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THE FUKUSHIMA DAIICHI ACCIDENT: THE INTERNATIONAL COMMUNITY RESPONDS

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The accident at the Fukushima Daiichi nuclear power plant site in northeastern Japan has led to a worldwide focus on the safety of nuclear power and a renewed debate over its role in the generation of electricity. In the decade before the accident, interest in nuclear energy returned in the face of growing demand for electricity coupled with increased attention to reducing carbon emissions. These factors fostered what many call a "nuclear renaissance." But, as the accident at the Fukushima Daiichi site unfolded in March 2011, the question seemed to become whether nuclear energy had any future at all. Although not as severe in terms of radioactive releases as the 1986 Chernobyl accident, the accident at the Fukushima Daiichi was significant and the only multi-unit accident in the history of nuclear power generation.[1]

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1. *See generally* AM. SOC'Y OF MECHANICAL ENGINEERS PRESIDENTIAL TASK FORCE ON RESPONSE TO JAPAN NUCLEAR POWER PLANT EVENTS, FORGING A NEW NUCLEAR SAFETY CONSTRUCT app. A, at 88 (June 12, 2012) (comparing economic and socio-political impacts of Three

National governments as well as international organizations have taken action to assess the safety of operating nuclear power plants and have embarked on plans to consider the significance of the accident for plant designs, the ability of plants to withstand the effects of severe natural phenomena, the capability to mitigate accidents if they do occur, and the effectiveness of emergency planning and response. For some countries, like Germany and Italy, the accident led to the end of tentative steps toward expanded nuclear generation.

At its 55th General Conference in September 2011, the International Atomic Energy Agency ("IAEA") Member States endorsed an action plan to address many of these issues as well as the implications of the accident on the legal framework for nuclear safety and regulation. Although the action plan addresses the range of actions one would expect in response to this severe accident, this article focuses on two aspects: (1) the responsibility of regulatory bodies and plant operators under the international conventions, and (2) the renewed call for a global nuclear liability regime.

The approaches to enhancing the effectiveness of the international system in light of the Fukushima Daiichi accident vary in some respects, a result that can be explained in part by the different context for addressing institutional capabilities or for establishing liability regimes under the relevant international instruments. On the one hand, the relevant international safety conventions, to which virtually every State with an operating nuclear power plant adheres, address in only general terms the principles describing the responsibility of the plant operator for safety or the characteristics of an effective regulator. The safety conventions rely on a peer review system as an incentive for improvement and adherence to high levels of safety. In contrast, several well-defined liability conventions have been developed since the earliest days of civilian nuclear power. Unlike the safety conventions, a major obstacle has been broader adherence to these instruments, particularly in their modernized forms.

In responding to the Fukushima Daiichi accident, the international community has acted within the existing constructs of the relevant instruments, for example, by calling for enhanced peer review of

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Mile Island, Chernobyl, and Fukushima Daiichi accidents) [hereinafter ASME REPORT]; UN Scientific Comm. on the Effects of Atomic Radiation [UNSCEAR], *Health Effects Due to Radiation from the Chernobyl Accident*, 2 SOURCES AND EFFECTS OF IONIZING RADIATION Annex D (2008), *available at* http://www.unscear.org/docs/reports/2008/11-80076_Report_2008_Annex_D.pdf (providing assessment of the health effects of the Chernobyl accident).

regulatory bodies or by calling on States to join one of the liability regimes. Although these approaches may seem modest, they are pragmatic.

Indeed, as explained in this Article, what the accident underscores is not a gap in principles governing nuclear safety, but rather, a need for greater vigilance and intentionality with respect to the accepted principles that already exist. Part I of this Article discusses the accident itself and the immediate international response. Part II describes the institutional structures responsible for safety, minimizing risks, and preventing accidents. It provides the fundamental principles to achieving regulatory effectiveness and plant operator accountability and the status of several States' integration of such fundamental principles since the accident. Part III looks to liability if and when accidents occur. It provides the widely acknowledged principles critical to the success of any nuclear liability regime as well as the status of States' acceptance of the international agreements necessary to effectuate a global nuclear liability regime that integrates these widely acknowledged principles. Part IV concludes the Article.

I. THE ACCIDENT AT THE FUKUSHIMA DAIICHI NUCLEAR POWER PLANT SITE

This part of the Article gives an overview of the accident and the international response to it.

A. Description of the Accident

The Great East Japan Earthquake struck northeastern Japan on March 11, 2011, approximately 81 miles east of the city of Sendai and approximately 231 miles northeast of Tokyo, Japan.[2] The magnitude 9.0

2. *See, e.g.*, U.S. NUCLEAR REGULATORY COMM'N, NEAR-TERM TASK FORCE REPORT: RECOMMENDATIONS FOR ENHANCING REACTOR SAFETY IN THE 21ST CENTURY 7–14 (July 12, 2011) [hereinafter NRC TASK FORCE REPORT], *available at* http://pbadupws.nrc.gov/docs/ML1118/ML111861807.pdf; THE NAT'L DIET OF JAPAN, THE OFFICIAL REPORT OF THE FUKUSHIMA NUCLEAR ACCIDENT INDEPENDENT INVESTIGATION COMMISSION REPORT ch. 2, 12–40 (2012) [hereinafter NAT'L DIET REPORT], *available at* http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/en/report/index.html (English translation); INST. OF NUCLEAR POWER OPERATIONS, SPECIAL REPORT ON THE NUCLEAR ACCIDENT AT THE FUKUSHIMA DAIICHI NUCLEAR POWER STATION INPO 11-005 (Nov. 2011) [hereinafter INPO REPORT]; INST. OF NUCLEAR POWER OPERATIONS, SPECIAL REPORT ON THE NUCLEAR ACCIDENT AT THE FUKUSHIMA DAIICHI NUCLEAR POWER STATION, at add. (Aug. 2012), *available at* http://www.nei.org/corporatesite/media/filefolder/11_005_Special_Report_on_Fukushima_Daiichi_MASTER_11_08_11_1.pdf.

earthquake and ensuing tsunami caused widespread devastation, including the loss of over 15,000 lives and disruption of local infrastructure.[3] Eleven operating nuclear power plants along the northeastern coast of Japan shut down automatically, including three plants operating at the six-unit Fukushima Daiichi station.[4] The Fukushima Daiichi reactors are boiling water reactors designed by General Electric Company, similar to designs used at operating reactors in the United States and elsewhere in the world.[5] The first unit began operation in 1971, and the other units all began operation by 1979.[6]

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 refueling.[7] The Fukushima Daiichi station lost power from the electrical grid, and flooding caused by the tsunami waves, including one as high as forty-nine feet, rendered all but one of the site's diesel generators incapable of supplying back-up power.[8] As a consequence, four of the units at the site entered a condition called "station blackout"—meaning the only electric power available comes from station batteries, which are capable of providing power only in terms of hours, not days.[9] Although Units 1 through 3 had shut down automatically as

3. *Current Situation and Government of Japan's Response*, JAPAN MINISTRY OF FOREIGN AFFAIRS, http://www.mofa.go.jp/j_info/visit/incidents/announcements.html#current-situation (last visited Jan. 15, 2013). Another 3725 persons are still considered missing. *Id.* No loss of life has been attributed to radiation releases or exposures due to the Fukushima Daiichi accident. *See* ASME Report, *supra* note 1, at 3, 87.

4. NRC TASK FORCE REPORT, *supra* note 2, at 7; *Fukushima Accident 2011*, WORLD NUCLEAR ASS'N (Nov. 2012), http://www.world-nuclear.org/info/fukushima_accident_inf129.html. For a few days after the earthquake and tsunami hit Japan, there was also concern about the stability of plants at the Fukushima Daini site, further south along the coast from the Daiichi site. *Id.* (discussing "Fukushima Daini plant").

5. *See* NAT'L DIET REPORT, *supra* note 2, ch. 2, 34; NRC TASK FORCE REPORT, *supra* note 2, at 8; *List of Power Reactor Units*, U.S. NUCLEAR REGULATORY COMM'N (Sept. 14, 2012), http://www.nrc.gov/reactors/operating/list-power-reactor-units.html; Bill Dedman, *General Electric-designed Reactors in Fukushima Have 23 Sisters in U.S.*, NBC NEWS (Dec. 18, 2012, 3:23 EST), http://openchannel.nbcnews.com/_news/2011/03/13/6256121-general-electric-designed-reactors-in-fukushima-have-23-sisters-in-us?lite; *see also What is a Nuclear Reactor*, EUR. NUCLEAR SOC., http://www.euronuclear.org/1-information/energy-uses.htm (last visited Dec. 26, 2012) ("PWRs [pressurized water reactors] and BWRs [boiling water reactors] are the most commonly operated reactors in Organisation for Economic Cooperation and Development (OECD) countries.").

6. NAT'L DIET REPORT, *supra* note 2, ch. 2, 3–4.

7. NRC TASK FORCE REPORT, *supra* note 2, at 9; INPO REPORT, *supra* note 2, at 5.

8. *See* NAT'L DIET REPORT, *Exec. Summary*, *supra* note 2, at 12; NRC TASK FORCE REPORT, *supra* note 2, at 9; INPO REPORT, *supra* note 2, at 6–7; *Fukushima Accident 2011*, *supra* note 4 (discussing "Events at Fukushima Daiichi 1–3 & 4").

9. NRC TASK FORCE REPORT, *supra* note 2, at 9. A station blackout is generally defined as "the

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.[10]

Not only did they have to deal with the operability of critical safety equipment, but workers at the plant were also faced with significant damage to site infrastructure from the earthquake and tsunami that complicated their ability to access parts of the plant and conduct other recovery operations.[11] Despite valiant efforts to cool the plants, adequate core cooling was lost within hours to the Unit 1 reactor, within thirty-six hours to Unit 3, and seventy-one hours to Unit 2. As a consequence, the fuel in each of these reactors was damaged.[12]

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.[13] 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.[14] Units 5 and 6, which are separated from the other Daiichi units

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complete loss of AC power supplies from off-site, the plant power generator and the EPSs [emergency power systems]." Int'l Atomic Energy Agency [IAEA], *Safety Standards Series: Design of Emergency Power Systems for Nuclear Power Plants*, at 3 n.1, IAEA Doc. NS-G-1.8 (2004). Regarding the regulatory requirements in 10 C.F.R. § 50.63 (2012), the U.S. Nuclear Regulatory Commission provides a definition for conducting evaluations of station blackout defenses: "*Station blackout* means the complete loss of alternating current (ac) electric power to the essential and nonessential switchgear buses in a nuclear power plant (i.e., loss of offsite electric power system concurrent with turbine trip and unavailability of the onsite emergency ac power system). . . ." NRC Definitions, 10 C.F.R. § 50.2 (2012) (emphasis in the original).

10. NAT'L DIET REPORT, *Exec. Summary*, *supra* note 2, at 14; INPO REPORT, *supra* note 2, at 9–10; *Fukushima Accident 2011*, *supra* note 4 (discussing "Events at Fukushima Daiichi 1–3 & 4").

11. NAT'L DIET REPORT, *Exec. Summary*, *supra* note 2, at 13–14; INPO REPORT, *supra* note 2, at 13.

12. NRC TASK FORCE REPORT, *supra* note 2, at 9–11; INPO REPORT, *supra* note 2, at 14–33 (describing details of accident sequence in Units 1-3).

13. INPO REPORT, *supra* note 2, at 33.

14. NRC TASK FORCE REPORT, *supra* note 2, at 10–12; INPO REPORT, *supra* note 2, at 11, 20, 27, 32. For example, the cause of an explosion in the spent fuel building for Unit 4 was not readily explained and led some to believe the fuel in the Unit 4 spent fuel pool was overheating; subsequent analyses attributes the cause of the explosion to backflow of gases from Unit 3 during its venting. INPO REPORT, *supra* note 2, at 33. At the time its report on the accident was issued in July 2011, the NRC Task force said, "The source of the explosive gases causing the Unit 4 explosion remains unclear." NRC TASK FORCE REPORT, *supra* note 2, at 9.

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.[15]

In summary, as the IAEA has characterized the events,

> [t]he Fukushima accident was the result of a combination of two extreme external hazards that occurred sequentially. The first and the initiating event was an earthquake and the second and ensuing event was a tsunami. During the assessment of the impact of external hazards on the design of a NPP [nuclear power plant], seismic and flooding are normally considered separately. It was also learned that the basic resources that are relied upon to maintain the three fundamental safety functions of reactivity control, heat removal and containment integrity were lost due to the unavailability of electrical power and the ultimate heat sink, resulting in an unmitigated accident progression. This resulted in the loss of control over the installation and eventually in severe damage to the nuclear power plant and the release of radioactive material to the environment.[16]

The Japanese government initially ordered evacuation of residents within three kilometers of the site and expanded that to as far as thirty kilometers.[17] In April 2011, the government established a restricted area within twenty kilometers of the site to allow temporary access for members of the public but excluded the public within three kilometers.

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15. NRC TASK FORCE REPORT, *supra* note 2, at 9, 14; *Fukushima Accident 2011*, *supra* note 4 (discussing "Fukushima Daiichi 5 & 6").

16. IAEA, *Progress in the Implementation of the IAEA Action Plan on Nuclear Safety: Report by the Director General*, ¶ 7, IAEA Doc. GOV/INF/2012/11-GC(56)/INF/5 (Aug. 9, 2012), *available at* http://www.iaea.org/About/Policy/GC/GC56/GC56InfDocuments/English/gc56inf-5-att1_en.pdf. Although study of the radioactive releases from the accident and their impact are ongoing, the releases and estimated health effects are considered to be far lower than that of the Chernobyl accident. *See* James Acton & Mark Hibbs, *Why Fukushima Was Preventable*, THE CARNEGIE PAPER, at 6 (Mar. 2012), http://carnegieendowment.org/2012/03/06/why-fukushima-was-preventable; John E. Ten Hoevea & Mark Z. Jacobson, *Worldwide Health Effects of the Fukushima Daiichi Nuclear Accident*, 5 ENERGY & ENV'T. SCI. 8743, 8753, 8754 (2012), *available at* http://pubs.rsc.org/en/content/articlelanding/2012/ee/c2ee22019a.

