

The importance of systematic reporting and evaluation of operating experience was underscored by the realisation that two precursor events had occurred at other reactors but were unknown to the staff operating Three Mile Island. The Davis-Besse plant in Ohio and the Beznau plant in Switzerland had also experienced a stuck pilot-operated relief valve with misleading indications to operators that the reactor coolant system had sufficient water, but the operators at both plants were able to recognise and address the problem before serious damage occurred. Although the Davis-Besse event had been reported to NRC, the Special Inquiry Group report found that the NRC's "preoccupation with hardware and design questions, and the lack of any clear-cut responsibility for identifying significant operating problems and warning operators about them combined to prevent the real message of Davis-Besse from getting to Three Mile Island."[14] The agency did not become aware of the Beznau experience until *after* the TMI accident.[15]

Initial steps to establish a system to share information on incidents at nuclear installations had begun under an NEA initiative in 1978, and OECD countries approved the institution of an Incident Reporting System in 1981.[16] The OECD Council adopted the system as a Council Recommendation in 1983; such recommendations, though not binding, are accorded "great moral force as representing the political will of the Adherents".[17] The IAEA extended the reporting system to its member states with nuclear power programmes in April 1983, and the IAEA and NEA now jointly run the system.[18]

In the realm of emergency response and assistance, the Three Mile Island accident prompted the IAEA to enhance its activities and to encourage states to consider arrangements to provide mutual assistance in the event of an accident. Although efforts to establish a legal framework for emergency assistance had borne some fruit in the 1960s with the conclusion of the Nordic Mutual Emergency Assistance Agreement, little enthusiasm had existed for a broader agreement.[19] After the Three Mile Island accident, discussions were initiated under IAEA auspices to consider further development of an assistance framework. The United States had initiated efforts to negotiate a convention to address arrangements for emergency assistance.[20] The efforts led in February 1982 to the establishment of a group of experts to study the means of responding to and facilitating requests for assistance prompted by a radiological emergency. The expert panel developed two documents: *Guidelines for Mutual Emergency Assistance Arrangements in Connection with a Nuclear*

13. See Sacchetti, D. (2009), "The Peer View", *IAEA Bulletin*, Vol. 50, No. 2, p. 29; Hancher, L. and P. Cameron (1988), "After Chernobyl: Has Anything Really Changed?", in P. Cameron, L. Hancher and W. Kühn (eds.), *Nuclear Energy Law After Chernobyl*, Graham and Troutman, London, pp. 183-84.
14. NRC Special Inquiry Group, *supra* note 4, Vol. 1, p. 95; see also *ibid.*, pp. 94-99 for further context.
15. *Ibid.*, p. 94.
16. IAEA (2018), *Operating Experience Feedback for Nuclear Installations*, IAEA Safety Standards Series No. SSG-50, Annex, pp. 35-36; IAEA (2010), *IRS Guidelines – Joint IAEA/NEA International Reporting System for Operating Experience*, Services Series No. 19, p. 1.
17. OECD (1983), *Recommendation of the Council concerning the Operation of a Nuclear Power Plant Incident Reporting System*, OECD/LEGAL/0201, C(83)6/Final, adopted 22 Feb. 1983, https://legal instruments.oecd.org/en/instruments/OECD-LEGAL-0201.
18. See references in *supra* note 16.
19. IAEA (1963), *Nordic Mutual Emergency Assistance Agreement in Connection with Radiation Accidents*, INFCIRC/49; see Cameron, P. (1988), "The Vienna Conventions on Early Notification and Assistance", in *Nuclear Energy Law After Chernobyl*, *supra* note 13, p. 22.
20. Cameron, P. (1988), *supra* note 19, p. 21.

Accident or Radiological Emergency (IAEA Doc. INFCIRC/310, 1984) and *Guidelines on Reportable Events, Integrated Planning and Information Exchange in Transboundary Release of Radioactive Materials* (IAEA Doc. INFCIRC/321, 1985). These recommendations were useful to states as models if they wished to pursue bilateral or multilateral agreements, but they fell short of any binding international agreement on the subject.

Although no new binding international legal instruments came into being as a result of the Three Mile Island accident, the response to the accident sowed seeds that would finally germinate in the wake of the Chernobyl accident. Indeed, the 1994 Diplomatic Conference on the Convention on Nuclear Safety acknowledged that:

> The accident at Three Mile Island and the disaster at Chernobyl had given further impetus to the establishment of international norms. While the Chernobyl accident was the only one to have transboundary radiological consequences, the impact of both accidents had gone far beyond the borders of the States where they had occurred.[21]

II. Chernobyl

On 26 April 1986, a sudden power surge during a reactor systems test destroyed Unit 4 of the nuclear power station at Chernobyl, Ukraine, in the former Soviet Union. The operators had prepared a test to determine the length of time that the turbines could rotate and provide power to the main circulating pumps in the event of a loss of main electric supply.[22] Among other actions, the operators disabled the automatic shutdown mechanisms prior to the planned test. The reactor became extremely unstable, and when the operators began the shutdown procedure, the control rods caused a significant power surge as they were inserted into the reactor core. The reactor experienced substantial damage, the control rods jammed without having fully inserted, and intense steam generation eventually caused a steam explosion that spewed fission products into the atmosphere. Another explosion soon followed, throwing graphite and other fragments out of the fuel channels. The fuel melted and started fires that added to the radioactive release.

The accident resulted in the largest uncontrolled release of radioactive material ever experienced from any civilian installation. For some ten days, large quantities of radioactive material were released into the air. Most of the released material fell close to the plant in the form of dust and debris, but some material was carried by wind over Belarus, Russia, Ukraine and even into Scandinavia and other parts of Europe. Initial information that an accident had occurred came from detection of

21. "Summary Record of the First Plenary Meeting of the Diplomatic Conference on a Nuclear Safety Convention", in IAEA (1994), *Convention on Nuclear Safety*, Legal Series No. 16, p. 64, para. 12.
22. The summary of the accident is based on information posted online at: WNA (2018), "Chernobyl Accident 1986", www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx (accessed 5 Dec. 2018). Information on health effects was drawn from the World Health Organization (WHO). See WHO/IAEA/UNDP, Press Release, "Chernobyl: the true scale of the accident" (5 Sept. 2005), www.who.int/mediacentre/news/releases/2005/pr38/en/; WHO (2016), "1986-2016: Chernobyl at 30", www.who.int/ionizing_radiation/chernobyl/Chernobyl-update.pdf?ua=1. The IAEA issued an official report on the accident through its International Nuclear Safety Advisory Group (INSAG) in IAEA (1986), *Summary Report on the Post-accident Review Meeting on the Chernobyl Accident*, INSAG-1, IAEA, Vienna, which was later updated in IAEA (1992), *The Chernobyl Accident: Updating of INSAG-1*, INSAG-7, IAEA, Vienna. The document includes as an annex a report commissioned by the USSR State Committee for the Supervision of Safety in Industry and Nuclear Power.

elevated radiation readings in Sweden, before the Soviet government had informed the international community that the accident had occurred.

Emergency responders poured sand and boron by helicopter on the reactor debris in order to extinguish the fires, mitigate radioactive releases and prevent the criticality of the nuclear material. A temporary concrete "sarcophagus" was constructed within a few weeks to retard further release of radioactive material. The government closed the area within 30 km of the plant, except for those persons who were involved in the recovery from the accident or who were operating the undamaged reactors at the site (which were not finally closed until 1999). Some 115 000 people were evacuated from the most heavily contaminated areas in 1986 and another 220 000 people were evacuated in following years.

About 1 000 on-site staff and emergency workers received high radiation doses on the first day of the accident. By July 1986, 28 deaths, including 6 fire fighters, had resulted from radiation exposures – estimated to range up to 20 000 mSv – which were incurred by those responding to the accident on the first day. Some 200 000 people from across the Soviet Union were involved in the recovery and clean-up during 1986 and 1987. They also received high doses, on average 100 mSv. Experts estimate, based on statistical projections, that radiation exposure among the higher-exposed populations could cause up to 4 000 eventual deaths, i.e. among emergency workers in 1986-1987 as well as among the evacuees and residents of the most contaminated areas. About 4 000 cases of thyroid cancer have resulted from the accident, and nine children died from thyroid cancer.

As noted above, the occurrence of the accident was not immediately known outside the Soviet Union, and the initial response of the international community was to urge the Soviet government to provide information relevant to the accident. For example, a statement issued by the G-7 during its Tokyo summit in early May 1986 urged the Soviet government "which did not do so in the case of Chernobyl, to provide urgently such information [on the emergency and accident], as our and other countries have requested".[23] The Soviet government invited IAEA Director General Hans Blix to visit the USSR and Chernobyl in early May. In a speech broadcast on 14 May 1986, Soviet General Secretary Mikhail Gorbachev, while accusing the Western powers of trying to make political capital out of the accident, nonetheless announced the openness of the Soviet Union to broad enhancements in the international regime for notification, assistance and plant safety, a message he reiterated in subsequent communications to the IAEA.[24] The IAEA through its Board of Governors soon put the wheels in motion that would lead to the broad consideration of new instruments to govern the international nuclear safety regime.

