

## Revisiting the Convention on Nuclear Safety:

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# Revisiting the Convention on Nuclear Safety: Lessons Learned from the Fukushima Accident

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## Abstract

The Fukushima nuclear accident raised questions about the implementation of the Convention on Nuclear Safety by the Japanese government and identified the need to reassess the obligation of each contracting party deriving from the Convention and IAEA safety standards. The author analyzes several major deficiencies such as the lack of independence and effectiveness of the regulatory body, the failure to evaluate all relevant site- and design-related factors, and design and construction of the installation, as well as the emergency response, in order to determine the failure of the Japanese government to comply with the Convention and exercise the obligation of due diligence. As a result, the author demonstrates the fulfilment of two elements of state responsibility for nuclear damage. The author also establishes the ineffectiveness of the Convention's preventive monitoring mechanisms and recommends the introduction of a stronger monitoring regime and highlights the need to amend the Convention safety rules.

In its preliminary report<sup>1</sup> six months after the Fukushima accident of 11 March 2011, some of the findings of the IAEA were that:

The tsunami hazard for several sites was underestimated. Nuclear regulatory systems should address extreme external events adequately, including their periodic review, and should ensure that regulatory independence and clarity of roles are preserved in all circumstances in line with IAEA Safety Standards.<sup>2</sup>

The IAEA also found that, notwithstanding the fact that the catastrophe was caused by a natural disaster, there were, *inter alia*, serious deficiencies in the siting and design of the plant and the emergency readiness of the country, as well as an incomplete and imprecise legislative and regulatory framework.<sup>3</sup> Thus, the nuclear accident raised questions about

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1. International Atomic Energy Agency, "IAEA International Fact Finding Expert Mission of the Nuclear Accident Following the Great East Japan Earthquake and Tsunami: Preliminary Summary" (1 June 2011), online: IAEA <<http://www.iaea.org/newscenter/focus/fukushima/missionsummary010611.pdf>>.

2. *Ibid.*, at 4.

3. See also The National Diet of Japan, "Official Report of the Fukushima Nuclear Accident Independent Investigation Commission" (1 October 2012), online: NAIIC <<http://www.nirs.org/fukushima/>>.

the implementation of the Convention on Nuclear Safety (NSC)<sup>4</sup> and the IAEA safety standards by the Japanese authorities. Moreover, the events prior and subsequent to the accident demonstrated the need to revisit the obligations deriving from the various provisions of the Convention, especially provisions relating to powers of the national regulatory body and the safety of installations. Consequently, states producing nuclear energy began to re-evaluate their own domestic nuclear energy capacity and regulatory and legislative frameworks in order to assess the safety of national nuclear power plants in the light of the Japanese catastrophe.<sup>5</sup>

The Fifth Review Meeting of the NSC was also convened in Vienna, Austria, from 4 to 14 April 2011 to discuss safety issues and draw lessons from the Fukushima accident. At this meeting the parties also reiterated the need to:

[R]eaffirm their commitment to the objectives of the NSC: to achieve and maintain a high level of nuclear safety worldwide through enhancement of national measures and international cooperation; to establish and maintain effective defences in nuclear installations against potential radiological hazards and to prevent accidents with radiological consequences and to mitigate such consequences should they occur.<sup>6</sup>

This article will first briefly chronicle the events that occurred prior to and after the accident in order to evaluate the response of the Japanese government. Second, it will analyze the provisions of the NSC and the IAEA safety standards that are relevant in this case. Third, it will evaluate the implementation of the relevant NSC provisions by the Japanese authorities in order to assess its compliance with the Convention. This consequently raises the issue of Japan's international responsibility for wrongful acts in the case of Fukushima. Finally, the suggestions and recommendations for reviewing the effectiveness of the NSC provisions will be analyzed.

## I. THE FUKUSHIMA ACCIDENT

The nuclear accident that occurred in the Fukushima Daiichi Nuclear Power Plant on 11 March 2011 was a result of a major earthquake of magnitude 9.0 and the subsequent tsunami of 14 to 15 metres that rose at its highest to 39 metres at Aneyoshi, Miyako.<sup>7</sup> The human consequences of these events were devastating. According to the UN Office

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naic\_report.pdf) at 16. The Independent Investigation Commission appointed by the National Diet was even more critical, calling the disaster a manmade disaster that was the result of collusion between the government, the regulators, and TEPCO, and a lack of governance by said parties.