17. *See* IAEA, REPORT OF JAPANESE GOVERNMENT TO IAEA MINISTERIAL CONFERENCE ON NUCLEAR SAFETY—ACCIDENT AT TEPCO'S FUKUSHIMA NUCLEAR POWER STATIONS, RESPONSE TO THE NUCLEAR EMERGENCY, at V-6–V-11 (June 7, 2011) [hereinafter JAPANESE REPORT], http://www.iaea.org/newscenter/focus/fukushima/japan-report/; NRC TASK FORCE REPORT, *supra* note 2, at 14. The U.S. Government recommended that U.S. citizens evacuate the area within 50 miles of Fukushima. Press Release, NRC Provides Protective Action Recommendations Based on U.S. Guidelines, NRC Release No. 11-050 (Mar. 16, 2011), http://pbadupws.nrc.gov/docs/ML1108/ML110800133.pdf.

These restrictions remained largely in place at the end of 2012.[18] The Japanese government announced in mid-December 2011 that the three damaged reactors had been brought to cold shutdown, a significant step in maintaining the long-term stability of the reactor cores.[19]

B. The International Response to the Accident

As efforts to stabilize the damaged plants took hold in the first weeks after the accident, national authorities and international organizations began to consider the long-term implications of the Fukushima Daiichi accident for the safety of nuclear power operations. The accident precipitated a crisis of confidence in the safety of nuclear energy and the institutions responsible for safe operation and oversight of nuclear facilities. As the accident unfolded, questions mounted in Japan about the robustness of plant design, the capability to withstand severe natural phenomena, the preparedness to cope with accidents, and the institutional commitment to safety and the competence of the operator and the regulator.[20] The Japanese experience prompted an assessment of national programs as well as the effectiveness of the international regime for nuclear safety.

The Contracting States to the Convention on Nuclear Safety ("CNS") met in Vienna, Austria in early April 2011 for a previously scheduled Review Meeting under the CNS.[21] At the meeting, nuclear regulators from various nations discussed their plans to study the Fukushima accident and consider changes to their domestic programs. Members of the CNS agreed to hold an "extraordinary meeting" in August 2012 to share additional information about their attempt to identify and incorporate lessons learned from the Fukushima accident into their nuclear safety programs.[22]

Across the globe, States with nuclear power programs took steps to assess the safety and robustness of their nuclear power stations. In the

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18. *Fukushima Accident 2011*, WORLD NUCLEAR ASS'N (Nov. 2012), http://www.world-nuclear.org/info/fukushima_accident_inf129.html.

19. Press Conference by Prime Minister Yoshihiko Noda, Prime Minister of Japan and His Cabinet (Dec. 16, 2011), *available at* http://www.kantei.go.jp/foreign/noda/statement/201112/16kaiken_e.html.

20. *See* JAPANESE REPORT, *supra* note 17, at V, XII–IV.

21. The convention and its significance to the international nuclear safety regime are discussed *infra* Part II.

22. IAEA, *Summary Report of the 5th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety*, at 4–14, IAEA Doc. CNS/RM/2011/6/Final (Apr. 2011), *available at* http://www.iaea.org/Publications/Documents/Conventions/cns-summaryreport0411.pdf.

United States, home to 104 operating reactors, the Nuclear Regulatory Commission ("NRC") established a Near-Term Task Force in April 2011 to conduct a review of NRC's processes and regulations to determine whether any other actions should be taken by the NRC or whether improvements to the NRC's inspection regime or licensing review system should be made.[23] The Task Force was directed initially to determine within ninety days whether any near-term or immediate actions might be required at U.S. power plants, particularly with respect to protection from natural hazards, station blackout and degraded power supplies, combustible gas control, mitigation of severe accidents, and emergency preparedness.

The Near-Term Task Force issued its report on July 12, 2011 with twelve primary recommendations for NRC action.[24] On the whole, the Task Force found no imminent threat requiring immediate shut-down of operating reactors or a halt to new plant licensing, but the Task Force did recommend a series of actions for the near term, while reassessment and improvements are made to regulation of plant safety in the longer term.[25] The NRC adopted, in most respects, the recommended near term actions while longer-term actions were further developed and also included some additional safety improvements for consideration.[26] The NRC issued orders and required additional reports from its licensees in March 2012 as

23. NRC TASK FORCE REPORT, *supra* note 2, app. B; Memorandum from Chairman G.B. Jaczko to R.W. Borchardt, Executive Director for Operations, Tasking Memorandum—COMGBJ-11-002—NRC Actions Following the Events in Japan (Mar. 23, 2011), *available at* http://www.nrc.gov/reading-rm/doc-collections/commission/comm-secy/2011/2011-0002comgbj-srm.pdf.

24. NRC TASK FORCE REPORT, *supra* note 2, at 69, 73–76.

25. *Id*. at 18, 69–72.

26. *See generally* Memorandum from A.L. Bates, Acting Secretary, to R.W. Borchardt, Executive Director for Operations, Staff Requirements–SECY-11-0093–Near-Term Report and Recommendations for Agency Actions Following the Events in Japan (Aug. 19, 2011), *available at* http://www.nrc.gov/reading-rm/doc-collections/commission/srm/2011/2011-0093srm.pdf; Memorandum from A.L. Vietti Cook, Secretary, to R.W. Borchardt, Executive Director for Operations, Staff Requirements–SECY-11-0124–Recommended Actions to be Taken Without Delay from the Near-Term Task Force Report (Oct. 18, 2011), *available at* http://www.nrc.gov/reading-rm/doc-collections/commission/srm/2011/2011-0124srm.pdf; Memorandum from A.L. Vietti Cook, Secretary, to R.W. Borchardt, Executive Director for Operations, Staff Requirements—SECY-11-0137—Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned (Dec. 15, 2011), *available at* http://www.nrc.gov/reading-rm/doc-collections/commission/srm/2011/2011-0137srm.pdf; Policy Issue Notation Vote, *Staff Requirements—SECY-12-0025—Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami* (Feb. 17, 2012), *available at* http://pbadupws.nrc.gov/docs/ML1203/ML12039A111.pdf.

it continued down the path toward implementation of the recommended safety improvements.[27]

The European Commission asked its Member States to develop a framework for examining the Fukushima accident and determining how best to address its implications within the European Union ("EU").[28] The EU focused on developing "stress tests" in order to perform a targeted reassessment of the safety margins of nuclear power plants in the light of the Fukushima events.[29] The scope of the stress tests included an assessment of plant design bases[30] and the engineering margins to withstand earthquakes and flooding, to cope with a loss of electrical power (station blackout), to cope with a loss of the ultimate heat sink, to protect against the loss of cooling for both the reactor core and for spent fuel pools, to maintain containment integrity, and to provide severe accident management.[31] The stress test effort was undertaken by the European

27. The NRC issued orders to licensees in March 2012 to enhance protection of equipment used to mitigate fires and explosions against the effects of external events, to install spent fuel pool instrumentation, and to require reliable hardened vents in older General Electric boiling water reactors. *See* In the Matter of All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status: Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Effective Immediately), NRC-2012-0067, 77 Fed. Reg. 16,082 (Mar. 19, 2012); Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events Wolf Creek Generating Station, NRC-2012-0068, 77 Fed. Reg. 16,091-16,098 (Mar. 19, 2012). The NRC also required licensees to submit an evaluation of seismic, flooding, and other natural hazards on plant equipment and structures. Letter from NRC to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident (Mar. 12, 2012), *available at* http://pbadupws.nrc.gov/docs/ML1205/ML12053A340.pdf. As the task force also recommended, the NRC has initiated rulemaking to enhance the capability to deal with a prolonged station blackout. Station Blackout, 77 Fed. Reg. 16,175 (Mar. 20, 2012).

28. Council Conclusions, *24/25 March 2011 Conclusions*, EUCO Doc. 10/1/11 REV 1, CO EUR 6 CONCL 3, at 10–12 (Apr. 20, 2011) (EC), *available at* http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/120296.pdf.

29. *See* EUR. NUCLEAR SAFETY REGULATOR GROUP [ENSREG], POST-FUKUSHIMA ACCIDENT: PEER REVIEW REPORT, STRESS TESTS PERFORMED ON EUROPEAN NUCLEAR POWER PLANTS (Apr. 26, 2012), *available at* http://www.ensreg.eu/node/407.

30. The design basis for a plant generally refers to the range of conditions and events taken into account in the design, which includes conditions under normal operation as well as circumstances resulting from malfunctions or accidents caused, for example, by equipment failure or the effects of natural hazards and specific values or ranges of values chosen for controlling parameters for the design. *See* U.S. Nuclear Regulatory Commission Definitions, 10 C.F.R. § 50.2 (2012), *available at* http://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-0002.html (defining design bases). *See generally* IAEA, *Safety Standards, Safety of Nuclear Power Plants: Design*, at 17–27, IAEA Doc. SSR-2.1 (2012), *available at* http://www-pub.iaea.org/MTCD/publications/PDF/Pub1534_web.pdf (discussing considerations relevant to developing a plant's design basis).

31. *See* Eur. Commission, *Joint Declaration/Press Statement on Comprehensive Risk and Safety Assessments of Nuclear Plants* (June 23, 2011), *available at* http://news-europa.eu/portal/index.php/

Nuclear Regulators Group ("ENSREG"), an organization comprised of representatives of each national regulator within the EU, European Commission representatives, and observers from IAEA and a few other countries. ENSREG issued an interim report in November 2011 that included reports from fifteen EU Member States as well as the Ukraine and Switzerland. A final report containing peer reviews was issued in April 2012.[32] The stress test initiative covered 152 operating power reactors: 132 in the EU, 5 in Switzerland, and 15 in the Ukraine.[33]

As an outcome of the review, national regulators within the EU were to develop action plans and several European-level recommendations were identified.[34] In a communication to the European Council and Parliament, the European Commission noted that it expected to provide the Council and Parliament an "ambitious revision" to the EU nuclear safety directive in 2013 to achieve greater harmony and consistency in guidance to EU Member States on nuclear safety matters.[35] Like the United States, European regulators did not conclude that the results of the reviews required suspension of operation of any particular facility, though safety improvements, implementation of best practices, and other measures were warranted.[36]

The accident also prompted States to reassess how nuclear power fits into their energy portfolio. Germany, most notably, announced barely

energy-natural-resources/item/4917-energy-stress-tests-european-commission.

32. *See* ENSREG, *supra* note 29; *see also Commission Staff Working Document: Technical Summary on the Implementation of Comprehensive Risk and Safety Assessments of Nuclear Power Plants in the European Union*, SWD (2012) 287 final (Oct. 4, 2012), *available at* http://ec.europa.eu/energy/nuclear/safety/doc/swd_2012_0287_en.pdf.

33. *Communication from the Commission to the Council and the European Parliament on the Comprehensive Risk and Safety Assessments ("Stress Tests") of Nuclear Power Plants in the European Union and Related Activities*, at 4 n.5, COM (2012) 571 final (Oct 4, 2012) [hereinafter EUR. COMMISSION, COMMUNICATION], *available at* http://ec.europa.eu/energy/nuclear/safety/doc/com_2012_0571_en.pdf.

34. *See* ENSREG, COMPILATION OF RECOMMENDATIONS AND SUGGESTIONS 1 (July 26, 2012), http://www.ensreg.eu/sites/default/files/Compilation%20of%20Recommendationsl.pdf. For an example of the actions at a national level in Europe, see the national report of the French nuclear regulatory authority (Autorité de sûreté nucléaire—ASN). ASN, NATIONAL REPORT FOR THE SECOND EXTRAORDINARY MEETING FOR THE CONVENTION ON NUCLEAR SAFETY 8–13 (Aug. 2012), *available at* http://www.french-nuclear-safety.fr/index.php/English-version/News-releases/2012/Convention-on-Nuclear-Safety-french-report-is-published-on-ASN-website. National action plans submitted by participating countries at the end of 2012 or in early 2013 are available through ENSREG's web site. *EU Member States*, ENSREG, http://www.ensreg.eu/EU-Stress-Tests/Country-Specific-Reports/EU-Member-States (last visited Jan. 24, 2013).

35. EUR. COMMISSION, COMMUNICATION, *supra* note 33, at 16.

36. *Id.* at 6–11. As the European Commission noted, implementation of particular safety improvements is essentially a matter of national regulation. *Id*. at 6, 9.

three months after the accident that it would abandon nuclear energy, effectively terminating the operations of some of its plants immediately and ending the operational life of others by 2022.[37] A referendum in Italy overwhelmingly rejected plans to revive nuclear options.[38] Nonetheless, some States, including Poland, Turkey, Vietnam, and the United Arab Emirates (which recently issued construction licenses for two plants),[39] are proceeding with prior plans to develop nuclear power.[40] Additionally, the United Kingdom continues to pursue a program of new nuclear plant construction.[41] Likewise, China has resumed an ambitious construction program for new nuclear units.[42]

In Japan itself, there has been an understandable ambivalence toward a return to operation of its nuclear power fleet. In January 2012, the IAEA approved Japan's approach to conducting evaluations of its power plants, which the Japanese developed with the European "stress tests" as a reference point.[43] At one point, in May 2012, none of Japan's fifty still

37. Judy Dempsey & Jack Ewing, *In Reversal, Germany Announces Plan to Close All Nuclear Plants by 2022*, N.Y. TIMES, May 30, 2011, at A4, *available at* http://www.nytimes.com/2011/05/31/world/europe/31germany.html; Dreizehntes Gesetz zur Änderung des Atomgesetzes [Act of 31 July 2011], Aug. 5, 2011, BUNDESGESETZBLATT [BGBL I] at 1704, no. 43 (Ger.).

38. *See Italy Nuclear: Berlusconi Accepts Referendum Blow*, BBC NEWS EUR. (June 14, 2011), http://www.bbc.co.uk/news/world-europe-13741105.

39. *UAE Nuclear Regulator Approves Barakah Power Plant Construction*, FEDERAL AUTH. FOR NUCLEAR REG. (July 18, 2012), http://www.fanr.gov.ae/En/MediaCentre/News/Pages/UAE-nuclear-regulator-approves-Barakah-power-plant-construction.aspx.

40. *See* Heather Timmons & Vikas Bajaj, *Emerging Economies Move Ahead with Nuclear Plans*, N.Y. TIMES (Mar. 14, 2011), http://www.nytimes.com/2011/03/15/business/energy-environment/15power.html?pagewanted=all.

41. *See generally* DEP'T OF ENERGY AND CLIMATE CHANGE, *National Policy Statement for Nuclear Power Generation*: *En-6 Nuclear Power Generation NPS*, vols. 1 & 2 (July 19, 2011), *available at* http://www.decc.gov.uk/en/content/cms/meeting_energy/consents_planning/nps_en_infra/nps_en_infra.aspx. An energy bill was introduced into the House of Commons on November 29, 2012 that supports the government's new build policy and includes provisions for establishing the Office of Nuclear regulation as an independent statutory entity. Energy Bill, 2012, H.C. Bill [100] pt. 2, ch. 1–4 (U.K.), *available at* http://www.publications.parliament.uk/pa/bills/cbill/2012-2013/0100/cbill_2012-20130100_en_1.htm.