Even the novice at nuclear law gains an early appreciation of the impact of the Chernobyl accident on the international legal framework affecting emergency notification and assistance, the safety of nuclear installations, and the liability for damage from nuclear incidents. The Early Notification Convention and the Assistance Convention were negotiated within months of the accident and entered

23. IAEA (1986), "Statement Issued on 5 May 1986 by the Heads of Government of Seven Major Industrial Nations and the Representatives of the European Community", IAEA Doc. INFCIRC/333.
24. Letter dated 14 May 1986 from the Permanent Representative of the Union of Soviet Socialist Republics to the United Nations addressed to the Secretary-General, A/41/339 (1986), Annex, "Address given on Soviet Television on 14 May 1986 by the General Secretary of the Central Committee of the Communist Party of the Soviet Union (CPSU)", pp. 5-7, http://undocs.org/A/41/339; Letter from Mr M. Gorbachev, General Secretary of the Central Committee of the Communist Party of the Soviet Union, to Dr H. Blix, Director General of the Agency (20 June 1986), IAEA Doc. INFCIRC/334.

into force before a year had passed.[25] The Convention on Nuclear Safety was adopted in 1994 and was followed by the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management in 1997.[26] Although nuclear liability conventions had been adopted in the early 1960s, the transboundary effects of Chernobyl spurred efforts to improve the conventions and achieve greater harmonisation between the existing instruments. The Joint Protocol linking the Paris and Vienna Conventions on nuclear liability was negotiated in 1988,[27] and further negotiations led to proposed revisions to both the Vienna and Paris Conventions and to a new Convention on Supplementary Compensation (CSC).[28] Some suggest that the accident had an impact as well on other instruments relating to nuclear safety and environmental protection.[29]

For some, the reaction to the negotiation of new international legal instruments after Chernobyl could be said to be, "It's about time!". From this point of view, nuclear energy had lagged in the development of a robust system of international legal instruments and was dominated by national systems of law and regulation that guarded themselves against external scrutiny. But Dr Norbert Pelzer offers a more balanced assessment of the lessons from Chernobyl in an article he wrote within a year of the accident:

> [O]ne can state that – long before the Chernobyl accident in 1986 – there has been a comprehensive régime of national and international norms to assure the safe use of peaceful nuclear energy and to guarantee just compensation in case of an incident. So the stable door seemed to be locked without giving the horse a chance to bolt. It bolted nevertheless, Chernobyl happened, and the management of the incident proved that there are still gaps in the system.[30]

25. Convention on Early Notification of a Nuclear Accident (1986), IAEA Doc. INFCIRC/335, 1439 UNTS 276, entered into force 27 Oct. 1986 (Early Notification Convention); Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1986), IAEA Doc. INFCIRC/336, 1457 UNTS 134, entered into force 26 Feb. 1987 (Assistance Convention).
26. Convention on Nuclear Safety (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 Oct. 1996 (CNS); Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997), IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001 (Joint Convention).
27. Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (1988), IAEA Doc. INFCIRC/402, 1672 UNTS 293, entered into force 27 Apr. 1992 (Joint Protocol).
28. Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (1997), IAEA Doc. INFCIRC/566, 2241 UNTS 302, entered into force 4 Oct. 2003 (1997 Vienna Protocol); Convention on Supplementary Compensation for Nuclear Damage (1997), IAEA Doc. INFCIRC/567, 36 ILM 1473, entered into force 15 April 2015 (CSC); Protocol to Amend the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (2004) (not yet in force), available at: www.oecd-nea.org/law/paris_convention.pdf (2004 Paris Protocol).
29. See Sands, P. (1996), "Observations on International Nuclear Law Ten Years after Chernobyl", *Review of European, Comparative & International Environmental Law* (*Reciel*), Vol. 5, Issue 3, Wiley-Blackwell Publishing, Oxford, p. 199.
30. Pelzer, N. (1987), "The impact of the Chernobyl accident on international nuclear energy law", *Archiv des Völkerrechts*, Vol. 25, No. 3, Mohr Siebeck Verlag, Tübingen, p. 295. Compare Tanguy, P. (1988), "Three decades of nuclear safety", *IAEA Bulletin*, Vol. 30, No. 2, pp. 51-57. For perspectives that preceded the Chernobyl accident, see Pelzer, N. (1981), "The nature end scope of international co-operation in connection with the peaceful uses of nuclear energy, and its limits - an assessment", *Nuclear Law Bulletin*, No. 27, OECD, Paris, pp. 34-49; de la Fuente, A.H. (1982), "The legal force of international rules relating to nuclear risks", *Nuclear Law Bulletin*, No. 30, OECD, Paris, pp. 47-59.

Despite the call to action prompted by the accident and the resulting negotiation of new legal instruments, the commentary on the development and text of the new instruments reflects a mixed reaction to the outcomes, both in views expressed contemporaneously with their negotiation as well as in retrospective reflection on what had been achieved. The cup was half full *and* half empty: the new instruments marked great progress in establishing international norms – but couldn't they have been much better?[31]

A. Early Notification and Assistance Conventions

Within a month of the accident, the IAEA Board of Governors had set out the path that would lead to the adoption of the Early Notification and the Assistance Conventions. In July 1986 the IAEA had invited experts to work toward developing a framework for notification and assistance in the event of a nuclear accident, and by the end of September 1986 the conventions had been adopted and opened for signature at a special session of the IAEA General Conference.[32]

Apart from the political will galvanised by the accident, several additional factors contributed to the conventions' swift negotiation. First, the focus was narrowed to the issues of notification of incidents posing a threat of radiological releases and of the provision of mutual assistance to mitigate the consequences of incidents and recover from them. Thus, the more complex and potentially controversial question was pushed down the road as to whether international instruments should lay out standards for the safety of nuclear installations or establish a scheme for ensuring adherence to such standards. The narrower approach can be understood as allowing states to focus on the possibility of "easy wins" to help restore public credibility after the Chernobyl accident and to avoid a stalemate over further progress had debate over safety standards turned to a focus on the argued defects in the Soviet reactor designs.[33]

Second, the existence of the relatively fresh guidelines in INFCIRC/310 and INFCIRC/321 that arose out of post-Three Mile Island discussions, as well as earlier related efforts, helped speed negotiation of the new Early Notification and Assistance Conventions by providing a baseline for their substantive content.[34] Third, the language of the conventions is extraordinarily flexible, so much so that the text is criticised as allowing states to simply decide for themselves how they will comply without repercussions. As Carlton Stoiber colourfully puts it, the conventions are full of "weasel words" that allow a state "to make its own determination about what action to take or what information to provide to other

31. See e.g. Sands, P. (1996), *supra* note 29, p. 200.
32. A good overview of the conventions is found in Moser, B. (1989), "The IAEA Conventions on Early Notification of a Nuclear Accident and on Assistance in the Case of a Nuclear Accident or Radiological Emergency", *Nuclear Law Bulletin*, No. 44, OECD, Paris, pp. 10-23. See also Pelzer, N. (1987), *supra* note 30, p. 299; Rautenbach, J., W. Tonhauser and A. Wetherall (2006), "Overview of the International Legal Framework Governing the Safe and Peaceful Uses of Nuclear Energy – Some Practical Steps", in NEA and IAEA (eds.), *International Nuclear Law in the Post-Chernobyl Period*, OECD, Paris, p. 9.
33. See Cameron, P. (1988), *supra* note 19, p. 20; Stoiber, C. (2018), "Inside nuclear baseball: Reflections on the development of the safety conventions", *Nuclear Law Bulletin*, No. 100, OECD, Paris, p. 61.
34. Adede, A.O. (1987), *The IAEA Notification and Assistance Conventions in the Case of a Nuclear Accident*, Graham and Trotman – Martinus Nijhoff, London, pp. xxii, 1 (Mr Adede was a legal adviser at IAEA and secretary to the Group of Experts that negotiated the conventions); Cameron, P. (1988), *supra* note 19, pp. 21-22; Pelzer, N. (1987), *supra* note 30, pp. 304-305. Mr Adede's view of the progress achieved through the conventions was criticised as too sanguine in one review. Sands, P. (1991), "Book Review", *British Yearbook of International Law*, Vol. 61, Issue 1, Oxford University Press, pp. 363-364.