42. *See, e.g.*, *Three Chinese Reactor Projects Underway*, WORLD NUCLEAR NEWS (Dec. 13, 2012), http://www.world-nuclear-news.org/NN-Three_Chinese_reactor_projects_underway-1312124.html; *Nuclear Power in China*, WORLD NUCLEAR ASS'N (Dec. 29, 2012), http://www.world-nuclear.org/info/inf63.html.

43. IAEA, IAEA MISSION TO REVIEW NISA'S APPROACH TO THE "COMPREHENSIVE ASSESSMENTS FOR THE SAFETY OF EXISTING POWER REACTOR FACILITIES" CONDUCTED IN JAPAN 2 (Jan. 23–31, 2012), *available at* http://www.iaea.org/newscenter/focus/actionplan/reports/nisa-mission-report0312.pdf; Statement of Japanese Cabinet, Confirmation of the Safety of Nuclear Power Stations in Japan, at 2 (July 11, 2011), *available at* http://www.kantei.go.jp/foreign/incident/pdf/stresstest_e.pdf

operational power reactors[44] generated electricity because further decisions were pending on resumed operation after stress tests and government consultations.[45] In July 2012, the Ohi Unit 1 Plant was the first to resume operation.[46] The Japanese government had taken some steps toward what appeared to be a nuclear phase-out in the 2030s, but the commitment to such policy appears to be waning, particularly in light of the outcome of national elections in December 2012 that returned the Liberal Democratic Party to power.[47]

II. AN ACTION PLAN ON NUCLEAR SAFETY

Within a couple months after the accident, multilateral ministerial meetings were held to consider the implications of the Fukushima Daiichi accident for the safety of nuclear energy. In early June 2011, the G8 and the Organisation for Economic Co-operation and Development's ("OECD") Nuclear Energy Agency ("NEA") held an International Ministerial Seminar on Nuclear Safety in Paris followed by a meeting of nuclear regulators, including those from the G8 and NEA member countries.[48] These meetings were followed shortly thereafter by a

44. The IAEA maintains statistical information on worldwide power reactor status at its Power Reactor Information System website. *The Database on Nuclear Power Reactors*, IAEA (Jan. 1, 2013) [hereinafter IAEA, *The Database on Nuclear Power Reactors*], http://www.iaea.org/pris/.

45. C. Harlan, *Japan's Last Reactor to Shut Down, Leaving Country Nuclear-free for First Time Since 1966*, WASH. POST (May 4, 2012), http://www.washingtonpost.com/world/asia_pacific/japans-last-reactor-to-shut-down-leaving-country-nuclear-free-for-first-time-since-966/2012/05/04/gIQAcNKx0T_story.html.

46. *Ohi Restart Gives Japan Breathing Space*, WORLD NUCLEAR NEWS (July 9, 2012), http://www.world-nuclear-news.org/NP-Ohi_restart_gives_Japan_breathing_space-0907128.html.

47. THE ENERGY AND ENV'T COUNCIL OF THE GOV'T OF JAPAN, INNOVATIVE STRATEGY FOR ENERGY AND THE ENVIRONMENT 5 (Sept. 14, 2012), http://www.npu.go.jp/en/policy/policy06/pdf/20121004/121004_en2.pdf. A Cabinet decision made days later committed only that the government will "implement future policies on energy and the environment, taking into account [the strategy document], while having discussions in a responsible manner with related local governments, the international community and others, and obtaining understanding of the Japanese public, by constantly reviewing and re-examining policies with flexibility." Japanese Cabinet Decision, Future Policies for Energy and the Environment (Sept. 19, 2012), *available at* http://www.npu.go.jp/en/policy/policy06/pdf/20121004/121004_en1.pdf; *see also* Hiroko Tabuchi, *Japan, Under Pressure, Backs Off Goal to Phase Out Nuclear Power by 2040*, N.Y. TIMES, Sept. 20, 2012, at A9, *available at* http://www.nytimes.com/2012/09/20/world/asia/japan-backs-off-of-goal-to-phase-out-nuclear-power-by-2040.html. The Liberal Democratic Party, which prevailed in the December 2012 parliamentary elections, is viewed more likely to follow a "pro-nuclear" policy and to allow a return of idled reactors to service. Martin Fackler, *Japan Election Returns Power to Old Guard*, N.Y. TIMES, Dec. 17, 2012, at A1, *available at* http://www.nytimes.com/2012/12/17/world/asia/conservative-liberal-democratic-party-nearing-a-return-to-power-in-japan.html?nl=todaysheadlines&emc=edit_th_20121217&_r=0.

48. The OECD Nuclear Energy Agency produced a report on the forum. NUCLEAR ENERGY

ministerial conference on nuclear safety at the IAEA in Vienna.[49] The IAEA had sent a multinational team of technical experts to Japan for a "fact-finding mission" into the accident in May 2011.[50] The team issued a report prior to the IAEA's June ministerial meeting.[51]

This Part discusses the institutional arrangements deemed important for nuclear safety. It first discusses the general framework of international agreements on effective regulators and plant operator accountability, including the fundamental aspects of nuclear safety deemed important for evaluation after the Fukushima Daiichi accident. Next, it discusses the present status of States addressing regulatory reform. Finally, this Part explains how safety cannot occur without holding plant operators accountable.

A. General Framework of International Agreements on Effective Regulators and Plant Operator Accountability

As a result of its June ministerial conference on nuclear safety, the IAEA developed a draft "Action Plan" of items for Member States, operators, the IAEA, and other multinational organizations to carry out to strengthen nuclear safety.[52] After an opportunity for comment by IAEA Member States, the Director General submitted the plan to the IAEA Board of Governors for approval.[53] The Board approved the Action Plan

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AGENCY [NEA], *Proceedings of the Forum on the Fukushima Accident: Insights and Approaches*, NEA Doc. NEA/CNRA/R(2012)12 (Nov. 30, 2011), *available at* http://www.oecd-nea.org/nsd/docs/2011/cnra-r2011-12.pdf.

49. *See IAEA Ministerial Conference on Nuclear Safety 20-24 June 2011, Austria Centre, Vienna*, IAEA, http://www.iaea.org/conferences/ministerial-safety/ (last visited Jan. 11, 2013) (providing conference highlights).

50. *See* IAEA, MISSION REPORT: THE GREAT EAST JAPAN EARTHQUAKE EXPERT MISSION, IAEA INTERNATIONAL FACT FINDING EXPERT MISSION OF THE FUKUSHIMA DAI-ICHI NPP ACCIDENT FOLLOWING THE GREAT EAST JAPAN EARTHQUAKE AND TSUNAMI 12 (2011), *available at* http:// www-pub.iaea.org/MTCD/Meetings/PDFplus/2011/cn200/documentation/cn200_Final-Fukushima-Mission_Report.pdf.

51. *Id.*

52. *See* IAEA, *Declaration by the IAEA Ministerial Conference on Nuclear Safety in Vienna on 20 June 2011*, at 3, ¶ 23, IAEA Doc. INFCIRC/821 (June 20, 2011), *available at* http://www.iaea.org/Publications/Documents/Infcircs/2011/infcirc821.pdf; Director General Yukiya Amano, Concluding Statement at the IAEA Ministerial Conference on Nuclear Safety, at 3 (June 24, 2011), http://www-pub.iaea.org/MTCD/Meetings/PDFplus/2011/cn200/documentation/iaea-concluding-statement.pdf.

53. IAEA, *Draft IAEA Action Plan on Nuclear Safety, Report by the Director General*, IAEA Doc. GOV/2011/59-GC(55)/14 (Sept. 5, 2011), http://www.iaea.org/About/Policy/GC/GC55/Documents/gc55-14.pdf. The Draft IAEA Action Plan was approved by the IAEA Board of Governors on September 13, 2011 and presented at the General Conference on September 22, 2011. IAEA, IAEA ACTION PLAN ON NUCLEAR SAFETY 1 n.1 (2011) [hereinafter IAEA ACTION PLAN], *available at*

and recommended that the IAEA General Conference endorse it during its September 2011 meeting.[54] All 151 Member States endorsed the plan at the General Conference.[55]

The IAEA Action Plan encourages the cooperation and involvement of Member States in implementing twelve main actions:

- safety assessments of nuclear power plants in light of lessons learned from the Fukushima 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 organizations 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 program;
- strengthening and maintaining capacity building (i.e., ensuring available of human resources necessary for safe nuclear power operation);

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http://www.iaea.org/newscenter/focus/actionplan/reports/actionplanns130911.pdf. The IAEA Action Plan was unanimously endorsed at the General Conference. *IAEA Action Plan on Nuclear Safety*, IAEA.ORG, http://www.iaea.org/newscenter/focus/actionplan/ (last visited Jan. 12, 2013).

54. IAEA, *Measures to Strengthen International Cooperation in Nuclear, Radiation, Transport and Waste Safety*, Gen. Conf. Res. 9, IAEA Doc. GC(55)/RES/9 (Sept. 22, 2011), http://www.iaea.org/About/Policy/GC/GC55/GC55Resolutions/English/gc55res-9_en.pdf. Press reports indicate differing views among countries over the primarily voluntary nature of the Action Plan. *See* Fredrik Dahl, *IAEA States Adopt Nuclear Safety Action Plan*, REUTERS (Mark Heinrich ed., Sept. 13, 2011), http://www.reuters.com/article/2011/09/13/nuclear-safety-iaea-idUSL5E7KD1IY20110913.

55. IAEA, *Initial Progress in Implementation of the IAEA Action Plan on Nuclear Safety, Report by the Director General*, § A.2, IAEA Doc. GOV/INF/2011/15 (Nov. 10, 2011), *available at* http://www.iaea.org/Publications/Documents/Board/2011/govinf2011-15.pdf. The UN General Assembly convened a special meeting in New York devoted to nuclear safety in September 2011, during the same week as the IAEA's annual General Conference in Vienna. *See* Secretary General Ban Ki-Moon, Secretary-General's Remarks to the Opening Session of the High-Level Meeting on Nuclear Safety and Security (Sept. 22, 2011), *available at* https://www.un.org/sg/statements/index.asp?nid=5553.

- protecting people and the environment from ionizing radiation following an emergency;
- enhancing the transparency and effectiveness of communications and improving the dissemination of information; and
- effectively utilizing research and development.[56]

The IAEA Director General reported on progress of the Action Plan after the first year of its implementation before the 56th General Conference in September 2012.[57] The Japanese government and the IAEA co-sponsored a ministerial conference in December 2012 to consider further insights gleaned from the analysis of the accident as well as to discuss progress on the IAEA Action Plan and national efforts to improve nuclear safety.[58]

The IAEA Action Plan lists broad areas of inquiry for improvement in nuclear safety across a range of technical, engineering, organizational, institutional, and legal issues. The Action Plan is not a binding agreement but a statement of political commitment to focus on improving nuclear safety.

The Action Plan should be understood in the context of the general framework for nuclear safety at the international level. Indeed, in specifying the focus of actions to improve the effectiveness of the international legal framework as one of its objectives, the Action Plan identifies the major conventions relevant to the tasks:

> States parties to explore mechanisms to enhance the effective implementation of the Convention on Nuclear Safety [CNS], 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

56. IAEA ACTION PLAN, *supra* note 53, at 2–6.

57. IAEA, *Progress in the Implementation of the IAEA Action Plan on Nuclear Safety, Report by the Director General*, IAEA Doc. GOV/INF/2012/11-GC(56)/INF/5 (Aug. 9, 2012), *available at* http://www.iaea.org/About/Policy/GC/GC56/GC56InfDocuments/English/gc56inf-5_en.pdf; IAEA, *Progress in the Implementation of the IAEA Action Plan on Nuclear Safety Supplement*, IAEA Doc. GOV/INF/2012/11-GC(56)/INF/5 (Aug. 15, 2012), *available at* http://www.iaea.org/About/Policy/GC/GC56/GC56InfDocuments/English/gc56inf-5-att1_en.pdf.

58. *The Fukushima Ministerial Conference on Nuclear Safety*, IAEA (Dec. 17, 2012), http://www-pub.iaea.org/iaeameetings/20120216/-The-Fukushima-Ministerial-Conference-on-Nuclear-Safety.

> Convention on Nuclear Safety and the Convention on the Early Notification of a Nuclear Accident.[59]

The listed instruments are all products of the post-Chernobyl era.

Some of these conventions were adopted with what might be considered remarkable speed for international instruments. For example, 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 were adopted five months after the Chernobyl accident, and both were in force by early 1987.[60] The CNS was adopted in 1994 and came into force in 1996.[61] It addresses the broad safety standards and institutional arrangements expected for operation of nuclear power plants.[62] The Joint Convention focuses on matters deferred in the CNS[63] with respect to the obligations associated with the storage, handling, and disposal of spent reactor fuel and radioactive waste.[64]

The CNS and its sister, the Joint Convention, are considered "incentive" conventions.[65] That is, States are not subject to a particular

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59. IAEA ACTION PLAN, *supra* note 53, at 4.

60. The two conventions were adopted in September 1986. IAEA, *Convention on Early Notification of a Nuclear Accident*, IAEA Doc. INFCIRC/335 (Nov. 18, 1986), 1439 U.N.T.S. 276 (entered into force Oct. 27, 1986), *available at* http://www.iaea.org/Publications/Documents/Infcircs/Others/infcirc335.shtml; IAEA, *Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency*, IAEA Doc. INFCIRC/336/Add.1 (Nov. 18, 1986), 1457 U.N.T.S. 134 (entered into force Mar. 10, 1987), *available at* http://www.iaea.org/Publications/Documents/Infcircs/Others/infcirc336.shtml.

61. IAEA, *Convention on Nuclear Safety [CNS]*, IAEA Doc. INFCIRC/449, *opened for signature* Sept. 20, 1994, 1963 U.N.T.S. 317 (entered into force Oct. 24, 1996) [hereinafter IAEA, *CNS*]; *see* O. Jankowitsch, *The Convention on Nuclear Safety*, 54 NUCLEAR L. BULL. 9 (1994) (discusses development and drafting of the CNS).

62. IAEA, *CNS*, *supra* note 61, art. 2. Under Article 2, the Convention applies to "nuclear installations," defined as "any land-based civil nuclear power plant . . . including such storage, handling and treatment facilities for radioactive materials as are on the same site and are directly related to the operation of the nuclear power plant." *Id.* art. 2(i).