parties", and they lack enforcement measures or strong dispute resolution procedures that would strengthen them.[35] For example, the Early Notification Convention essentially vests in the state where the incident occurs the discretion to determine the significance of the event for other states, thereby leading one to wonder whether the Soviet Union would have given notification of the Chernobyl accident had the convention been in force at that time.[36] Thus, some argue that the Early Notification Convention is weaker than other international instruments on reporting similar events or even customary law.[37] The Assistance Convention's provisions allowing a state to avoid dispute resolution by opting out of the provisions is similarly criticised.[38]

Nonetheless, the two conventions were praised for their swift negotiation and entry into force and are credited as making necessary progress, if only with modest effect, in the establishment of the international nuclear safety regime. Viewed from the perspective contemporaneous with their negotiation, the conventions are viewed as a "first step in the right direction" and of "considerable significance".[39]

B. The safety conventions

As noted earlier, consideration of a convention addressing the safety of nuclear power plants was deferred in the immediate aftermath of the Chernobyl accident. Finally, in 1990, member states of the European Community proposed the convening of a conference in 1991 to review the status of nuclear safety and to formulate recommendations at both a national and an international level.[40] The 1990 General Conference approved the proposal, and the special conference was held in early September 1991. Later that month, having received the report on the proceedings, the General Conference initiated the steps that would ultimately result in the development of a draft text of a convention. An open-ended "Group of Experts on a Nuclear Safety Convention" met seven times between May 1992 and February 1994

35. Stoiber, C. (2018), *supra* note 33, p. 62.
36. Pelzer, N. (1987), *supra* note 30, p. 303.
37. *Ibid.*; Sands, P. (1996), *supra* note 29, p. 200; Carroll, S. (1996), "Transboundary Impacts of Nuclear Accidents: Are the Interests of Non-Nuclear States Adequately Addressed by International Nuclear Safety Instruments?", *Reciel*, Vol. 5, Issue 3, p. 207; Politi, M. (1987), "The Vienna Conventions of September 26, 1986 on early notification and assistance in case of a nuclear accident or radiological emergency", in F. Vandenabeele (ed.), *Nuclear Inter Jura '87*, *Proceedings*, International Nuclear Law Association, Belgium, pp. C-93 to C-96.
38. Cameron, P. (1988), *supra* note 19, p. 29; Pelzer, N. (1987), *supra* note 30, p. 306; Politi, M. (1987), *supra* note 37, p. C-94.
39. Cameron, P. (1988), *supra* note 19, p. 32, *quoting* Pelzer, N. (1987), *supra* note 30, p. 306. See also Pelzer, N. (2006), "Learning the Hard Way: Did the Lessons Taught by the Chernobyl Accident Contribute to Improving Nuclear Law?" in *International Nuclear Law in the Post-Chernobyl Period*, *supra* note 32, pp. 78-79.
40. See Note by the Director General (1991), "Measures to Strengthen International Co-Operation in Matters relating to Nuclear Safety and Radiological Protection", IAEA Doc. GC(XXXV)/970, p. 1. Political developments such as the dissolution of the Soviet Union and the reunification of Germany provided renewed impetus for a nuclear safety convention. See Wellock, T. (2013), "The Children of Chernobyl: Engineers and the Campaign for Safety in Soviet-designed Reactors in Central and Eastern Europe", *History and Technology*, Vol. 29, No. 1, Routledge, London, pp. 3, 14-15; Stoiber, C. (2018), *supra* note 33, p. 63; Stoiber, C. (1999), "International Convention on Nuclear Safety: National Reporting as the Key to Effective Implementation", in N. Horbach (ed.), *Contemporary Developments in Nuclear Energy Law: Harmonising Legislation in CEEC/NIS*, Kluwer Law International, London, pp. 97, 98. The following two excellent synopses were drawn upon when describing the developments leading to the Convention on Nuclear Safety: Jankowitsch, O. (1994), "The Convention on Nuclear Safety", *Nuclear Law Bulletin*, No. 54, OECD, Paris, pp. 9-22, and Jankowitsch, O. and F. Flakus (1994), "International convention on nuclear safety: A legal milestone", *IAEA Bulletin*, Vol. 36, No. 3, pp. 36-40.

to shape the text that would be then submitted for consideration at a Diplomatic Conference convened in June 1994.

The preliminary work of the expert group is reflected in the final draft of the proposed convention and in the Convention on Nuclear Safety as it was adopted at the Diplomatic Conference. For example, the expert group agreed that the principles set out in a draft document on safety fundamentals would serve as the basis of the obligations of the parties to the Convention.[41] The incentive nature of the Convention's approach also stems from the deliberation of the expert group, as did the decision to focus the Convention on nuclear power plants and to defer consideration of an international agreement on safe waste management. The Convention on Nuclear Safety was opened for signature in September 1994 in conjunction with the 38th General Conference and came into force in October 1996.

Following the commitment (see CNS, Preamble (ix)) to further develop a convention that would address the safety of radioactive waste management, the General Conference in 1994 invited the Director General and the Board of Governors to begin preparations for such a convention.[42] An expert group prepared a draft text in March 1997. The Joint Convention follows in many respects the general framework of the Convention on Nuclear Safety, including the "incentive" model. One issue that required more extensive negotiation included the issue of the treatment of spent fuel (which reprocessing states would not consider "waste"); ultimately, consensus was achieved by using safe management as a common focus for both radioactive waste and for spent fuel – thus, a "joint convention" covering both. Other issues included (1) ensuring proper integration with the Convention on Nuclear Safety in treating waste stored on an installation site and the treatment of an installation when it entered the decommissioning phase, (2) coverage of waste related to military or defence programmes, and (3) provisions on transboundary movement of waste and spent fuel. The Joint Convention was adopted on 5 September 1997 at the conclusion of the Diplomatic Conference convened to consider the draft. The Joint Convention entered into force in June 2001.

The reaction to the conventions was mixed, ranging from cautious optimism over their potential for enhancing nuclear safety to blunt criticism of them as creating a toothless regime that fails to solidify specific norms or obligations on their adherents.[43] Viewpoints differed over the embrace of general principles of safety *versus* specific norms, the emphasis on state responsibility *versus* a more international system, and the incentive *versus* a sanctions approach under the conventions. As noted above, the expert groups who developed the convention drafts relied on the safety fundamentals document that had been recently issued by the IAEA rather than more precise binding technical standards. These advisory norms were thus recognised within the conventions as a baseline of acceptable common standards for safety, but the conventions stop short of elevating them to

41. IAEA (1993), *Safety Fundamentals: The Safety of Nuclear Installations*, Safety Series No. 110, superseded by IAEA (2006), *Fundamental Safety Principles*, IAEA Safety Standards Series, No. SF-1, IAEA, Vienna.
42. An overview of the negotiation of the Joint Convention is provided in Tonhauser, W. and O. Jankowitsch-Prevor (1997), "The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management", *Nuclear Law Bulletin*, No. 60, OECD, Paris, pp. 9, 12-21. The text and relevant official documents can be found in IAEA (2006), *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*, IAEA International Law Series No. 1, IAEA, Vienna.
43. Norbert Pelzer provides a good bibliography of commentary on the two conventions in his 2006 article "Learning the Hard Way: Did the Lessons Taught by the Chernobyl Accident Contribute to Improving Nuclear Law?", *supra* note 39, p. 88, nn. 77 and 78.

more stringent, enforceable requirements.[44] While some might defend the efficacy of this approach in the face of the variance among widely differing national systems, others would compare the approach unfavourably to the international standards governing the aviation and maritime industries.[45]

From the outset, tension was present between an approach resting upon state authority and responsibility as opposed to a more intrusive international inspection and sanctions regime.[46] Even in some of the earliest statements encouraging movement toward an international safety regime, IAEA Director General Hans Blix suggested:

> Whatever is done, however, it is important to retain the principle that responsibility for nuclear safety must remain with national governments. They alone can legislate. They alone exercise the power to enforce. They cannot be relieved of this duty by any international arrangements. But they might, of course, be required to comply with minimum standards.
>
> Whatever might be done as regards international safety standards, important steps could and should probably be taken in the sphere of international safety review of nuclear installations. I am not suggesting for your consideration a system of safety inspections in any way parallel to the safeguards. However, schemes falling short of such radical ideas and taking present programmes as a point of departure might have considerable value and be acceptable.[47]

The ultimate "incentive" approach of the conventions reflects a path that accommodates the tension between the competing considerations. In an oft-cited passage from her article on the Convention on Nuclear Safety, Odette Jankowitsch notes that the incentive character of the convention is intended to be synonymous with "encouragement" or "emulation", i.e. the peer reviews would be persuasive in encouraging states to achieve their obligations under the Convention and improve the safety of their facilities.[48] Notwithstanding the criticism of some commentators of the conventions as "disappointing" and failing to establish, or indeed evading, a "clearly binding international regime",[49] more recent assessments of the

44. See Lamm, V. (2017), "Reflections on the development of international nuclear law", *Nuclear Law Bulletin*, No. 99, OECD, Paris, pp. 31, 36, 41-43. Nonetheless, Chernobyl fostered greater discussion about common safety criteria, progress that should not be discounted given the variability in national approaches, not only between the Soviet Union and other nations, but among other states as well. See Wellock, T. (2013), *supra* note 40, pp. 6-8.
45. Compare Handl, G. (1988), "Transboundary Nuclear Accidents: The Post-Chernobyl Multilateral Legislative Agenda", *Ecology Law Quarterly*, Vol. 15, Issue 2, University of California Berkeley School of Law, Oakland, pp. 203, 207 with Kamminga, M. (1995), "The IAEA Convention on Nuclear Safety", *International and Comparative Law Quarterly*, Vol. 44, Issue 4, Cambridge University Press, Cambridge, pp. 872, 873.
46. See Reyners, P. (1996), "The Convention on Nuclear Safety of 1994", *Reciel*, Vol. 5, Issue 3, p. 231, 232 and 234; Pelzer, N. (2006), *supra* note 39, p. 87.
47. Director General's Statement to Meeting of the Board of Governors, 21 May 1986, at 11; see also Blix, H. (1986), "The post-Chernobyl outlook for nuclear power", *IAEA Bulletin*, Vol. 28, No. 3, IAEA, Vienna, pp. 9, 11.
48. Jankowitsch, O., "The Convention on Nuclear Safety", *supra* note 40, p. 13. Ms Jankowitsch served as secretary to the Group of Experts and was an IAEA legal advisor.
49. See Kamminga, M. (1995), *supra* note 45, p. 880; Szasz, P. (1994), "Introductory Note, International Atomic Energy Agency: Convention on Nuclear Safety", *International Legal Materials*, Vol. 33, pp. 1514, 1515; Cameron, P. (1999), "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management", in N. Horbach (1999), *supra* note 40, pp. 117, 128. Boustany, K. (1998), "The Development of Nuclear Law Making or the Art of Legal 'Evasion'", *Nuclear Law Bulletin*, No. 61, OECD, Paris, pp. 39-53.

conventions' incentive approach have been more favourable, if still advising some caution.[50]

C. The nuclear liability conventions

At the time of the Chernobyl accident a nuclear liability regime of sorts existed in the international sphere in the form of two independent conventions: the 1960 Paris Convention established under OECD auspices (with the additional compensation scheme established under the Brussels Supplementary Convention) and the 1963 Vienna Convention under IAEA auspices.[51] Although the two conventions shared common principles, such as strict liability, channelling of liability to the operator, the obligation to maintain financial security, and assignment of jurisdiction, there was no link between the conventions. Thus, a victim would be likely shut out of compensation for injuries suffered if the accident occurred in a neighbouring state that was party to a different convention than the one to which the state where the victim lived adhered.

Attempts to link the two conventions stretched back to the time that the Vienna Convention had been adopted in 1963. A serious effort to negotiate a joint protocol linking the conventions gained some traction in 1974 but fell by the wayside. Work recommenced in 1984, but the Chernobyl accident – the first with significant transboundary effects – finally inspired an intentional focus on linking the existing conventions through the Joint Protocol adopted in 1988 as well as working further toward the improvement of the individual conventions.[52] That the Soviet Union did not adhere to an existing liability convention and the low likelihood of obtaining an enforceable judgment in Soviet courts added to the call for expanding and improving the existing liability regime.[53] Moreover, the conventions enjoyed relatively limited adherence. Although the Paris-Brussels regime in 1986 included fourteen OECD states in Europe as members (including all countries that operated nuclear power plants), only ten states had ratified the Vienna Convention.

50. Handl, G. (2003), "The IAEA Nuclear Safety Conventions: An Example of Successful 'Treaty Management'?", *Nuclear Law Bulletin*, No. 72, OECD, Paris, pp. 7-27; Pelzer, N. (2006), *supra* note 39, pp. 93-95; de Wright, T. (2007), "The 'Incentive' Concept as Developed in the Nuclear Safety Conventions and its Possible Extension to Other Sectors", *Nuclear Law Bulletin*, No. 80, OECD, Paris, pp. 29-47; Montjoie, M. (2015), "Treaty implementation applied to conventions on nuclear safety", *Nuclear Law Bulletin*, No. 96, OECD, Paris, pp. 9-34.
51. Convention on Third Party Liability in the Field of Nuclear Energy of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (1960), 1519 UNTS 329 (Paris Convention or PC); Convention of 31st January 1963 Supplementary to the Paris Convention of 29th July 1960, as amended by the Additional Protocol of 28th January 1964 and by the Protocol of 16th November 1982 (1963), 1041 UNTS 358 (Brussels Supplementary Convention or BSC); Vienna Convention on Civil Liability for Nuclear Damage (1963), IAEA Doc. INFCIRC/500, 1063 UNTS 266, entered into force 12 Nov. 1977.
52. See IAEA (2013), *The 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention – Explanatory Text*, International Law Series No. 5, IAEA, Vienna, pp. 4-8; Busekist, O. (1989), "A Bridge Between Two Conventions on Civil Liability for Nuclear Damage: the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention", *Nuclear Law Bulletin*, No. 43, OECD, Paris, pp. 10, 11-14.
53. See, e.g. Country report for Federal Republic of Germany (1986), "Compensation for Damage caused by the Chernobyl Accident under the Atomic Energy Act (1986)", *Nuclear Law Bulletin*, No. 38, OECD, Paris, pp. 21-22; Country report for Sweden (1986), in *ibid.*, pp. 33-34 (addressing compensation to victims suffering damage from the Chernobyl accident).

Only two of them – Argentina and Yugoslavia – operated nuclear power facilities, and none of the Soviet satellite states adhered to the Vienna Convention.[54]

The Joint Protocol was the initial task intended to improve the liability regime. The IAEA and NEA experts worked on a proposal in 1986 and 1987, and the IAEA Board of Governors' and the OECD Council's respective actions approved the holding of a Diplomatic Conference to consider the texts. The Diplomatic Conference adopted the draft text on 21 September 1988 and it entered into force in April 1992 upon the ratification or accession of five states party to the Paris and five states party to the Vienna liability conventions.[55]

The conclusion of the Joint Protocol was widely viewed as only a first, though necessary, step toward invigorating the international nuclear liability regime.[56] The Joint Protocol only linked those within the existing Paris and Vienna regimes that ratified the Joint Protocol; it did not attempt to otherwise improve the compensation scheme under the conventions. Focusing on "modernising" the liability conventions was the next step. However, the journey toward an improved liability regime since Chernobyl has been a lengthy one, as evidenced by the time that it took after the accident occurred to negotiate revisions to the Vienna and Paris Conventions – 11 and 16 years respectively. Moreover, the CSC, an additional convention developed under IAEA auspices concurrent with the 1997 Vienna Protocol, only recently came into force in 2015, and the Paris- Brussels regime's revisions have yet to come into force.

Among other things, improvements to the liability regime focused on increasing the minimum liability amount, compensating a broader range of damage (including for the first time the environmental and economic costs of an accident), compensating more victims by widening the geographical scope of the regimes, and extending the prescription period within which victims may make their claims.[57] Work on revising the Vienna Convention began in 1989 and was ultimately shepherded by a Standing Committee on Liability for Nuclear Damage that held 17 sessions from 1990 to 1997. In its early stages, discussion focused not only on the liability of individuals or juridical entities under the law but also on the question of state liability in the event of an accident.[58] Ultimately, however, the work centred on

54. See IAEA (1988), "Special Report, Highlights of the IAEA General Conference: 32nd regular session", *IAEA Bulletin*, Vol. 30, No. 4, IAEA, Vienna, p. 35.
55. See IAEA (2013), *supra* note 52, pp. 6-10.
56. See Boulanenkov, V. and B. Brands (1988), "Nuclear Liability: Status and prospects", *IAEA Bulletin*, Vol. 30, No. 4, pp. 5-9; Sands, P. (1996), *supra* note 29, p. 200; Carroll, S. (1996), *supra* note 37, pp. 208-209.
57. "Progress towards a global nuclear liability regime" (2014), *Nuclear Law Bulletin*, No. 93, OECD, Paris, pp. 9-23. An earlier version of this note was developed as a background document for the policy debate on nuclear liability held in April 2014 before the NEA Steering Committee. Appendix 1, pp. 21-22 (outlines the enhancements under the revised conventions).
58. IAEA (2007), *The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage – Explanatory Texts*, IAEA International Law Series No. 3, pp. 18-19; see Pelzer, N. (1987), *supra* note 30, p. 308; see also Lamm, V. (1998), "The Protocol amending the 1963 Vienna Convention", *Nuclear Law Bulletin*, No. 61, OECD, Paris, pp. 7-24.

revision to the Convention and on establishing an approach to supplemental funding.[59]

The Protocol to Amend the Vienna Convention was adopted at a Diplomatic Conference on 12 September 1997 and entered into force on 4 October 2003. The 1997 Vienna Protocol exists concurrently with the 1963 Vienna Convention. Thus, states may accede to the 1963 Vienna Convention only; the Vienna Convention *and* its 1997 Protocol; or the 1997 Vienna Protocol but not to the 1963 convention. The Diplomatic Conference also adopted the CSC, which is open to all states, including those already parties to the Paris-Brussels or Vienna regimes. Support for establishing a mechanism to provide supplementary funds to compensate nuclear damage arose during the discussion of the new Vienna Protocol, which would be over and above the amounts to be provided by the operator under the Paris and Vienna Conventions. The system of supplementary state funding in the CSC was modelled in part on the Brussels Supplementary Convention.