63. *See id.* pmbl. (ix).

64. IAEA, *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*, IAEA Doc. INFCIRC/546, *opened for signature* Sept. 29, 1997, 2153 U.N.T.S. 357 (entered into force June 18, 2001) [hereinafter IAEA, *Joint Convention*]. The scope of the convention is described in Article 3 and may include military or defense wastes when transferred to civilian control. *Id.*

65. IAEA, *CNS*, *supra* note 61, pmbl. (vii); IAEA, *Joint Convention supra* note 64, pmbl. (ix). *See* T. de Wright, *The "Incentive" Concept as Developed in the Nuclear Safety Conventions and Its Possible Extension to Other Sectors*, 80 NUCLEAR L. BULL. 29, 32–35 (2007); J. Rautenbach, W. Tonhauser & A. Wetherall, *Overview of the International Legal Framework Governing the Safe and Peaceful Uses of Nuclear Energy—Some Practical Steps*, *in* INTERNATIONAL NUCLEAR LAW IN THE POST-CHERNOBYL PERIOD 7, 14–16 (OECD 2006), *available at* http://www.oecd-nea.org/law/chernobyl/.

regime of inspections or sanctions for their failure to comply with their obligations. Rather, each Member State agrees to periodically prepare a national report that includes a self-assessment of its implementation of the CNS and to participate in periodic peer review meetings with other states.[66]

The CNS lacks detailed safety standards, but it does identify broad criteria related to the safety of nuclear installations as well as expectations with respect to radiological protection, emergency preparedness, quality assurance, verification of safety, and consideration of human factors.[67] Overall, States "shall take the appropriate steps to ensure that all organizations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety."[68]

In terms of the operation of nuclear power plants, the institutions primarily responsible for ensuring safety in accord with these general principles are the regulatory authority and the plant operator. The CNS speaks to the organization and responsibility of both.[69] The capacity and commitment of the regulator and the regulated is critical to nuclear safety and, indeed, the outcome of the IAEA Action Plan. To developments with respect to these institutional arrangements we now turn.

B. Regulatory Independence and Competence Are Key to Nuclear Safety

The IAEA Action Plan encourages Member States to review their regulatory bodies, including "an assessment of their effective independence, adequacy of human and financial resources and the need for appropriate technical and scientific support, to fulfil their responsibilities."[70] The inclusion of such a recommendation in the Action Plan is not surprising given the sharp criticism of the Nuclear and

66. IAEA, *CNS*, *supra* note 61, arts. 5, 20. For an assessment of the Convention's effectiveness conducted from a U.S. perspective, see U.S. GENERAL ACCOUNTABILITY OFFICE, CONVENTION ON NUCLEAR SAFETY IS VIEWED BY MOST MEMBER COUNTRIES AS STRENGTHENING SAFETY WORLDWIDE, GAO-10-489, at 7–29 (Apr. 2010), http://www.gao.gov/assets/310/303698.pdf.

67. IAEA, *CNS*, *supra* note 61, arts. 12–19. The obligations were based largely on the safety principles for nuclear installations contained in the IAEA's Safety Fundamentals document, IAEA, *The Safety of Nuclear Installations*, IAEA Safety Series No. 110 (1993). IAEA, *CNS Brochure: Convention on Nuclear Safety (CNS), Introduction to the CNS and its Associated Rules of Procedure and Guidelines*, at 4 (May 2010), *available at* http://www-ns.iaea.org/downloads/ni/safety_convention/cns_2010_March.pdf.

68. IAEA, *CNS*, *supra* note 61, art. 10.

69. *Id.* arts. 8–9, 11; IAEA, *Joint Convention*, *supra* note 64, arts. 19–21 (mirrors provisions in the CNS with respect to these primary institutional responsibilities).

70. IAEA ACTION PLAN, *supra* note 53, at 3.

Industrial Safety Agency ("NISA"), the Japanese regulator, which is reflected in the official reviews of the Fukushima Daiichi accident.[71] Questions were raised about NISA's independence from those it regulated, its complacency, and its technical capacity.[72]

The CNS identifies in brief terms several attributes of a regulatory body. The regulator is to be "provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities," and there is to be assurance of "an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy."[73] However, no particular form of organization is prescribed. Thus, regulatory structures vary from country to country, with some taking the form of multi-member agencies or commissions, such as in the United States,[74] Canada,[75] Spain,[76] and France,[77] while other regulatory authorities

71. The Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company committee was established by a Cabinet Decision on May 24, 2011. The committee released an interim report in December 2011, INVESTIGATION COMM. ON THE ACCIDENT AT THE FUKUSHIMA NUCLEAR POWER STATIONS OF TOKYO ELEC. POWER CO. [ICANPS], INTERIM REPORT (2011) [hereinafter ICANPS, INTERIM REPORT], *available at* http://icanps.go.jp/eng/interim-report.html, and a final report on July 23, 2012, ICANPS, FINAL REPORT (2012) [hereinafter ICANPS FINAL REPORT], http://icanps.go.jp/eng/final-report.html. The Japanese Diet established the National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, which issued a report on July 5, 2012, available in English translation. NAT'L DIET REPORT, *supra* note 2.

72. NAT'L DIET REPORT, *supra* note 2, at 47–57; ICANPS, INTERIM REPORT, *supra* note 71, at 544–53, 594–96; ICANPS, FINAL REPORT, *supra* note 71, at 415–19.

73. IAEA, *CNS*, *supra* note 61, art. 8; *see also* IAEA, *Joint Convention*, *supra* note 64, arts. 19-20 (using "independence" rather than "separation" regarding the organizational situation of the regulator). Further guidance on the meaning of these principles can be found in other IAEA publications. *See, e.g.*, IAEA, *Governmental, Legal and Framework for Safety*, IAEA Doc. GSR Part 1 (2010) (IAEA Safety Standards Series), *available at* http://www-pub.iaea.org/MTCD/publications/PDF/Pub1465_web.pdf; IAEA, *Organization and Staffing of the Regulatory Body for Nuclear Facilities*, § 3.4, IAEA Doc. GS-G-1.1 (2002); IAEA, *Independence in Regulatory Decision Making* IAEA Doc. INSAG-17 (2003). The OECD Nuclear Energy Agency also acts as a forum for exchanging experience and information among regulators. *See* NEA, IMPROVING REGULATION: NEA REGULATORY GUIDANCE BOOKLETS (OECD 2011), *available at* http://www.oecd-nea.org/pub/improving-nuclear-regulation/index.html.

74. Energy Reorganization Act of 1974 (ERA) § 2(c), 42 U.S.C. § 5801 (2006).

75. Nuclear Safety and Control Act, S.C. 1997, c. 9 (Can.).

76. Law Reforming the Act Creating the Nuclear Safety Council (B.O.E. 2007, No. 268) (Spain), http://www.boe.es/boe/dias/2007/11/08/pdfs/A45920-45932.pdf (unofficial English translation available through OECD NEA, http://www.oecd-nea.org/law/legislation/spain/spain-nuclear-safety-council-2007.pdf).

77. Loi 2006-686 du 13 juin 2006 relative à la transparence et à la sécurité en matière nucléaire [Law 2006-686 of June 13, 2006 on Transparency and Security in the Nuclear Field] JOURNAL OFFICIEL DE LA REPUBLIQUE FRANÇAISE [J.O.] [OFFICIAL GAZETTE OF FRANCE], June 14, 2006, No. 0136, http://www.journal-officiel.gouv.fr (unofficial English translation available at http://www.french-nuclear-safety.fr/index.php/English-version/References).

are headed by a single director or administrator, sometimes organized within a ministry, such as in Germany[78] and Sweden.[79]

The overarching principle for regulatory authorities is independence—or separation—from the developmental or promotional functions of government and, of course, the operator itself.[80] The independence principle, like most if not all principles embedded in the CNS, reflects the consensus of experience in nuclear governance. It is an underlying principle, for example, that led the United States in 1974 to abolish the former U.S. Atomic Energy Commission and separate the regulatory and promotional responsibilities over nuclear energy between the NRC as an independent regulatory commission and what is now the Department of Energy.[81]

Although the CNS also emphasizes the principle that the operator of a nuclear power plant bears primary responsibility for the safety of operations,[82] the regulatory body is accountable for the effectiveness of its oversight of the operator. Accidents or even "near misses" often reveal weaknesses in the regulator. This observation is certainly true of the U.S. experience, most notably in the evaluations of the NRC after the Three Mile Island accident,[83] but also in critiques of the agency's regulatory

78. At the federal level the Federal Office for Radiation Protection is established within the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety; German *Länder* also carry out some responsibilities for nuclear regulation. Gesetz über die friedliche Verwendung der Kernenergie und den Schutz gegen ihre Gefahren (Atomgesetz) [Law on the Peaceful Uses of Nuclear Energy and Protection against its Hazards (Atomic Law)] Dec. 23, 1959, BUNDESGESETZBLATT [BGBL I] at 821, § 24, no. 56 (Ger.), as amended by Neufassung des Atomgesetzes [Revision of the Atomic Law], July 15, 1985, BGBL I at 1576, § 24, no. 41; Gesetz über die Errichtung eines Bundesamtes für Strahlenschutz [Law on the Establishment of a Federal Office for Radiation Protection] Oct. 9, 1989, BGBL I at 1830, §§ 1–2, no. 47, as modified in Gesetz vom [Law of] May 3, 2000, BGBL I at 636, art. 2, no. 20; *see* GOV'T OF THE FED. REPUB. OF GER., CONVENTION ON NUCLEAR SAFETY REPORT FOR THE FIFTH REVIEW MEETING 19–20, 40–46 (Apr. 2011), *available at* http://www.bfs.de/en/kerntechnik/CNS2011_ENG.pdf.

79. §§ 18, 24 MED INSTRUKTION FÖR STRÅLSÄKERHETSMYNDIGHETEN [Ordinance with Instructions for the Swedish Radiation Safety Authority] (Svensk författningssamling [SFS] 2008:452) (Swed.), *available at* http://www.lagboken.se/files/SFS/2008/080452.PD (unofficial English text available at http://www.stralsakerhetsmyndigheten.se/Global/IRRS/Ordinance%20with%20instructions%20for%20SSM.pdf).

80. IAEA, *CNS*, *supra* note 61, art. 8.2; IAEA, *Joint Convention*, *supra* note 64, art. 20.2; C. STOIBER, A. BAER, N. PELZER & W. TONHAUSER, HANDBOOK ON NUCLEAR LAW 26 (2003) [hereinafter STOIBER, HANDBOOK], *available at* http://www-pub.iaea.org/mtcd/publications/pdf/pub1160_web.pdf.

81. Energy Reorganization Act of 1974 (ERA) § 2(c), 42 U.S.C. § 5801 (2006); S. Rept. No. 93-980, at 19 (1974).

82. IAEA, *CNS*, *supra* note 61, art. 9; STOIBER, HANDBOOK, *supra* note 80, at 68.

83. *See* REPORT OF THE PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND, THE NEED FOR CHANGE: THE LEGACY OF THREE MILE ISLAND 51–56 (1979); NRC SPECIAL INQUIRY

oversight of licensed activities that did not result in any accident or radioactive release.[84] In Canada, the regulator's handling of the suspension of operation of a small reactor that produced radioisotopes for medical use led to the removal of the commission's chair in what some considered a challenge to the independence of the regulator.[85] Whether or not one hews to the proposition that regulators are inevitably "captured" by those they are charged with regulating, the credibility and effectiveness of the regulator is something that requires watchful attention.

The reports of the official investigations of the Fukushima Daiichi accident, particularly that of the commission established by the National Diet, contain blistering criticisms of the Japanese regulatory body. The accident itself is characterized as primarily a "manmade disaster" resulting from the "collusion between government, regulators, and TEPCO," the electric utility operating the plants.[86] The independence of the regulator was deemed a "mockery."[87] Its performance in setting safety standards and enforcing them as well as its response in an emergency were found wanting.[88] As the Diet report recounted, separation of the regulatory body in Japan had long been wanting both in appearance and in fact.[89] At the time of the Fukushima Daiichi accident, the regulator NISA was organized under the Ministry of Economy, Trade and Industry ("METI"), which also carried responsibility for nuclear power development. This organization persisted despite suggestions in an IAEA Integrated Regulatory Review Service ("IRRS") peer review of the Japanese regulatory system and questions raised during review meetings of the CNS.[90]

Even before the final reports of the review commissions, Japan took steps toward reform of its regulatory system and capability to deal with

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GROUP, THREE MILE ISLAND: A REPORT TO THE COMMISSIONERS AND TO THE PUBLIC, NUREG/CR-1250, at 112–14 (1980).

84. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-04-415, NRC NEEDS TO MORE AGGRESSIVELY AND COMPREHENSIVELY RESOLVE ISSUES RELATED TO THE DAVIS-BESSE NUCLEAR POWER PLANT'S SHUTDOWN 1 (May 2004), *available* at http://www.gao.gov/assets/250/242288.pdf.

85. B. MacKenzie, *The Independence of the Nuclear Regulator, Notes from the Canadian Experience*, 85 NUCLEAR L. BULL. 35 (2010).

86. NAT'L DIET REPORT, *supra* note 2, *Exec. Summary*, at 16, http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/en/report/index.html.

87. *Id.* at 20.

88. NAT'L DIET REPORT, *supra* note 2, Main Report, §§ 3.2, 5.2, 5.4, http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/wp-content/uploads/2012/08/NAIIC_Eng_Chapter5_web.pdf; ICANPS, INTERIM REPORT, *supra* note 71, § VI.8, at 544–54.

89. NAT'L DIET REPORT, *supra* note 2, Main Report, § 5.4.3.

90. *Id.* at 58–60. Normally, an IRRS mission is followed by a return mission within three years, but METI is said to have delayed the follow-up mission scheduled in February 2010. *Id.* at 59.

nuclear emergencies. A Cabinet decision was made in August 2011 to reconstitute the regulatory structure responsible for nuclear safety regulation.[91] The government submitted a bill to the Diet in January 2012 to establish the Nuclear Regulatory Authority headed by a single commissioner and organized under the Ministry of Environment.[92] The opposition parties submitted a counterproposal to the Diet in April 2012 that proposed a multi-member commission.[93] Ultimately, the government and the opposition parties agreed to a reform proposal in a new bill that was submitted to the Diet and adopted on June 27, 2012.[94] The bill also included provisions for strengthening the capability for emergency response through the establishment of the Nuclear Emergency Preparedness Commission ("NEPC") under the Cabinet. On September 19, 2012, the new Nuclear Regulation Authority began operation as a five-member independent commission under the Ministry of Environment with responsibility for safety and security of nuclear installations. Under other provisions of the legislation, the Nuclear Regulation Authority must prepare new safety regulations to address, for example, severe accident management.

C. States Turn to Regulatory Reform

The impetus for regulatory reform in Japan is understandable—but is it an isolated event? Interestingly enough, the Republic of Korea (South Korea) accomplished its own reform in October 2011, driven in part by its assessment of the Fukushima Daiichi accident. Korea's regulator, the Korean Institute of Nuclear Safety ("KINS"), had been organized under the Ministry of Education, Science & Technology ("MEST"), which also had the responsibility for nuclear research and development.[95] This

91. GOV'T OF JAPAN, CONVENTION ON NUCLEAR SAFETY NATIONAL REPORT OF JAPAN FOR THE SECOND EXTRAORDINARY MEETING, § B4.3, at 28-29 (July 2012), *available at* http://www.meti.go.jp/english/press/2012/pdf/0705_01b.pdf (providing a synopsis of the steps Japan has taken toward reform).

92. Statement of Japanese Cabinet, Reform of Japan's Nuclear Safety Regulation (Jan. 2012), http://www.cas.go.jp/jp/genpatsujiko/info/kokusaiws/siryo/reform_of_regulation.pdf.

93. *See* News Release, Japan Atomic Industrial Forum, Japanese Political Parties Begin Debate on New Nuclear Power Regulatory Organization in Lower House (June 4, 2012), http://www.jaif.or.jp/english/news_images/pdf/ENGNEWS01_1338802034P.pdf.

94. Genshiryoku kisei iinkai secchi ho [Act for Establishment of a Nuclear Regulation Authority], Law No. 47 of 2012 (Japan); 90 NUCLEAR L. BULL. 217 (2012) (forthcoming) (providing excerpts of the new law in English).

95. REPUBLIC OF KOREA, FIFTH NATIONAL REPORT FOR THE CONVENTION ON NUCLEAR SAFETY 25, 32–43 (Sept. 2010), http://210.218.197.2/pdf/Convention%20on%20Nuclear%20Safety%2020

organizational structure is comparable to the structure in Japan before the changes under the 2012 legislation. As a result of its reform legislation, Korea established a new Nuclear Safety and Security Commission ("NSSC") in October 2011.[96] NSSC now reports directly to the president,[97] and two institutes, the KINS and the Korea Institute of Nuclear Nonproliferation and Control, are transferred from MEST to NSSC as technical support organizations.[98]

Although not a direct outcome of the Fukushima Daiichi accident, the United Kingdom has moved over the past few years toward a restructuring of its regulatory system over nuclear power plants as part of its broader energy strategy that includes support for new nuclear plant construction. Nuclear regulation had been organized in several entities under the Health and Safety Executive ("HSE") Nuclear Directorate, including the Nuclear Installations Inspectorate, the Office for Civil Nuclear Security, and the United Kingdom Safeguards Office.[99] A 2008 report to the government recommended changes to enhance the capability, visibility, and organizational capacity of the regulator in the United Kingdom, particularly if the government was to pursue a policy of new nuclear construction.[100] Pending introduction of legislation, the new Office of Nuclear Regulation ("ONR") was established as a body within the HSE that consolidated disparate regulatory functions.[101] Under the Energy Bill pending in Parliament at the end of 2012, the ONR would be established

10.pdf.

96. 법률제10912호(원자력안전위원회의 설치 및 운영에 관한 법률) [Establishment and Operation of Nuclear Safety and Security Commission], Act No. 10912, Oct. 26, 2011, art. 3 (S. Kor.), http://gwanbo.korea.go.kr/main.gz; 88 NUCLEAR L. BULL. 173, 173–79 (2011) (providing excerpts of the new law in English).

97. Act No. 10912, Oct. 26, 2011, art. 3.1 (S. Kor.)

98. *Organization*, KOREAN NUCLEAR SAFETY AND SEC. COMM'N [NSSC], http://www.nssc.go .kr/nssc/english/introduction/organogram.html (last visited Jan. 12, 2013); *South Korea's Regulatory Changes*, NUCLEAR ENGINEERING INT'L (Apr. 20, 2012), http://www.neimagazine.com/story.asp ?storyCode=2062223.

99. *See* THE UNITED KINGDOM'S FIFTH NATIONAL REPORT ON COMPLIANCE WITH THE CONVENTION ON NUCLEAR SAFETY OBLIGATIONS 54–66 (Oct. 2010), http://www.decc.gov.uk/assets/ decc/What%20we%20do/UK%20energy%20supply/Energy%20mix/Nuclear/issues/safety/internationa l/731-uk-5th-nuclear-safety-obs.pdf (describing the earlier organization).

100. TIM STONE, NUCLEAR REGULATORY REVIEW PRIVATE ADVICE AND REASONING, OBSERVATIONS BY TIM STONE FOR THE SECRETARY OF STATE FOR ENERGY AND CLIMATE CHANGE 33–37 (Dec. 2008), *available at* http://www.decc.gov.uk/assets/decc/What%20we%20do/UK%20 energy%20supply/Energy%20mix/Nuclear/whitepaper08/1_20091116131031_e_@@_nuclearreviews toneadvice.pdf.

101. *See* Statement of Chris Grayling, Minister of State, Department for Work and Pensions (Feb. 8, 2011), *available at* http://www.publications.parliament.uk/pa/cm201011/cmhansrd/cm110208/ wmstext/110208 m0001.htm#11020828000008.

as a separate statutory entity, separate from the government but accountable through the Secretary of State who appoints the Chief Nuclear Inspector and other members of the ONR and approves ONR's five year strategic plans.[102]

India, another country with an eye toward new nuclear generation, has also taken steps toward regulatory reform. India's current regulatory body is the Atomic Energy Regulatory Board ("AERB").[103] The AERB and the Department of Atomic Energy currently fall under the purview of Atomic Energy Commission (the head of the department is also the chair of the Commission), which is accountable to the government.[104] As such, the current organization reflects the potential conflict between the promotional and regulatory sides of nuclear energy that the CNS charges states to avoid. As discussed earlier in this article, the lack of separation or independence of the regulator from governmental bodies responsible for nuclear promotion or development has led to recent regulatory restructuring in Japan and Korea since the Fukushima accident and was the impetus for such change several decades ago in the United States. A radiation incident in 2010, as well as reaction to the Fukushima Daiichi accident, prompted the introduction in the Indian parliament of a reform bill in 2011 to create an independent multi-member Nuclear Safety Regulatory Authority.[105] The Indian bill also created a Council of Nuclear Safety, headed by the prime minister and including a position for the chair of the Atomic Energy Commission to review policies on nuclear safety.[106] A parliamentary standing committee issued a report in March 2012 criticizing a number of aspects of the bill, including provisions related to the membership of the Council of Nuclear Safety and others that could adversely affect the autonomy of the Nuclear Safety Regulatory Authority

102. Energy Bill, 2012-13, H.C. Bill [100], sch. 7, §§ 2–4, 12(5) (U.K.), *available at* http://www.publications .parliament.uk/pa/bills/cbill/2012-2013/0100/cbill_2012-20130100_en_1.htm.

103. S.O. 4772 under the Atomic Energy Act of 1962, 1983, 5180 Gazette of India, part II, section.3(II), 25 (Dec. 31, 1983) (India), *available at* http://www.aerb.gov.in/cgi-bin/constitution/gazzette.asp (establishing the AERB).

104. *See* COMPTROLLER AND AUDITOR GENERAL OF INDIA, PERFORMANCE AUDIT ON ACTIVITIES OF ATOMIC ENERGY REGULATORY BOARD (DEP'T OF ATOMIC ENERGY), Rep. No. 9 of 2012–13, at 1–6, 12–13 (Mar. 2012), *available at* http://saiindia.gov.in/english/home/Our_Products/Audit_Report/Government_Wise/union_audit/recent_reports/union_performance/2012_2013/SD/Report_9/ReportNo_9.html.

105. *Id*. at 11. Nuclear Safety Regulatory Authority Bill, No. 76 of 2011, §§ 8–9 (India), *available at* http://www.prsindia.org/billtrack/the-nuclear-safety-regulatory-authority-bill-2011-1980/.

106. Nuclear Safety Regulatory Authority Bill, No. 76 of 2011, sec. 5 (India), *available at* http://www.prsindia.org/billtrack/the-nuclear-safety-regulatory-authority-bill-2011-1980/.

("NSRA").[107] At about the same time, the Comptroller and Auditor General of India issued a report sharply criticizing the performance and organization of the AERB, the current Indian regulator.[108] As of the writing of this Article, the bill remains pending in the Indian parliament.

Whether other reforms will come is yet to be seen. The international system continues to rely on the peer review system established under the CNS and further fostered through the IAEA's Integrated Regulatory Review Service ("IRRS") that conducts reviews of national regulatory programs. At the extraordinary meeting of the CNS in August 2012 and in the ministerial conference in Japan in December 2012, the Contracting States again emphasized the importance of ensuring the effective independence of the regulatory body in making regulatory judgments and taking enforcement action as well as ensuring that regulators are separated from promotional entities.[109] Also underscored were the importance of the regulator having financial and human resources, competent staff, and access as needed to external sources of expertise along with the regulator operating in a "transparent and open manner."[110] For the next review meeting, the parties agreed that national reports should address "[m]easures taken or planned to ensure the effective independence of the regulatory body from undue influence, including, where appropriate, information on the hosting of IRRS missions."[111]

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107. DEP'T-RELATED PARLIAMENTARY STANDING COMM. ON SCI. & TECH., ENV'T & FORESTS, TWO HUNDRED AND TWENTY FIRST REPORT ON THE NUCLEAR SAFETY REGULATORY AUTHORITY BILL, 2011 (Mar. 6, 2012), *available at* http://www.prsindia.org/uploads/media/Nuclear%20Safety/NSRA%20Bill%202011_%20Standing%20Com%20Report.pdf.

108. *See* COMPTROLLER AND AUDITOR GENERAL REPORT, *supra* note 104, vi-viii.

109. IAEA, *Final Summary Report, 2nd Extraordinary Meeting of the contracting Parties to the Convention on Nuclear Safety*, at 11, IAEA Doc. CNS/ExM/2012/04/Rev.2 (Aug. 31, 2012) [hereinafter *2nd Extraordinary Meeting Report*], *available at* http://www.iaea.org/Publications/Documents/Conventions/cns-summaryreport310812.pdf. The Swiss Federation offered proposals, inter alia, to amend the CNS to require contracting parties to subject their respective regulatory authority to a review by external experts and to remove provisions allowing reports to the convention and the debates to be confidential. *Id.* At the December 2012 Fukushima Ministerial Conference on Nuclear Safety, one of the working groups reporting to the conference noted that the accident

> reminds us of the imperative of establishing an effective nuclear safety regulatory framework, including an independent (in law, practice and culture) effective expert regulator that is credible, trusted, competent and adequately resourced. To achieve this objective, it is vital to recognize the importance of scientific and technical knowledge and expertise in taking effective, optimized regulatory decisions.

IAEA, *Fukushima Ministerial Conference on Nuclear Safety, Chairperson Summary*, Working Session 1, ¶ 4 (Dec. 15–17, 2012), http://www-pub.iaea.org/MTCD/Meetings/PDFplus/2012/20120216/20120216_CSummaries.pdf.

110. *Id.*

111. *2nd Extraordinary Meeting Report*, *supra* note 109, at 7, ¶ 23(e).

D. Nuclear Safety Starts with Plant Operator Accountability

Although the foregoing discussion has focused on the impetus for strengthening the regulatory body in carrying out its responsibilities, a few words should be said about the entity that holds the front line responsibility for safety—the plant operator. The CNS, being an agreement among States, speaks to the responsibility of the operator—the "license holder"—through the lens of the State's responsibility: "Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant license and shall take the appropriate steps to ensure that each such license holder meets its responsibility."[112]

As with the regulator NISA, the investigations of the Fukushima Daiichi accident exposed substantial shortcomings in TEPCO, the licensed operator of the Fukushima Daiichi power plants. These shortcomings range from TEPCO's failure to take measures that could have prevented or mitigated the impact of the tsunami before it occurred, to poor management of the accident and ineffective implementation of emergency protective measures.[113] The recalcitrance of the Federation of Electric Power Companies of Japan, an industry association, to work toward safety improvements to address seismic and tsunami threats is also blamed as contributing to the accident.[114]

In taking steps to improve the effectiveness of plant-operating organizations, the IAEA Action Plan stresses actions by States to improve "management systems, safety culture, human resources management, and scientific and technical capacity" of plant operators.[115] States are also urged to host an Operational Safety Review Team ("OSART") mission during the coming three years, a peer review program that looks at the safety of plants.[116] The plan also calls for strengthening cooperation between the IAEA and the World Association of Nuclear Operators ("WANO") "to enhance information exchange on operating experience and on other relevant safety and engineering areas and, in consultation with other relevant stakeholders, to explore mechanisms to enhance

112. IAEA, *CNS*, *supra* note 61, art. 9. Article 11 speaks to ensuring the availability of financial resources and qualified staff throughout the life of the installation. *Id.* art. 11.

113. *See generally* NAT'L DIET REPORT, *supra* note 2, *Exec. Summary*, at 16-18, 20; *id.*, Main Report, §§ 5.1–5.3; ICANPS, FINAL REPORT, *supra* note 71, *Exec. Summary*, at 24–25, 30.

114. NAT'L DIET REPORT, *supra* note 2, §§ 5.1, 5.2, 5.2.2.

115. IAEA ACTION PLAN, *supra* note 53, at 4.

116. *Id.*

communication and interaction among operating organizations."[117] This latter recommendation is of interest because it calls directly for greater cooperation with industry-based organizations in the interest of safety improvements.

WANO was established in 1989 after the Chernobyl accident, a non-profit organization with the purpose of providing peer reviews, some technical support, and sharing operational experience among its members, some 440 plant operators across the world.[118] WANO's organization and staff are based in four regional centers (Atlanta, Tokyo, Moscow, and Paris) and a central coordinating center in London.