The CSC provides for a two-tier compensation system: the first tier is provided by the operator and, if necessary, the state where its installation is situated; the second tier is provided by the CSC states. The CSC allows a state to establish at its option a third tier of compensation. The CSC was also intended to provide the basis for a global liability regime to supplement and enhance the measures provided in the Paris and Vienna regimes. Importantly, the CSC allowed the United States to join an international nuclear liability convention without amending its national law, the Price-Anderson Act, 42 USC Section 2210, which provides for economic channelling of liability to the operator rather than the legal channelling approach provided in the conventions. The free-standing nature of the CSC and its structure gave support to the argument that the CSC lays the foundation for a more global liability regime.[60]

The parties to the Paris-Brussels regime participated in the discussions on the 1997 Protocol and soon moved to improve their own regime.[61] On 12 February 2004, the Protocol to Amend the Paris Convention and the Protocol to Amend the Brussels Supplementary Convention were signed. The protocols have yet to enter into force, mainly because a decision of the Council of the EU of 8 March 2004 requires that the contracting parties to the Paris Convention that are also EU members "take the necessary steps to deposit simultaneously their instruments of ratification of the

59. A rich record of the viewpoints of experts on the changes to the liability system leading to the revised Vienna Convention and ultimately the revised Paris-Brussels regime can be found in a series of NEA publications on the subject. See NEA (2000), *Reform of Civil Nuclear Liability: Budapest Symposium 1999*, OECD, Paris; NEA (1994), *Liability and Compensation for Nuclear Damage: An International Overview*, OECD, Paris; NEA (1992), *Nuclear Accidents: Liabilities and Guarantees*, Proceedings of the Helsinki Symposium Organised Jointly by the NEA and IAEA, OECD, Paris. These publications are available at: NEA (2018), "Nuclear liability publications, workshops and symposia", www.oecd-nea.org/law/nuclear-liability-pubs-workshops-symposia.html (accessed 5 Dec. 2018).
60. McRae, B. (1998), "The Compensation Convention: Path to a Global Regime for Dealing with Legal Liability and Compensation for Nuclear Damage", *Nuclear Law Bulletin*, No. 61, OECD, Paris, pp. 25-38.
61. Dussart-Desart, R. (2005), "The Reform of the Paris Convention on Third Party Liability in the Field of Nuclear Energy and of the Brussels Supplementary Convention", *Nuclear Law Bulletin*, No. 75, OECD, Paris, pp. 7-33. Unofficial consolidated texts of both revised conventions under the protocols are published in NEA (2005), *Supplement to Nuclear Law Bulletin*, No. 75, OECD, Paris.

Protocol, or accession to it".[62] At the time, this requirement did not seem to be a constraint, but it ultimately became one. Only Italy among the Paris Convention states has yet to conclude its national prerequisites for ratification of the 2004 Protocols.

Building on the common principles that underlie the original liability conventions, the efforts to improve the international liability regime did make progress in the years after Chernobyl. A broader range of compensable damages, longer time to make claims and a wider group of covered claimants are provided in the revised and new conventions. Moreover, a substantial increase in the minimum liability amounts was achieved: e.g. from operator liability of 15 million Special Drawing Rights (SDR, equivalent to about EUR 18.1 million or USD 21 million) maximum to EUR 700 million minimum under the revised Paris Convention and, under the 1997 Vienna Protocol, from USD 5 million in gold valued at USD 35 per troy ounce adjusted to reflect the current price of gold (about USD 172 million or EUR 123 million with gold at USD 1200 per troy ounce) to SDR 300 million (about EUR 362 million or USD 421 million). Despite these improvements, progress was slow in the 25 years that lapsed between the Chernobyl and Fukushima Daiichi accidents. By 2011 neither the CSC nor the 2004 Paris and Brussels protocols had taken force, and adherence to the 1997 Vienna Protocol was modest. Whatever momentum Chernobyl had prompted seemed to have lost its steam.[63]

III. Fukushima Daiichi

The Great East Japan Earthquake struck north-eastern Japan on 11 March 2011, approximately 130 km east of the city of Sendai and approximately 370 km northeast of Tokyo, Japan.[64] The magnitude 9.0 earthquake and ensuing tsunami caused widespread devastation, including the loss of over 15 000 lives and disruption of local infrastructure. Eleven operating nuclear power plants along the north-eastern coast of Japan shut down automatically, including three plants operating at the six-unit Fukushima Daiichi station. At the time of the accident, Units 1 through 3 were operating, Unit 4 (located adjacent to Unit 3) had no fuel in its reactor, and Units 5 and 6, which are located separately from Units 1-4 on the site, were shut down for routine maintenance and refuelling. The plants were boiling water reactors designed by the General Electric Company. The station lost power from the electrical grid, and flooding caused by the tsunami waves, including one as high as 15 metres, rendered all but one of the site's diesel generators incapable of supplying back-up power. As a consequence, four of the units at the site entered a condition called "station blackout", meaning the only electric power available came from station

62. Council Decision 2004/294/EC of 8 March 2004 authorising the member states to ratify, in the interest of the European Community, the Protocol of 12 February 2004 amending the Paris Convention, *Official Journal of the European Union* (OJ) L 97 (1 Apr. 2004), p. 53. The Council had to authorise member states that are contracting parties to the Paris Convention to ratify the 2004 Protocol to amend the Convention because some of its provisions concern the judicial resolution of disputes, a subject that, according to EU law, falls under the EU's exclusive competence.
63. See Pelzer, N. (2010), "Main Features of the Revised International Regime Governing Nuclear Liability – Progress and Standstill", in NEA (ed.), *International Nuclear Law: History, Evolution and Outlook*, OECD, Paris, pp. 355, 382-386.
64. The description of the accident is adapted from Burns, S. (2012), "The Fukushima Daiichi Accident: The International Community Responds", *Washington University Global Studies Law Review*, Vol. 11, No. 4, Washington University, St. Louis, pp. 739, 741-45, and the references cited therein. The IAEA has issued a multi-volume report addressing the accident and the lessons learnt therefrom. IAEA (2015), *The Fukushima Daiichi Accident: Report by the Director General*, GC(59)/14, Vols. 1-6, IAEA, Vienna. Volume 1 contains an executive summary.

batteries, which are capable of providing power only in terms of hours, not days. Although Units 1 through 3 had shut down automatically as designed in response to the earthquake itself, continued cooling of the reactor cores was necessary to remove residual heat and required the operability of equipment that relies in part on electric power.

Not only did workers at the plant have to deal with securing the operation of critical safety equipment, but they also faced significant damage to site infrastructure from the earthquake and tsunami. The damage complicated the workers' ability to access parts of the plant and conduct other recovery operations. Despite valiant efforts to cool the plants, adequate core cooling was lost within hours in the Unit 1 reactor, within 36 hours in Unit 3, and 71 hours in Unit 2. As a consequence, the fuel in each of these reactors was damaged.

Explosions caused by the ignition of hydrogen gas released from the damaged fuel in the reactors impaired the functionality of equipment and the integrity of structures at the site, thereby further complicating site operations and recovery. Concerns also arose over the cooling capability for the spent fuel pools in each unit. At first, some debate occurred over whether the spent fuel pool in Unit 4 had been substantially drained; loss of spent fuel cooling capability could lead to fuel damage and radioactive releases. This turned out not to be the case. Units 5 and 6, which are separated from the other Daiichi units and built on higher ground, were brought to a safe condition, in part relying on the single diesel generator that remained operable at Unit 6.

The Japanese government initially ordered evacuation of residents within a 2-km zone, increased it to 10 km from the site and then expanded the evacuation to as far as 30 km from the site. In April 2011, the government established a restricted area within 20 km of the site to allow temporary access for members of the public but excluded the public within 3 km. Unlike Chernobyl, no early health effects much less deaths were observed due to radiation exposure of workers or nearby residents, and no discernible latent radiation health effects are expected. No significant radioactive releases were experienced outside of Japan. Japan did initiate communication with the IAEA within about an hour and a half after the earthquake, consistent with the Early Notification Convention, and member states began enquiring about plant status through the IAEA's contact points for the Early Notification and Assistance Conventions about three hours after the earthquake. Japan did not formerly seek aid under the Assistance Convention.[65]

The accident occurred a few weeks before the scheduled Fifth Review Meeting in early April 2011 of the contracting parties to the Convention on Nuclear Safety. At the conclusion of the review meeting, the contracting parties adopted a statement committing themselves to achieving high levels of nuclear safety through the enhancement of national measures and international co-operation, to preventing and mitigating accidents, and to carry out efforts to ensure the safety of existing and planned nuclear plants from the lessons learnt from the accident.[66] The parties also committed themselves to holding a dedicated meeting on the accident in 2012 at which the parties would consider lessons learnt from the accident and "if necessary, the continued suitability of the provisions of the Convention on Nuclear Safety". IAEA Director General Yukiya Amano announced the convening of a ministerial conference in June 2011 to make an initial assessment of the accident and its bearing on the international regime for emergency response and for safety.

65. IAEA (2015), *supra* note 64, Vol. 1, pp. 94-96; *ibid*., Vol. 3, p. 131, Table 3.5 (timeline of events) and pp. 134-137.
66. IAEA, "Summary Report of the 5th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 4-14 April 2011", IAEA Doc CNS/RM/2011/6/Final, pp. 2-3.

In early June, the G-8 and the NEA held an International Ministerial Seminar on Nuclear Safety in Paris followed by a meeting of nuclear regulators.[67] These meetings were followed shortly thereafter by the ministerial conference on nuclear safety at the IAEA in Vienna.[68] As a result of the June ministerial conference, the IAEA developed a draft "Action Plan" of items for member states, operators, the IAEA, and other multinational organisations to carry out to strengthen nuclear safety. All 151 member states endorsed the plan at the General Conference on 22 September 2011.[69]

A. Impact on the emergency response and safety regime

The IAEA Action Plan encouraged the co-operation and involvement of member states in implementing 12 main actions:

- safety assessments of nuclear power plants in light of lessons learnt from the accident;
- strengthening peer reviews conducted by the IAEA;
- strengthening emergency preparedness and response capabilities;
- strengthening the effectiveness of national regulatory bodies;
- strengthening the effectiveness of operating organisations with respect to nuclear safety;
- reviewing and strengthening IAEA Safety Standards and improving their implementation;
- improving the effectiveness of the international legal framework;
- facilitating the development of the infrastructure necessary for member states embarking on a nuclear power programme;
- strengthening and maintaining capacity building (i.e. ensuring available human resources necessary for safe nuclear power operation);
- protecting people and the environment from ionising radiation following an emergency;
- enhancing the transparency and effectiveness of communications and improving the dissemination of information; and
- effectively utilising research and development.

67. The NEA produced a report on the forum. NEA (2011), "Proceedings of the Forum on the Fukushima Accident: Insights and Approaches", NEA Doc. NEA/CNRA/R(2012)12, OECD, Paris.
68. See IAEA (2011), "Declaration by the IAEA Ministerial Conference on Nuclear Safety in Vienna on 20 June 2011", IAEA Doc. INFCIRC/821; IAEA (2011), Report by the Director General, "IAEA Ministerial Conference on Nuclear Safety 20-24 June 2011", IAEA Doc. GOV/INF/2011/13-GC(55)/INF/10.
69. IAEA (2011), "Draft IAEA Action Plan on Nuclear Safety", Report by the Director General, IAEA Doc. GOV/2011/59-GC(55)/14, endorsed by the IAEA General Conference in Resolution, "Measures to strengthen international cooperation in nuclear, radiation, transport and waste safety", IAEA Doc. No. GC(55)/RES/9 (22 Sept. 2011; IAEA (2011), "Initial Progress in Implementation of the IAEA Action Plan on Nuclear Safety", Report by the Director General, IAEA Doc. GOV/INF/2011/15, sec. A.2.

As to improving the effectiveness of the international legal framework, the Action Plan calls on states, in the context of nuclear safety,

> to explore mechanisms to enhance the effective implementation of the Convention on Nuclear Safety, the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, the Convention on the Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, and to consider proposals made to amend the Convention on Nuclear Safety and the Convention on the Early Notification of a Nuclear Accident.[70]

The focus on the safety implications of the accident was not carried out solely through the international framework. National and regional responses to the accident led the way, whether in focusing on plant safety or re-assessing national policy on generating power from nuclear plants. For example, the European Union initiated "stress tests" (a term borrowed from the recent global financial crisis) to assess the safety of nuclear power plants and took other steps that eventually resulted in the adoption of revised safety directive in 2014. In the United States, the NRC constituted a task force to evaluate the implications of the accident for US plants and ultimately required measures to improve plant equipment, to enhance capability to cope with severe accidents, and to re-evaluate natural hazards such as seismic and flooding events that could adversely affect plants. Japan initiated a process to reassess the safety of its reactor fleet and changed its regulatory structure in the face of withering criticism of its institutions as having caused a "man-made disaster" at the Fukushima Daiichi station.[71] As to energy policy, Germany is notable for its swift decision – the *Energiewende* – to transition away from nuclear energy production.[72]

The Fukushima Daiichi accident has been a catalyst for a re-examination of the underlying assumptions of the framework for nuclear safety and a cause for reflection on the capacity and integrity of the responsible institutions. However, as for the international conventions related to nuclear safety, no changes have been made as a consequence of the Fukushima Daiichi accident. This should not be viewed as a failure of the international system but the result of the necessary and ultimately more productive focus on technical criteria, mitigation measures and public protection, and the resulting improvement of the "soft law" guidance and standards arising out of the lessons learnt from the accident.

Although the IAEA Action Plan identified, for example, potential changes to the Early Notification Convention as a task, the IAEA and its members worked on enhancing communication as well as assessment and dissemination of information in the context of the existing conventions as a means to productive improvement of

70. IAEA Draft Action Plan, *supra* note 69, p. 4.
71. See Burns, S. (2012), *supra* note 64, pp. 745-750, 758-759. The updated EU Directive was issued as 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations, OJ L 219 (25 July 2014), p. 42 (2014 Amended Safety Directive).
72. On the ups and downs of Germany's policy on nuclear power, see Winter, G. (2013), "The Rise and Fall of Nuclear Energy Use in Germany: Processes, Explanations and the Role of Law", *Journal of Environmental Law*, Vol. 25, Issue 1, Oxford University Press, Oxford, pp. 95-124.

the system of notification and assistance.[73] The Russian Federation had offered a proposal to amend the Early Notification Convention, but the required majority of contracting parties did not request the convening of a Diplomatic Conference to consider the proposal.[74]

Amendments to the Convention on Nuclear Safety were offered by Russia, Spain and Switzerland, but only a later Swiss amendment reached consideration at a Diplomatic Conference in 2015 where the contracting parties agreed to a non-binding declaration in lieu of the proffered amendment. Under Article 32 of the Convention on Nuclear Safety, proposed amendments to the Convention are considered at a review meeting or at an extraordinary meeting, and proposed amendments may be adopted by consensus or, in the absence thereof, submitted to a Diplomatic Conference if two-thirds of the parties present and voting at the meeting approve. Although Spain withdrew its proposal, Swiss and Russian proposals came before the 2012 extraordinary meeting that the contracting parties had agreed to hold after the Fifth Review Meeting.[75]

The Swiss proposal included amendments aimed at greater transparency, by requiring periodic reviews of national regulatory bodies (e.g. through an IAEA Integrated Regulatory Review Service mission) and public dissemination of the regulatory body's findings and by making country reports under the Convention publicly available and deleting the provision in the Convention providing for confidentiality of the debates at the review meetings on country reports. As to the safety of installations, the Swiss proposal would require systematic safety assessments based on updated information from operating experience and state of the art hazards assessments of the facility and its siting, design reviews by external experts to ensure compliance with IAEA standards, external reviews of operational safety, i.e. through OSART missions conducted by the IAEA. Russia proposed including requirements for regular assessment of existing installations, noting IAEA safety standards as a basis for the regular assessment of a plant, and requiring that plant designs take into account an integrated assessment of unfavourable natural and "man-made" hazards affecting a site. The proposal also focused on institutional aspects, such as ensuring the requisite infrastructure and planning to support construction of new facilities and to ensure integration of relevant national bodies