WANO followed the earlier establishment by the nuclear industry in the United States of the Institute for Nuclear Power Operations ("INPO") after the Three Mile Island accident in 1979. INPO has acted in many respects as an industry self-regulatory body in the United States, and can be said to have brought together an otherwise fragmented industry of disparate operators.[119] INPO conducts periodic evaluations of plant performance and corporate management, accredits training programs, and evaluates events and operating experience.[120] While not a substitute for regulatory oversight of the NRC, INPO and NRC have established a memorandum of agreement with respect to communication of safety information.[121]

At the ministerial forum held in connection with the G8 meeting in Paris in June 2011, WANO's President suggested greater emphasis on emergency management, fuel storage, and design as areas to complement its core peer evaluation process.[122] In September 2012, IAEA and WANO

117. IAEA ACTION PLAN, *supra* note 53, at 4.

118. *About Us*, WANO, http://www.wano.info/about-us/ (last visited Jan. 12, 2013).

119. *See* JOSEPH V. REES, HOSTAGES OF EACH OTHER: THE TRANSFORMATION OF NUCLEAR SAFETY SINCE THREE MILE ISLAND 42–44 (Univ. of Chicago 1994); *see also* EDWARD BLANDFORD & MICHAEL MAY, LESSONS LEARNED FROM "LESSONS LEARNED": THE EVOLUTION OF NUCLEAR POWER SAFETY AFTER ACCIDENTS AND NEAR ACCIDENTS 11–13 (2012) [hereinafter BLANDFORD & MAY, LESSONS LEARNED], http://www.amacad.org/pdfs/lessonsLearned.pdf. In the assessment in the wake of the disastrous oil spill in the Gulf of Mexico, INPO was viewed as a potential model for self-policing by the oil industry to enhance safe operations. NAT'L COMM'N ON THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING, DEEP WATER: THE GULF OIL DISASTER AND THE FUTURE OF OFFSHORE DRILLING 235–42 (Jan. 2011), http://www.oilspillcommission.gov/final-report.

120. U.S. NUCLEAR REG. COMM'N, THE UNITED STATES OF AMERICA FIFTH NATIONAL REPORT FOR THE CONVENTION ON NUCLEAR SAFETY 181-93, NUREG-1650, Rev. 3 (Sept. 2010), *available at* http://www.balch.com/files/upload/Safety%20Report%2010.10.pdf.

121. *See id*. at 177.

122. OECD NUCLEAR ENERGY AGENCY, PROCEEDINGS OF THE FORUM ON THE FUKUSHIMA ACCIDENT: INSIGHTS AND APPROACHES 10, 87–94, OECD Doc. NEA/CNRA/R(2012)12 (Nov. 30, 2011).

concluded an updated memorandum of understanding to enhance cooperation and coordination on nuclear safety matters.[123] Such cooperation covers their respective performance indicator programs, exchange documents on operating experience, exchange of information during a serious incident at a nuclear installation, and providing staff support to each other's review teams as needed.[124]

In Japan itself, Federation of Electric Power Companies of Japan have recently established the Japan Nuclear Safety Institute ("JANSI"), which is intended to provide evaluation and support to nuclear operators along the lines of the INPO model.[125] JANSI will maintain relations with both INPO and WANO to seek guidance and peer review.[126]

As the foregoing discussion shows, the focus at an international level on improving the effectiveness of regulatory bodies and the accountability of operators will largely take place in the context of the incentive regime established by the CNS and related conventions. The actual task of strengthening the regulator will essentially rest with national governments. Structural changes to enhance the independence and the capacity of the regulatory bodies in accordance with the principles articulated in the CNS are important steps to enable effective oversight and build public confidence. Improving the capacity and corporate responsibility of those organizations that operate plants rests in the first instance with the operators themselves but should be closely monitored through active and vigorous oversight by the competent regulatory body.

Is this too much to ask? Within the shared framework of international peer review, perhaps not if States and operators are prepared to embrace and carry out the principles of the IAEA Action Plan. Strengthening institutional capacity is a necessary, even if by itself insufficient, step to achieving improvement in nuclear safety.

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123. IAEA Press Release, IAEA and WANO Sign New Memorandum of Understanding (Sept. 17, 2012), http://www.iaea.org/newscenter/pressreleases/2012/prn201222.html.

124. *Id.* As one commentary notes, however, WANO's assessments may have less of an impact than do INPO's. BLANDFORD & MAY, LESSONS LEARNED, *supra* note 119, at 13.

125. Statement of Makoto Yagi, Chairman, The Federation of Electric Power Companies of Japan (Nov. 15, 2012), *available at* http://www.fepc.or.jp/english/news/message/__icsFiles/afieldfile/2012/11/16/press_E_20121115.pdf.

126. *Japanese Industry Bolsters Nuclear Safety Cooperation*, WORLD NUCLEAR NEWS (Nov. 16, 2012), http://www.world-nuclear-news.org/RS-japanese_industry_bolsters_nuclear_safety_cooperation-1611124.html.

III. A GLOBAL NUCLEAR LIABILITY REGIME

Although implementing strengthened safety policies and practices and improving the capability of regulators and operators are important contributors to reducing the risk of nuclear power plant failures, the risk of accidents cannot be entirely eliminated. This Part discusses the liability regimes that apply in the event an accident does occur. The Fukushima Daiichi accident brings a new focus to the discussion of international liability regimes, one that is not merely about theoretical problems of the impacts of a nuclear accident. But unlike our discussion of regulatory and corporate failure in the preceding section of this commentary, the Japanese experience in responding to the accident is more a cautionary tale for others than it is a demonstration of a failure to ensure that basic principles of nuclear operation and regulation were followed.

To put the recommendation in the IAEA Action Plan in context, it is worth recalling how we got to where we are today, with several primary international instruments on liability, but with a large number of countries, including Japan, that lie outside of any of the regimes. This Part begins by providing a background of the existing global nuclear liability instruments. Then it explains the fundamental principles of a global nuclear liability regime. Next it discusses the present status of acceptance by States for the existing global nuclear liability instruments, including any partial acceptance of the fundamental principles in national legislation. This Part finishes with recommendations to achieving a global nuclear liability regime.

A. Background of Existing International Nuclear Liability Instruments

With the emergence of civilian nuclear power development in the mid-1950s, the question of a need for a special liability regime soon arose in view of the perceived special and uncertain hazards of nuclear operations as well as the potentially far-reaching consequences of a nuclear accident that might cross national borders. Whether private investment in and development of nuclear energy, despite its promise, would occur absent some regime that managed risks and balanced the interests of victims and operators was an open question.[127] In the United States, Congress adopted

127. *See, e.g.*, Exposé des Motifs of the Paris Convention (rev.) § 2, *approved by* OECD Council (Nov. 16, 1982), *available at* http://www.oecd-nea.org/law/nlparis_motif.html. In the United States, the main goals of the Price Anderson Act in establishing the U.S. liability regime were articulated in

the Price-Anderson Act in 1957 to establish a nuclear liability scheme for a nascent nuclear industry.[128] At about the same time in Europe, the then Organisation for European Economic Co-operation—now the OECD—gathered legal experts to explore the development of a legal instrument that would "provide a uniform system for all Western European countries."[129] These efforts led to the adoption in 1960 of the Paris Convention on Third Party Liability in the Field of Nuclear Energy.[130]

Of course, the 1960 Paris Convention, which entered into force in 1968, was only the first step toward the development of an international nuclear third party liability regime. After the adoption of the Paris Convention in 1960, the Brussels Convention Supplementary to the Paris Convention was adopted in 1963[131] (and entered into force in 1974) to provide additional funds to compensate damage as a result of a nuclear incident where Paris Convention funds proved to be insufficient. The Paris Convention itself was modified by two protocols adopted in 1964 and 1982.[132] The Vienna Convention on Civil Liability for Nuclear Damage

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its preamble as (1) providing confidence to the industry that it would not face unreasonable risk from participation in the nuclear program; (2) assuring the public that it would be compensated for injuries that could result from a nuclear accident; and (3) protecting the federal treasury from unnecessary exposure. Pub. L. No. 85-256, § 1, 71 Stat. 576 (1957); *see* Jason Zorn, *Compensation in the Event of a Terrorist Attack on A Nuclear Power Plant: Will Victims Be Adequately Protected?*, 38 NEW ENG. L. REV. 1087, 1105-07 (2003) (synopsis of development of Price Anderson Act).

128. Pub. L. No. 85-256, § 4, 71 Stat. 576 (adding § 170 to the Atomic Energy Act of 1954, 42 § U.S.C. 2210). The initial Price Anderson scheme provided for a level of public funding of compensation in addition to private insurance carried by the operator, but the modernized scheme, in effect since 1982, is based on insurance and a retrospective premium imposed on all operators. *See* Michael G. Faure & Tom Vanden Borre, *Compensating Nuclear Damage: A Comparative Economic Analysis of the U.S. and International Liability Schemes*, 33 WM & MARY ENV'L L. & POL'Y REV. 219, 240–44 (2008) [hereinafter Faure & Vanden Borre, *Compensating Nuclear Damage*], *available at* http://scholarship.law.wm.edu/cgi/viewcontent.cgi?article=1043&context=wmelpr.

129. Exposé des Motifs of the Paris Convention (rev.), *supra* note 127, § 3. *See* Tom Vanden Borre, *Shifts in Governance in Compensation for Nuclear Damage, 20 years after Chernobyl*, in TORT AND INSURANCE LAW, VOL. 21, SHIFTS IN COMPENSATION FOR ENVIRONMENTAL DAMAGE 262–66 (Michael Faure & Albert Verheij eds., 2007) (describing origins of international nuclear liability law).

130. Convention on Third Party Liability in the Field of Nuclear Energy, July 29, 1960, 956 U.N.T.S. 251 (entered into force Apr. 1, 1968) [hereinafter Paris Convention], *available at* http://treaties.un.org/doc/publication/unts/volume%20956/volume-956-i-13706-english.pdf.

131. Convention Supplementary to the [Paris Convention], concluded at Brussels, Jan. 31, 1963, 1041 U.N.T.S. 358 (entered into force Dec. 4, 1974) [hereinafter Brussels Supplementary Convention], *available at* http://treaties.un.org/doc/Publication/UNTS/Volume%201041/volume-1041-I-13706-English.pdf. The Brussels Supplementary Convention was amended by a Protocol adopted Nov. 16, 1982, 1650 U.N.T.S. 446 (entered into force Aug. 1, 1991), *available at* http://treaties.un.org/doc/Publication/UNTS/Volume%201650/v1650.pdf.

132. Additional Protocol to the Convention on Third Party Liability in the Field of Nuclear Energy, Jan. 28, 1964, 956 U.N.T.S. 335 (entered into force Apr. 1, 1968), *available at* http://treaties.un.org/doc/Publication/UNTS/Volume%20956/v956.pdf; Protocol to Amend the [Paris

was also adopted in 1963 and came into force in 1977.[133] The Vienna Convention is open to all States; the Paris Convention is open to any OECD Member and to any non-member with the consent of the other contracting parties.

The 1986 Chernobyl accident underscored the limitations of the international regimes to protect Member States when a major nuclear energy country in close proximity did not adhere. Just as the Chernobyl accident provided the catalyst for adoption of the Convention on Nuclear Safety and other instruments focused on emergency response and assistance, it also gave impetus to the search for further improvements in the nuclear liability regime.[134] The 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention[135] provided a bridge between those two conventions and thereby broadened the geographic scope of the conventions' coverage. Further, in 1997 negotiations were completed on two instruments under IAEA auspices: the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage[136] and a new instrument, the Convention on Supplementary

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Convention], as Amended by the Additional Protocol of 28 January 1964, concluded at Paris, Nov. 16, 1982, 1519 U.N.T.S. 329 (entered into force on Oct. 7. 1988), *available at* http://treaties.un.org/doc/Publication/UNTS/Volume%201519/volume-1519-I-13706-English.pdf. A consolidated text of the Paris Convention reflecting the 1964 and 1982 amending protocols is available at http://www.oecd-nea.org/law/nlparis_conv.html. There are 16 parties to the Paris Convention as amended through 1982, primarily in Western Europe and Turkey. Austria and Luxembourg also signed the convention. NEA, *Paris Convention on Nuclear Third Party Liability—Latest Status of Ratifications or Accessions*, http://www.oecd-nea.org/law/paris-convention-ratification.html (last visited Jan. 22, 2013).

133. Vienna Convention on Civil Liability for Nuclear Damage, *opened for signature* May 21, 1963, 1063 U.N.T.S. 266 (entered into force Nov. 12, 1977) [hereinafter Vienna Convention], *available at* http://treaties.un.org/doc/Publication/UNTS/Volume%201063/volume-1063-I-16197-English.pdf. There are currently 38 parties, including much of Eastern Europe and the Russian Federation. *See Vienna Convention on Civil Liability for Nuclear Damage*, IAEA, http://www.iaea.org/Publications/Documents/Conventions/liability_status.pdf (last visited Jan. 22, 2013).

134. *See* J. Schwartz, *International Nuclear Third Party Liability Law: The Response to Chernobyl*, *in* INTERNATIONAL NUCLEAR LAW IN THE POST-CHERNOBYL PERIOD 37, 44–53 (2006), *available at* http://www.oecd-nea.org/law/chernobyl/.

135. Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention, *opened for signature* Sept. 21, 1988, 1672 U.N.T.S. 293 (entered into force Apr. 27, 1992), *available at* http://treaties.un.org/doc/Publication/UNTS/Volume%201672/v1672.pdf; *see Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention*, IAEA (Aug. 29, 2012), http://www.iaea.org/Publications/Documents/Conventions/jointprot_status.pdf (last visited Jan. 22, 2013) (latest status of signature and ratification).

136. Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage, *opened for signature* Sept. 29, 1997, 2241 U.N.T.S. 302 (entered into force Oct. 4, 2003) [hereinafter 1997 Revised Vienna Convention], *available at* http://treaties.un.org/doc/Publication/UNTS/Volume%202241/v2241.pdf.

Compensation for Nuclear Damage ("CSC").[137] These developments were followed by negotiations concluded in 2004 by which the Paris Convention Member States adopted revisions to modernize the Paris Convention and the Brussels Supplementary Convention.[138]

B. Fundamental Principles of a Global Nuclear Liability Regime

In general, the liability conventions have coalesced around several major principles that continue to inform the liability regimes:

- *Strict liability*: Victims need not prove fault or negligence in seeking compensation;
- *Exclusive liability*: All liability is channeled to the facility operator;[139]
- *Provision of financial security*: Arrangements are made to ensure availability of funds to cover liability obligations;
- *Unity of jurisdiction*: Jurisdiction is focused, generally, in a single court of the State where the incident occurred to facilitate access to justice and avoid forum shopping; and
- *Non-discrimination*: The relevant convention and national legislation apply to all victims, regardless of their nationality, domicile or residence.[140]

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137. Convention on Supplementary Compensation for Nuclear Damage, *opened for signature* Sept. 29, 1997, 36 I.L.M. 1473 [hereinafter CSC], *available at* http://www.iaea.org/Publications/Documents/Infcircs/1998/infcirc567.shtml (awaiting sufficient signatures to be entered into force).

138. Protocol to Amend the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, *as amended by* the Additional Protocols of 28 January 1964 and by the Protocol of 16 November 1982, Feb. 12, 2004 [hereinafter 2004 Protocol to Amend Paris Convention], *available at* http://www.oecd-nea.org/law/paris-convention-protocol.html (awaiting sufficient signatures to be entered into force); Protocol to Amend the Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960 on Third Party Liability in the Field of Nuclear Energy, *as amended by* the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982, Feb. 12, 2004 [hereinafter 2004 Protocol to Amend Brussels Supplementary Convention], *available at* http://www.oecd-nea.org/law/brussels-supplementary-convention-protocol.htmlnvention (awaiting sufficient signatures to be entered into force).

139. On this point, the United States departs from the general principles because the scheme under the Price Anderson Act provides for *economic* as opposed to *legal* channeling. *See* Ben McRae, *The Compensation Convention: Path to a Global Regime for Dealing with Legal Liability and Compensation for Nuclear Damage*, 61 NUCLEAR L. BULL. 25, 29 n.14 (1998).

140. *See generally* J. Schwartz, *Liability and Compensation for Third Party Damage Resulting from a Nuclear Incident*, *in* INTERNATIONAL NUCLEAR LAW: HISTORY EVOLUTION AND OUTLOOK

Two other principles also shape the liability regimes and have evolved since the original conventions were adopted:

- *Liability limited in amount:* Under the early rationale for a special liability regime, a limitation on liability was part of the balance of the interests of victims and operators—e.g., strict and exclusive liability would ease the path toward compensation for victims, whereas liability limits would protect the nascent industry from ruinous claims. The modernized regimes have moved toward higher liability limits, but also allow the possibility of unlimited liability.[141]
- *Liability limited in time:* The 1960 Paris Convention and the 1963 Vienna Convention prescribe 10 years from the accident as the time limitation to bring claims. The 1997[142] and 2004[143] modernized versions of those conventions extend the period to 30 years for personal injury, whereas the 1997 CSC provides 10 years for all types of damage.[144]

These fundamental principles of a nuclear liability regime have developed over time and are generally accepted.

307, 307–16 (OECD 2010), *available at* http://www.oecd-nea.org/law/isnl/10th/isnl-10th-anniversary.pdf; STOIBER, HANDBOOK, *supra* note 80, at 109–16.

141. For example, Article 7(b) of the 1960 Paris Convention, *supra* note 130, capped liability at 15 million Special Drawing Rights (SDRs), the equivalent of about $23 million under the valuation system used by the International Monetary Fund. *SDR Valuation*, INT'L MONETARY FUND, http://www.imf.org/external/np/fin/data/rms_sdrv.aspx (last visited Jan. 22, 2013). Under Article I.H(a) of the 2004 Protocol to Amend Paris Convention, *supra* note 138, the operator's liability shall not be less than €700 million. Article V.1. & 3. of the Vienna Convention, *supra* note 133, set the operator's liability at a minimum of $5 million in terms of a specified value of the U.S. dollar in terms of gold, i.e., $35 per one troy ounce of fine gold. Article 7.1 of the 1997 Revised Vienna Convention, *supra* note 136, sets the minimum amount of operator liability at 300 million SDRs, which may be made up in part by public funds. The CSC, *supra* note 137, art III.1.(a)(1), provides for operator liability in the minimum amount of 300 million SDRs. *See* Faure & Vanden Borre, *Compensating Nuclear Damage*, *supra* note 128, at 234, 235 n.67, 236–40 (comparing liability regimes using SDR values as of July 2008); Norbert Pelzer, *Main Features of the Revised International Regime Governing Nuclear Liability – Progress and Standstill*, *in* INTERNATIONAL NUCLEAR LAW: HISTORY EVOLUTION AND OUTLOOK 355, 367–69 (OECD 2010) [hereinafter Pelzer, *Main Features*].

142. 1997 Revised Vienna Convention, *supra* note 136, art. 8(I).

143. 2004 Protocol to Amend Paris Convention, *supra* note 138, art I (recommending replacement of art. 8 of the Paris Convention currently in force).

144. CSC, *supra* note 137, annex, art. 9.1.

C. The Present Status of Acceptance of a Global Nuclear Liability Regime

Despite the general consensus on such principles and the apparent progress to modernize the conventions and draw new States into the international regime, progress toward a global regime seemed to flounder even before the Fukushima Daiichi accident. Although the United States has ratified the CSC, that instrument has only been ratified by a few other States and has yet to enter into force for want of sufficient member States with the requisite installed nuclear generating capacity.

The 2004 protocols revising the Paris and Brussels Conventions have also yet to enter into force.[145] Several governments, including the United Kingdom, Belgium, Italy, and Turkey, have yet to take the final steps needed for ratification, and the European Union has instructed its members that ratification may only occur simultaneously when all EU members have taken the necessary preparatory steps to do so.[146] The 1997 Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage,[147] although in force, has only 10 contracting parties (and not all of them are nuclear-generating states).[148]

Moreover, a number of States with significant nuclear energy capacity are not part of *any* regime. IAEA data lists 437 operating reactors around the world with another 68 under construction.[149] About 380 of these units

145. *See supra* note 138.

146. Council Decision 2004/294, art. 2.1, 2001 O.J. (L 97) 53, 54, *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:097:0053:0054:EN:PDF. The Council urged ratification by December 31, 2006. *Id*.

147. 1997 Revised Vienna Convention, *supra* note 136.

148. IAEA, Status of Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage, IAEA Reg. No. 1759 (May 29, 2012), *available at* http://www.iaea.org/Publications/Documents/Conventions/protamend_status.pdf. Importantly, the newest contracting member of the 1997 Protocol, the United Arab Emirates, is a state newly embarked on a civilian nuclear energy program. *UAE First "Newcomer" in 27 Years to Start Nuclear Power Plant Construction*, IAEA (Sept. 5, 2012), http://www.iaea.org/newscenter/news/2012/uaenewcomer.html. The Russian Federation ratified the 1963 Vienna Convention in 2005. О ратификации Венской конвенции о гражданской ответственности за ядерный ущерб O ratifikatsii Venskoi konventsii o grazhdanskoi otvetstvennosti za iadernyi ushcherb [On Ratification of the Vienna Convention on Civil Liability for Nuclear Damage], ROSSIISKAIA GAZETA [ROS. GAZ.] Mar. 24, 2005, No. 3727 (Russ.), http://www.rg.ru/2005/03/24/uscherb-dok.html. It has not adopted the 1997 protocol. *See* Press Release, Ministry of Foreign Affairs of the Russian Federation, Press Release Concerning Russia's Ratification of the Vienna Convention on Civil Liability for Nuclear Damage (Mar. 31, 2005), http://www.un.int/russia/pressrel/2005/050331eprel.pdf.

149. IAEA, *The Database on Nuclear Power Reactors*, *supra* note 44. These numbers represent a slight increase over 2011 in both categories. *See* IAEA, NUCLEAR POWER REACTORS IN THE WORLD 10–11 (2012), *available at* http://www-pub.iaea.org/books/IAEABooks/8954/Nuclear-Power-Reactors-in-the-World-2012-Edition (there are currently 435 reactors in operation and 65 under construction).

under construction or in operation are in eight states: Canada, China, France, India, Japan, South Korea, the Russia Federation, and the United States. Several of these States—Canada, China, Japan, Korea, and India—are not members of *any* regime, and the United States is a party to a regime not yet in force, the CSC.[150] That leaves approximately 245 operating plants and 48 plants under construction—about 58% of the world total—outside the scope of an international third party liability regime currently in force.[151]

This is not to say that States that have yet to join an international convention are ignoring the issue of providing a liability and compensation regime applicable to nuclear accidents. A number have adopted relevant national legislation that reflects the general principles previously discussed.[152] Perhaps the best illustration is Japan, which has undertaken extraordinary efforts to implement its national nuclear liability scheme to address the profound demands of compensating losses in the wake of the TEPCO Fukushima Daiichi accident.[153]

The Japanese government moved purposefully to develop guidelines for compensation under its statutory scheme and established the mechanisms to fund compensation in amounts that exceeded the required financial assurance carried by the operator.[154] The Japanese experience

150. *See* IAEA, *The Database on Nuclear Power Reactors*, *supra* note 44.

151. In addition to the reactors in operation or under construction in Canada, China, India, Japan, Korea, and the United States, Iran, Pakistan, South Africa, and Taiwan are not parties to a liability regime and currently operate or have under construction power reactors. *Id*.

152. For example, Canada has its Nuclear Liability Act, R.S.C., 1985, c. N-28, http://laws-lois.justice.gc.ca/eng/acts/N-28/FullText.html, whereas in China, the current liability regime is largely based on a State Council Reply. [Official Reply of the State Council to Questions on the Liabilities of Compensation for Damages Resulting From Nuclear Accident] (promulgated by St. Council, Guo Han [2007] No. 64) (China), *reprinted in* 80 NUCLEAR L. BULL. 78–79, 103–04 (OECD 2007), http://www.oecd-nea.org/law/nlb/nlb-80/documents/103_104_TextChina.pdf; [Reply of the State Council to the Ministry of Nuclear Industry, the State Administration of Nuclear Safety and the State Council Nuclear Power Leading Group on Disposal of the Matter of Nuclear Third Party] (promulgated by St. Council, Guo Han [1986] No. 44) (China)

153. Shigekazu Matsuura, *The Current Progress of Relief of Victims of Nuclear Damage Caused by Fukushima Nuclear Power Plant Accident*, *in* JAPAN'S COMPENSATION SYSTEM FOR NUCLEAR DAMAGE 29 (OECD 2012), *available at* http://www.oecd-nea.org/law/fukushima/7089-fukushima-compensation-system-pp.pdf; Ximena Vásquez-Maignan, *Fukushima: Liability and Compensation*, 29.2 NEA NEWS 9 (2011), http://www.oecd-nea.org/nea-news/2011/29-2/nea-news-29-2-fukushima-e.pdf.

154. Yasufumi Takahashi, *The Financial Support by the Nuclear Damage Compensation Facilitation Corporation*, *in* JAPAN'S COMPENSATION SYSTEM FOR NUCLEAR DAMAGE 41 (OECD 2012) [hereinafter Takahashi, *Financial Support*]; Genshiryoku Songai no Baishō ni Kansuru Hōritsu [Compensation for Nuclear Damage], Law No. 147 of 1961, *as amended by* Law No. 19 of 2009, § 16 (Japan), *reprinted in* 84 NUCLEAR L. BULL. 159, 166 (2009); Genshiryoku Songai Baishō Hoshō Keiyaku ni kansuru Hōritsu [Indemnity Agreements for Compensation of Nuclear Damage], Law No.

after the Fukushima Daiichi accident highlights a number of areas of interest for liability and insurance experts: for example, the provision for unlimited liability of the operator under Japanese law, [155] the decision that the operator could not take the benefit of an exemption from liability for accidents caused by a "grave natural disaster,"[156] and the allowance of compensation for certain kinds of damage,[157] such as "rumour-related" damage.[158]

As part of the call for improving the effectiveness of the international legal framework, the IAEA Action Plan asks

> 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.[159]

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148 of 1961, *as amended by* Law No. 19 of 2009, § 2 (Japan), *reprinted in* 84 NUCLEAR L. BULL. 171 (2009).

155. Compensation for Nuclear Damage, Law No. 147 of 1961, *as amended by* Law No. 19 of 2009, § 3 (Japan), *reprinted in* 84 NUCLEAR L. BULL. 159, 161 (2009).

156. Taiga Uranaka, *Japan Says No Limits to TEPCO Liability from Nuclear Disaster*, REUTERS (May 2, 2011), http://www.reuters.com/article/2011/05/02/idUSL3E7G205620110502; *see also* Takahashi, *Financial Support*, supra note 154, at 42; Toyohiro Nomura, Taro Hokugo & Chihiro Takenaka, *Japan's Nuclear Liability System*, *in* JAPAN'S COMPENSATION SYSTEM FOR NUCLEAR DAMAGE 15, 18 (OECD 2012).

157. DISPUTE RECONCILIATION COMM. FOR NUCLEAR DAMAGE COMP., *Secondary Guidelines on Determination of the Scope of Nuclear Damage Resulting from the Accident at the Tokyo Electric Power Company Fukushima Daiichi and Daini Nuclear Power Plants*, at pt. V (May 31, 2011), *reprinted in* JAPAN'S COMPENSATION SYSTEM FOR NUCLEAR DAMAGE 103, 103–20, (OECD 2012); DISPUTE RECONCILIATION COMM. FOR NUCLEAR DAMAGE COMP., *Interim Guidelines on Determination of the Scope of Nuclear Damage Resulting from the Accident at the Tokyo Electric Power Company Fukushima Daiichi and Daini Nuclear Power Plants*, at pt. 7 (May 31, 2011), *reprinted in* JAPAN'S COMPENSATION SYSTEM FOR NUCLEAR DAMAGE 123, 148–57 (OECD 2012).

158. *See* Takahashi, *Financial Support* , *supra* note 154, at 57, Figure 1.3 (OECD 2012).

159. IAEA ACTION PLAN, *supra* note 53, at 5. The encouragement to join a liability regime was reiterated in a conference resolution at the 56th General Conference in September 2012. IAEA, *Measures to Strengthen International Cooperation in Nuclear, Radiation, Transport and Waste Safety*, at 4, Gen. Conf. Res. 56, IAEA Doc. GC(56)/RES/9 (Sept. 20, 2012), *available at* http://www.iaea.org/About/Policy/GC/GC56/GC56Resolutions/English/gc56res-9_en.pdf.

Although courted to join the CSC (a step that would bring the CSC into force),[160] Japan is not currently a member of any of the international nuclear liability conventions, but rather, it has its own legislation addressing nuclear liability matters.[161] Since the accident, Japan has been implementing its compensation scheme under its national framework.[162]

D. Recommendations to Achieving a Global Nuclear Liability Regime

The INLEX group was tasked with recommending actions to achieve the goals articulated in the IAEA Action Plan applicable to nuclear liability regimes. By the end of its May 2012 meeting, INLEX developed *Recommendations on How to Facilitate Achievement of a Global Nuclear Liability Regime* that were reported to the Director General of the IAEA and noted in his August 2012 report on progress on the IAEA's post Fukushima Action Plan.[163] The main points are summarized as follows:

> 1. States with nuclear installations should adhere to, and adopt in national legislation, "one or more of the relevant international nuclear liability instruments that contain commonly shared

160. Faure, *Compensating Nuclear Damage: A Comparative Economic Analysis of the U.S. and International Liability Schemes*, *supra* note 141, at 231 n.50.