73. IAEA (2015), *supra* note 64, Vol. 1, pp. 96-99; see also IAEA (2015), *Assessment and Prognosis in Response to a Nuclear or Radiological Emergency*, International Experts Meeting 20-24 April 2015, IAEA/IEM/IX, IAEA, Vienna and IAEA (2013), *Preparedness and Response for a Nuclear or Radiological Emergency in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant*, IAEA/REP/EPR, IAEA, Vienna (the reports are the result of experts' meetings conducted under IAEA auspices).
74. Johnson, P.L. (2014), "Opening Address: Developments in Nuclear Law", in R.F. Manovil (ed.), *Nuclear Law in Progress*, Proceedings of 21st International Nuclear Law Association Congress, Legis, Buenos Aires, pp. 13, 18-19. The Russian proposal would have specified the contracting party's obligation to report within 24 hours of specified information on the incident (including a preliminary assessment of the accident on the International Nuclear and Radiological Event Scale) and its obligation to make accessible environmental monitoring information and to post that information on its competent authority's website. Letter from S.V. Kirienko, Director General of the State Atomic Energy Corporation, to Yukiya Amano, Director General, IAEA (20 June 2011), forwarding "Proposals of the Russian Federation for amendments to the Convention on Early Notification of a Nuclear Accident".
75. IAEA, "Progress in the Implementation of the IAEA Action Plan on Nuclear Safety, Supplementary Information", IAEA Doc. GOV/INF/2012/11-GC(56)/INF/5, p. 22, para. 138.; Johnson, P.L. (2013), "The post-Fukushima Daiichi response: The role of the Convention on Nuclear Safety in strengthening the legal framework for nuclear safety", *Nuclear Law Bulletin*, No. 91, OECD, Paris, pp. 7, 14-15.

and operating organisations have resources and authority for effective emergency management and accident mitigation.[76]

At the extraordinary meeting held in August 2012 (only the second such meeting to have been held under the Convention), the contracting parties decided to establish a working group on "effectiveness and transparency" to consider actions to strengthen the Convention and to take into account potential amendments, including the Russian and Swiss proposals.[77] The working group's efforts resulted primarily in proposed revisions to various guidance documents and its report was considered at the Sixth Review Meeting of the Convention on Nuclear Safety held in March through April 2014.[78] The record of the Sixth Review Meeting reflects no further action on the original Russian and Swiss proposals, but Switzerland had submitted a new proposal in December 2013 to be considered at the Review Meeting.

Although Switzerland complimented the efforts of the working group to improve the review process of the Convention, it also suggested an amendment to Article 18 to emphasise "the critical importance" of maintaining containment integrity, a lesson of the Three Mile Island, Chernobyl and the Fukushima Daiichi accidents:

> Nuclear power plants shall be designed and constructed with the objectives of preventing accidents and, should an accident occur, mitigating its effects and avoiding releases of radionuclides causing long-term off site contamination. In order to identify and implement appropriate safety improvements, these objectives shall also be applied at existing plants.[79]

The Swiss amendment was comparable to the EU's 2014 Amended Safety Directive, particularly Article 8's admonition that member states implement the "objective of preventing accidents" and mitigating their consequences so as to avoid radioactive releases that would hamper initial emergency response or "would require protective measures that could not be limited in area or time".

At the Sixth Review Meeting, the necessary two-thirds majority of the contracting parties (only Canada and the United States dissented) decided to refer the new Swiss proposal to a Diplomatic Conference, which was held on 9 February 2015.[80] An informal working group held several meetings in preparation for the conference. Ultimately, the contracting parties concluded that consensus was not possible on the amendment.[81] A number of major nuclear power states, such as Russia and the United States, did not support the amendment. Arguments against the amendment questioned whether it added any real value, i.e. that it was unnecessary in light of the existing text of Article 18 addressed to the design of nuclear facilities and of the changes to relevant guidance documents to address lessons from the Fukushima Daiichi accident. Moreover, the amendment could be counterproductive. A long time might be required to attain the needed assent of two-thirds of the contracting parties; the outcome could also bifurcate the

76. The Swiss and Russian proposals are attached to the Final Summary Report, 2nd Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety, 27-31 Aug. 2012, IAEA Doc. CNS/ExM/2012/04/Rev.2.
77. *Ibid.*, p. 9, para. 33.
78. Lacoste, A.-C. (2014), "Summary Report", 6th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 24 March–4 April 2014, IAEA Doc. CNS/6RM/2014/11_Final, p. 10, para. 41.
79. *Ibid.*, Annex 1, "Proposal to amend the CNS by Switzerland".
80. *Ibid.*, p. 10, para. 42; "Summary Report", Diplomatic Conference to consider a Proposal by Switzerland to amend the Convention on Nuclear Safety, 9 Feb. 2015, IAEA Doc. CNS/DC/2015/3/Rev.2.
81. "Summary Report", *supra* note 80, para. 11.

convention scheme into groups of states that either were party to the amendment or were not.[82]

The contracting parties instead agreed to adopt the "Vienna Declaration on Nuclear Safety" that reiterated principles of the Convention on Nuclear Safety to prevent accidents and mitigate their consequences.[83] The Vienna Declaration provides with respect to the safety of installations:

1. New nuclear power plants are to be designed, sited, and constructed, consistent with the objective of preventing accidents in the commissioning and operation and, should an accident occur, mitigating possible releases of radionuclides causing long-term off site contamination and avoiding early radioactive releases or radioactive releases large enough to require long-term protective measures and actions.

2. Comprehensive and systematic safety assessments are to be carried out periodically and regularly for existing installations throughout their lifetime in order to identify safety improvements that are oriented to meet the above objective. Reasonably practicable or achievable safety improvements are to be implemented in a timely manner.

States' requirements for addressing the objectives are to take into consideration relevant IAEA safety standards and other "good practices" through the life of the plant. The contracting parties also agreed to address these principles in their national reports for the Seventh Review Meeting scheduled for 2017.

The Vienna Declaration simply reaffirms the objectives of the Convention on Nuclear Safety; it neither replaces the Convention nor does the Declaration place any legal requirements upon the contracting parties. But, as one observer notes, the future treatment of the Vienna Declaration could lead to its consideration as customary international law depending on its application in future review meetings

82. See Stoiber, C. (2015), "Developments in the Law of Nuclear Safety: the Vienna Declaration", in C. Raetzke, U. Feldmann, A. Frank (eds.), *Aus der Werkstatt des Nucklearrechts*, Nomos Verlag, Baden-Baden, pp. 397, 405-406; Durand-Poudret, E. (2015), "Towards a new international framework for nuclear safety: Developments from Fukushima to Vienna", *Nuclear Law Bulletin*, No. 95, OECD, Paris, pp. 27, 32, 35.

83. "Summary Report", *supra* note 80, Annex I, "Vienna Declaration on Nuclear Safety", IAEA Doc. CNS/DC/2015/2/Rev.1. The text of the Vienna Declaration is also published as INFCIRC/872. The Swiss characterised the outcome of the conference a success even though their amendment did not gain consensus. Swiss Federal Nuclear Safety Inspectorate (ENSI) (9 Feb. 2015), News Post, "International community adopts Swiss idea for improving nuclear power plant safety" (comments of Dr Hans Wanner), www.ensi.ch/en/2015/02/09/international-community-adopts-swiss-idea-for-improving-nuclear-power-plant-safety/. However, others noted their disappointment with the outcome. For example, the Autorité de sûreté nucléaire [Nuclear Safety Authority] (ASN), the French nuclear regulator, issued a press release stating:

> The general objectives of nuclear safety of the Convention remain below the legally-binding dispositions of the European directive on Nuclear Safety revised in 2014. This situation might lead to a two-tier nuclear safety in the world, which would eventually be detrimental to all the countries. Anyway, the outcome of the negotiations does not live up to the issues at stake, recalled by the Fukushima Daiichi accident. ASN will keep on promoting the highest safety standards at the international level.

ASN, Press Release, "Diplomatic Conference of the Convention on Nuclear Safety: ASN considers the outcome does not live up to the safety issues at stake after the Fukushima Daiichi accident and will keep on promoting the highest safety standards" (10 Feb. 2015), www.french-nuclear-safety.fr/Information/News-releases/CSN-ASN-considers-the-outcome-does-not-live-up-to-the-safety-issues.

and treatment in IAEA standards and review missions.[84] The contracting parties at the Seventh Review Meeting in 2017 agreed to address the Declaration's principles in their country reports and the discussions and agreed to reference the declaration in the introductory section of the guidelines on preparation of national reports for the Convention review meetings.[85] The Declaration certainly is viewed as a vital instrument shaping the safety perspective by some states, particularly within Europe.[86] However, the extent to which the emphasis on the Vienna Declaration will continue more broadly is yet to be seen.

B. Nuclear liability

Although the Fukushima Daiichi accident did not have appreciable transboundary effects, the scope of damage and Japan's implementation of its scheme to provide for compensation drew the attention of the international community.[87] With respect to nuclear liability, the IAEA Action Plan on Nuclear Safety calls on:

> Member States to work towards establishing a global nuclear liability regime that addresses the concerns of all States that might be affected by a nuclear accident with a view to providing appropriate compensation for nuclear damage. The IAEA International Expert Group on Nuclear Liability (INLEX) to recommend actions to facilitate achievement of such a global regime. Member States to give due consideration to the possibility of joining the international nuclear liability instruments as a step toward achieving such a global regime.[88]

INLEX was established as an advisory group to the Director General in 2003. In response to the Action Plan, INLEX issued in 2012 a set of recommendations to facilitate progress toward a global nuclear liability regime and to encourage both nuclear and non-nuclear states to consider joining one or more of the relevant

84. Stoiber, C. (2015), *supra* note 82, p. 407.
85. "Summary Report", Seventh Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, 27 March – 7 April 2017, IAEA Doc. CNS/7RM/2017/08/Final, pp. 2, 4, 6, 10, para. 2, 13, 22-24, 40-41. The change to the introduction to IAEA INFCIRC 572, *Guidelines regarding National Reports under the Convention on Nuclear Safety* is reflected in Rev. 6, p. 1, para. 3, issued 19 Jan. 2018.
86. See Western European Nuclear Regulators Association (WENRA) (2016), *Position Paper: WENRA Input to IAEA Safety Strategy*, pp. 3, 5-6, available at www.wenra.org/media/filer_public/2017/07/21/wenra_position_paper_iaea_strategy.pdf. A recent news post by the Swiss regulatory authority contains criticism of non-European states (with the exception of Japan) in the context of the Vienna Declaration. ENSI, News Post, "The lessons from Fukushima must not be forgotten" (14 Sept. 2018), www.ensi.ch/en/2018/09/14/the-lessons-from-fukushima-must-not-be-forgotten/:
    > "The Vienna Declaration stands for a culture that is characterised by the concept of continuous improvement of nuclear safety," sums up Hans Wanner, Director General of [ENSI] and Chairman of [WENRA]. In particular, the declaration demands the periodic backfitting of existing nuclear power plants … The first conclusion two and a half years after the Vienna Declaration is sobering. While in Switzerland and in Europe such backfittings are already implemented as standard, concrete backfitting obligations or changes in the legislation have not occurred in any other countries outside Europe with the exception of Japan.
87. NEA Legal Affairs prepared in co-operation with the Japanese government a comprehensive compilation of commentary and texts related to the compensation carried out in Japan in response to the accident. NEA (2012), *Japan's Compensation System for Nuclear Damage*, OECD, Paris.
88. IAEA Action Plan, *supra* note 69, p. 5.

international instruments.[89] INLEX urged states to reflect the international principles in their national legislation in order to establish a more universal system and to make progress in strengthening the modernised liability regimes. The recommendations included setting higher minimum liability amounts and ensuring coverage of latent injuries, as well as taking steps to secure financial remuneration or provide compensation where an accident might exceed the capacity of the required financial security. States are urged to ensure that claims arising from a nuclear accident are dealt with in a single forum, in a prompt, equitable and non-discriminatory manner with minimal litigation.

Although INLEX urges states – whether nuclear facilities exist in their territory or not – to establish treaty relations with as many states as practical, the INLEX recommendations do not express a preference for one of the existing nuclear liability regimes, noting that:

> [T]he CSC establishes treaty relations among States that belong to the Paris Convention, the Vienna Convention or neither, while leaving intact the Joint Protocol that establishes treaty relations among States that belong to the Paris Convention or the Vienna Convention. In addition to providing treaty relations, the CSC mandates the adoption of the enhancements developed under the auspices of the IAEA and contains features to promote appropriate compensation, including an international fund to supplement the amount of compensation available for nuclear damage.

Because INLEX is comprised of experts who are experienced in or advocate for one or more of the regimes, the dual approach reflected in the statement is understandable.[90] The recommendations did not foresee a change to the liability instruments but rather broader adherence to them as the path to be taken.

Notwithstanding the differing viewpoints as to which route provides the better path, a number of states affirmed their support for greater progress. For example, France and the United States – countries party to different international liability conventions – issued a "Joint Statement on Liability for Nuclear Damage" in August 2013 agreeing to "promote efforts to achieve a global nuclear liability regime based on treaty relations among France, the United States and other countries that might be affected by a nuclear accident", to "coordinate their actions in encouraging adherence to the enhanced international nuclear liability instruments" and to "urge countries to adopt national laws that incorporate the nuclear liability principles and recent enhancements to those principles", as well as certain best practices.[91] The G-20 issued a declaration in September 2013 after its meeting in St. Petersburg that

89. INLEX (June 2012), *Recommendations on How to Facilitate Achievement of a Global Nuclear Liability Regime, As Requested by the IAEA Action Plan on Nuclear Safety*, available at: http://ola.iaea.org/ola/documents/ActionPlan.pdf. I served as the NEA observer to INLEX in 2012 when these recommendations were adopted.
90. On the merits of the different instruments on liability, see views doubting the efficacy of the CSC as the basis of a unifying regime in Pelzer, N. (2006), *supra* note 39, p. 114; Chirpius, V. (2012), "Could the Convention on Supplementary Compensation (CSC) for Nuclear Damage Become the Fundament for a Unified EU Legal Regime of the Nuclear Third Party Liability?", in Beyens, M., D. Philippe and P. Reyners (eds.) (2012), *Prospects of a Civil Nuclear Liability Regime in the Framework of the European Union: Proceedings*, Bruylant, Brussels, pp. 78-81; for views supporting the CSC as the basis of a global regime, see Tonhauser, W. (2012), "Reactions to the EC Legal Study from a Legal and Policy Viewpoint", in *ibid.*, pp. 24-25; Brown, O. (2012), "Convention on Supplementary Compensation for Nuclear Damage (CSC)", in *ibid.*, pp. 169-170; McRae, B. (2007), "The Convention on Supplementary Compensation for Nuclear Damage: Catalyst for a Global Nuclear Liability Regime", *Nuclear Law Bulletin*, No. 79, OECD, Paris, pp. 17, 22-23.
91. The Joint Statement is available at: www.energy.gov/downloads/united-states-and-france-sign-joint-statement-civil-liability-nuclear-damage.

encouraged "multilateral cooperation towards achieving a global nuclear liability regime".[92]

Despite the slow path to progress, some accomplishments have been made. The CSC has finally come into force with the accession of Japan in 2015, followed by India in 2016 and Canada in 2017, all states with operating nuclear power plants. Countries seeking to embark on a nuclear power plant programme, such as Ghana, Jordan, Saudi Arabia and the United Arab Emirates, have joined the CSC or the 1997 Vienna Protocol or both. There is more to be done, the entry into force of the 2004 Protocols to the Paris and Brussels Conventions being perhaps the most important next step. But even if a well-integrated global regime is not within our immediate grasp, continued effort to harmonise the regimes and broaden the participation in them remains a worthy objective.[93]

IV. Conclusion

Three Mile Island was the wake-up call. Chernobyl was the spur to action. Fukushima Daiichi was a cause for reflection. Each of these accidents has influenced the development of nuclear law, though the regime within which the international community operates today is largely the product of the instruments developed after the Chernobyl accident. The safety regime has seen the push and pull of the debate whether the pragmatism of the current incentive regime serves us well or whether the insistence on more exacting international standards would better serve nuclear safety. In the liability field, the question as to how or whether to broaden the reach of one or more of the existing conventions is the focus.

Our task within the international framework is to keep the dialogue open and to keep at the work of sustaining and improving robust national regimes and the international standards and rules that govern us. That task is ongoing – and not always easy. It is one that should not await the next crisis to maintain or inspire our effort.[94] It requires vigilance, engagement, frankness in assessments, and continued movement toward greater transparency in national activities and assessments through the various review mechanisms. Ultimately, all states need to show how they have acted to meaningfully strengthen their institutions, maintain and as needed improve plant safety, mitigate the potential impact of malfunctions and natural events, and protect the public.

92. The G-20 Leaders' Declaration, Saint Petersburg Summit (5-6 Sept. 2013), p. 24, para. 97, available at: www.g20.utoronto.ca/2013/Saint_Petersburg_Declaration_ENG.pdf.
93. For an insurer's perspective on implementation of the revised conventions, see Quéré, A. (2014), "Challenges facing the insurance industry since the modernisation of the international nuclear third party liability regime", *Nuclear Law Bulletin*, No. 94, OECD, Paris, pp. 77-104.
94. See Rautenbach, J., W. Tonhauser and A. Wetherall (2006), *supra* note 32, p. 35.