161. *See* Genshiryoku Songai no Baishō ni Kansuru Hōritsu [Compensation for Nuclear Damage], Law No. 147 of 1961, *as amended by* Law No. 19 of 2009, § 16 (Japan); Genshiryoku Songai Baishō Hoshō Keiyaku ni kansuru Hōritsu [Indemnity Agreements for Compensation of Nuclear Damage], Law No. 148 of 1961, *as amended by* Law No. 19 of 2009, § 2, *reprinted in* 84 NUCLEAR L. BULL. 159, 171 (2009).

162. *See, e.g.*, JAPAN'S COMPENSATION SYSTEM FOR NUCLEAR DAMAGE (OECD 2012) (providing a compilation of Japanese statutes, and guidelines related to liability and compensation with commentary by Japanese legal experts); *see also* Michael Faure & Jing Liu, *The Tsunami of March 2011 and the Subsequent Nuclear Incident at Fukushima: Who Compensates the Victims*, 37 WM. & MARY ENVTL. L. & POL'Y REV. 129, 191–205 (2012), *available at* http://scholarship.law.wm.edu/wmelpr/vol37/iss1/5; Eri Osaka, *Corporate Liability, Government Liability, And The Fukushima Nuclear Disaster*, 21 PAC. RIM L. & POL'Y J. 427, 439–44 (2012), *available at* http://www.law.washington.edu/PacRim/.

163. IAEA, *Progress on the Implementation of the IAEA Action Plan on Nuclear Safety, Supplementary Information*, at 24, ¶ 144, IAEA Doc. GOV/INF/2012/11-GC(56)/INF/5 (Aug. 15, 2012) [hereinafter IAEA, *Progress on the Implementation of the IAEA Action Plan*], *available at* http://www.iaea.org/About/Policy/GC/GC56/GC56InfDocuments/English/gc56inf-5-att1_en.pdf (providing a link to the INLEX recommendations, http://ola.iaea.org/ola/documents/ActionPlan.pdf). A brief background paper prepared by the IAEA secretariat precedes the recommendations. Int'l Expert Group on Nuclear Liability (INLEX), *Recommendations on How to Facilitate Achievement of a Global Nuclear Liability Regime, As Requested by the IAEA Action Plan on Nuclear Safety* (last visited Jan. 13, 2013) [hereinafter INLEX, *Recommendations*], http://ola.iaea.org/ola/documents/ActionPlan.pdf.

international principles reflecting the enhancements developed under the auspices of the IAEA during the 1990's."[164]

2. "States with nuclear installations should strive to establish treaty relations with as many States as practical with a view to ultimately achieving universal participation in a global nuclear liability regime that establishes treaty relations among all States."[165]

3. States with no nuclear installations should consider "adhering to a global regime, taking into account the benefits that such a regime offers for victims once it achieves adherence by a significant number of States with nuclear installations."[166]

4. "States with nuclear installations should ensure that there are adequate funds available to compensate all victims of a nuclear incident, without discrimination."[167] States can do this by:

> a. Establish[ing] compensation and financial security amounts significantly higher than the minimum amounts envisaged under the existing instruments;
>
> b. Undertak[ing] regular reviews the adequacy of compensation amounts in order to ensure that their value is maintained and that they reflect developments in the understanding of the possible impact of incidents . . . noting that there is a trend towards establishing unlimited liability of the operator;
>
> c. Undertak[ing] regular reviews of the adequacy of financial security amounts in order to ensure that those amounts reflect available capacity in insurance markets, as well as other sources of financial security;
>
> d. Be[ing] prepared to set up appropriate funding mechanisms in cases where the amount of damage to be compensated exceeds the available compensation and financial security amounts;
>
> e. Provid[ing] compensation for latent injuries, noting that the revised Vienna and Paris Conventions set a 30-year time limit for filing claims for personal injury; and

164. INLEX, *Recommendations*, *supra* note 163, at 3, Rec. 1.
165. *Id.* at 3, Rec. 2.
166. *Id.* at 3, Rec. 3.
167. *Id.* at 3, Rec. 4.

> f. Ensur[ing] that compensation is available in the case of an incident directly due to grave . . . [and exceptional] natural disasters . . . .[168]

> 5. States should "ensure that all claims arising from a nuclear accident are dealt with in a single forum in a prompt, equitable and non-discriminatory manner with minimal litigation . . . ."[169]

The recommendations are nominally "convention-neutral." INLEX noted 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.[170]

So what's next? The INLEX recommendations reflect, of necessity, high-level goals and aspirations. After all, the INLEX experts themselves come from different backgrounds and viewpoints on the efficacy of the various existing international instruments. There is no certain consensus on how best to effect these recommendations, nor is there a simple or obvious fix that will convert the current "patchwork" of liability regimes into a seamless whole.[171] There are strong and often passionate views on the merits and adequacy of either the Paris and Vienna Conventions and the Joint Protocol linking them, or the CSC, as the foundation for achieving the goal of an international regime.[172] Indeed, some doubt whether there is

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168. *Id.* at 3–4, Rec. 4(a)-(f). Article I.J. of the 2004 Protocol to Amend Paris Convention, *supra* note 138, and Article 6.1 of the Vienna Convention, *supra* note 133, modified the text of the respective original conventions to eliminate the exemption from liability if an accident was caused by a grave natural disaster.

169. INLEX, *Recommendations*, *supra* note 162, Rec. 5.

170. *Id.* at 3, Rec. 2.

171. *See* Pelzer, *Main* Features, *supra* note 141, at 383; Jakub Handrlica, *Reactions to the EC Legal Study from a Legal and Policy Viewpoint*, *in* PROSPECTS OF A CIVIL NUCLEAR LIABILITY REGIME IN THE FRAMEWORK OF THE EUROPEAN UNION 39, 41–42 (2012) [hereinafter PROSPECTS OF A CIVIL NUCLEAR LIABILITY REGIME].

172. *Compare* Norbert Pelzer, *Learning the Hard Way: Did the Lessons Taught by the Chernobyl Nuclear Accident Contribute to Improving Nuclear Law?*, *in* INTERNATIONAL NUCLEAR LAW IN THE

really any merit to striving for a global liability regime if regional accommodations—such as a European or North American or an East Asian regime—can adequately address the interests of victims and operators.[173] There are also strong views about the consistency of national legislation in non-members to the conventions, like India with the unifying principles of the international regime.[174] In addressing these issues we still need to face other important questions. How far will private insurance cover heads of damage?[175] Is the notion of unlimited operator liability a mere illusion? Do these regimes inappropriately shift the burden to the public in the form of "state aid" to operators?[176] These questions remind us that the path to a global liability regime is not an easy one, and it may well be that modest progress toward adaptation of the universal principles in national legislation and further progress toward bringing the modernized regimes into force will have a salutary effect.[177]

POST-CHERNOBYL PERIOD 73, 111–15 (OECD 2006), *available at* http://www.oecd-nea.org/law/chernobyl/ (providing views doubting the efficacy of the CSC as the basis of a unifying regime); Vlad Chirpius, *Could the Convention on Supplementary Compensation for Nuclear Damage Become the Fundament for a Unified EU Legal Regime of the Nuclear Third Party Liability?*, *in* PROSPECTS OF A CIVIL NUCLEAR LIABILITY REGIME, *supra* note 171, at 71, 78–81 (same), *with* Wolfram Tonhauser, *Reaction to the EC Legal Study from a Legal and Policy Viewpoint*, *in* PROSPECTS OF A CIVIL NUCLEAR LIABILITY REGIME, *supra* note 171, at 24–25 (providing views supporting CSC as the basis of a global regime); Omer F. Brown, *Convention on Supplementary Compensation for Nuclear Damage* (CSC), *in* PROSPECTS OF A CIVIL NUCLEAR LIABILITY REGIME, *supra* note 171, at 169–70 (same); Ben McRae, *The Convention on Supplementary Compensation for Nuclear Damage: Catalyst for a Global Nuclear Liability Regime*, 79 NUCLEAR L. BULL. 17, 22–23 (2007) (same).

173. NORBERT PELZER, ON A GLOBAL NUCLEAR LIABILITY REGIME 4 (Oct. 11, 2012), http://www.burges-salmon.com/INLA_2012/10234.pdf; *see also France, U.S. Differ on Universal Liability Regime*, 52 NUCLEONICS WEEK 1–3 (July 27, 2011) (describing differences between France and the United States on approach to achieving global liability regime).

174. Civil Liability for Nuclear Damage Act, No. 38 of 2010, 47 Gazette of India [Gaz. India], pt II, sec. 1, 1–15 (Sept. 21, 2010); Civil Liability for Nuclear Damage Rules, 2011, 2112 Gaz. India, pt. II, sec. 3, 1–20 (Nov. 11, 2011), *available at* http://www.prsindia.org/billtrack/the-civil-liability-for-nuclear-damage-bill-2010-1042/. The controversy over the Indian regime largely centers on the provisions in Sections 4 and 17 of the 2010 Act and Rule 24 in the 2011 rules related to channeling of liability to the operator and the operator's right of recourse against its suppliers. *See, e.g.*, R. Gruendel & E. Kini, *Through the Looking Glass, Placing India's New Civil Liability Regime for Nuclear Damage in Context*, 89 NUCLEAR L. BULL. 45, 48–53, 64-66 (2012); Jayshree Bajoria, *India's Nuclear Liability Dilemma*, COUNCIL ON FOREIGN REL. (Nov. 4, 2010), http://www.cfr.org/international-peace-and-security/indias-nuclear-liability-dilemma/p23305# (reporting interview with Ashley J. Tellis, Senior Associate, Carnegie Endowment for International Peace).

175. *See* Mark Tetley, *Revised Paris and Vienaa Nuclear Liability Conventions—Challenges for Insurers*, 77 NUCLEAR L. BULL. 27, 33–34, 36–38 (2006).

176. *See* Michael G. Faure & Karine Fiore, *An Economic Analysis Of The Nuclear Liability Subsidy*, 26 PACE ENV'L L. REV. 419, 445–47 (2009).

177. For example, the United States and France, in their statements at the December 2012 ministerial conference at Fukushima, both acknowledged discussions to achieve greater collaboration and convergence toward achievement of a global liability regime. Statement by NRC Chairman

IV. CONCLUSION

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. Beyond the issues discussed in this Article related to strengthening regulators and operators and improving the liability system, there are other important areas being addressed at national levels and through international cooperation to enhance safety standards, strengthen protection against natural hazards, and improve emergency preparedness and response. Underlying all of these efforts is a need to foster a strong "cultural" commitment to nuclear safety at every level of the organizations involved in nuclear safety. As the contracting parties noted in their report on the August 2012 extraordinary meeting of the CNS, "Safety culture and human and organizational factors were identified as crosscutting issues, which affect the consideration of external events, design, severe accident management, including operator training, the good functioning of national organizations and emergency preparedness and response."[178]

As we have seen, much of the international response to the accident has proceeded largely within the existing framework for cooperation. In addressing the strength of regulatory bodies and plant operators, the peer review system remains the tool for consensus building and for providing incentives to organizational improvement. With responsibility for implementing regulation largely centered at the national level—and recognizing that the amendment of the CNS is no simple matter[179]—

Allison Macfarlane, Fukushima Ministerial Conference, at 2 (Dec. 15, 2012), *available at* http://www.mofa.go.jp/policy/energy/fukushima_2012/pdfs/statements_m67.pdf; Statement of Delphine Batho, Minister of Ecology, Sustainable Development and Energy, Republic of France, at 10 (Dec. 15, 2012), http://www.mofa.go.jp/policy/energy/fukushima_2012/pdfs/statements_m74.pdf (French text).

178. *2nd Extraordinary Meeting Report*, *supra* note 109, at 7, ¶ 24. "Safety culture" is "that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance." IAEA, *Safety Culture*, at 4, IAEA Doc. INSAG-4 (1991), *available at* http://www-pub.iaea.org/MTCD/publications/PDF/Pub882_web.pdf. The term "safety culture" in the nuclear safety context was introduced in the assessment of the Chernobyl accident. *Id*. at 3. For a further discussion of the concept of safety culture, see IAEA, *Key Practical Issues in Strengthening Safety Culture*, IAEA Doc. INSAG-15 (2002), *available at* http://www-pub.iaea.org/MTCD/publications/PDF/Pub1137_scr.pdf; INPO, *Principles for a Strong Nuclear Safety Culture* (2004), http://www.efcog.org/wg/ism_pmi/docs/Safety_Culture/Dec07/INPO%20PrinciplesForStrongNuclearSafetyCulture.pdf. The NRC has adopted a policy statement on safety culture. NRC Final Safety Culture Policy Statement, 76 Fed. Reg. 34,773 (June 14, 2011).

179. *See* IAEA, *CNS*, *supra* note 61, art. 32.

focusing on the robustness of the peer review system may well prove to be the best approach. It is, however, an approach that requires vigilance, frankness in assessments, and continued movement toward a more transparent sharing of national reports and assessments through the various review mechanisms.

With respect to nuclear liability, the issue has been primarily one of continuing to move forward with ratification of the improvements to the liability regimes by parties to the existing conventions or by drawing unaffiliated countries into a liability convention. As one commentator put it, there has been both "progress and standstill" in the liability field.[180] Even if a well-integrated global regime is not within our grasp, continued efforts to harmonize the regimes and broaden the participation in them are worthy objectives. The Fukushima Daiichi accident was termed a "manmade disaster" by the National Diet Investigation Commission[181] because the accident was as much a consequence of the complacency and hubris of those responsible for safety as it was the result of the impact of extraordinary natural events. That is an observation that should be kept in the forefront as the international community continues to implement the IAEA Action Plan's blueprint for addressing the lessons learned from the accident. Ultimately, States will need to show how outcomes of the studies and evaluations under the plan have been translated into meaningful measures to strengthen institutions, improve plant designs, mitigate the impact of malfunctions and natural events, and protect the public.

180. Pelzer, *Main* Features, *supra* note 141, 382–83.
181. NAT'L DIET REPORT, *supra* note 2, *Exec. Summary*, at 16.