4. *Convention on Nuclear Safety*, 17 June 1994, 1963 U.N.T.S. 293 (entered into force 24 October 1994) [NSC]. There are seventy-five contracting parties to the Convention and Japan is one of them.
5. See US Senate Committee on Energy and Natural Resources, *Nuclear Power Plant Tragedy in Japan Briefing*, 29 March 2011. Washington: Government Printing Office, 2011 [US Senate Briefing]; European Commission, "Joint Declaration/Press Statement on Comprehensive Risk and Safety Assessments of Nuclear Plants ('stress tests')" (23 June 2011), online: EC <<http://ec.europa.eu>>; European Union: European Commission, *Communication from the Commission to the Council and the European Parliament on the Interim Report on the Comprehensive Risk and Safety Assessments ("stress tests") of Nuclear Power Plants in the European Union*, 24 November 2011.
6. IAEA, "Summary Report of the 5th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety" (4–14 April 2011), online: IAEA <<http://www-ns.iaea.org>> at 3.
7. See *supra* note 1 at 2.

for the Coordination of Humanitarian Affairs, around 16,600 persons went missing, while many more were displaced from their homes.<sup>8</sup> The World Nuclear Association stated that the tsunami alone caused the deaths of 20,000 people.<sup>9</sup> The natural disaster also caused major destruction of infrastructure and the loss of many homes.<sup>10</sup> The World Health Organization and the Food and Agriculture Organization highlighted enduring health concerns which involve the development of cancer and other illnesses due to a long-term radiation exposure as well as the radioactive contamination of food and radioactivity of the soil and surrounding environment.<sup>11</sup>

Several nuclear power plants in the vicinity were affected by the natural disaster: Tokai, Higashi Dori, Onagawa, Daiichi, and Dai-ni.<sup>12</sup> The worst affected was TEPCO's (Tokyo Electric Power Co.) Daiichi Nuclear Power Plant which managed to resist the consequences of the earthquake by successfully shutting down all operating units.<sup>13</sup> However, the ensuing tsunami led to the loss of power supply which subsequently obstructed the cooling of the three reactors at the Fukushima Daiichi nuclear plant.<sup>14</sup> Only one emergency diesel generator (6B) remained intact and it "provided emergency power for the units 5 and 6".<sup>15</sup> Moreover, the instrumentation and control systems were also disabled by the tsunami, rendering repair work almost impossible. The absence of the cooling system quickly led to an explosion on site; the spent fuel pools began to leak and the radiological contamination spread into the environment.<sup>16</sup> Japan faced an unprecedented nuclear accident that was rated 7 on the INES scale.<sup>17</sup>

## II. THE CONVENTION ON NUCLEAR SAFETY

The Convention on Nuclear Safety was adopted in Vienna in 1994, eight years after the Chernobyl accident.<sup>18</sup> It was the result of growing concern over the operation of

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8. UN Office for the Coordination of Humanitarian Affairs, *Japan: Earthquake & Tsunami, Situation Report No. 7* (18 March 2011), online: OCHA <<http://reliefweb.int>>.
  9. World Nuclear Association, "Fukushima Accident 2011" (November 2011), online: WNA <[http://www.world-nuclear.org/info/fukushima\\_accident\\_inf129.html](http://www.world-nuclear.org/info/fukushima_accident_inf129.html)>.
  10. IAEA, "Report of Japanese Government to IAEA Ministerial Conference on Nuclear Safety—Accident at TEPCO's Fukushima Nuclear Power Stations" (7 June 2011), online: IAEA <<http://www.iaea.org/newscenter/focus/fukushima/japan-report/>> [*Report of Japanese Government*]. According to this report, the tsunami caused the inundation of 561km<sup>2</sup> of land and the destruction of 475,000 residential buildings. Approximately 460,000 households suffered from gas supply shortages, approximately 4,000,000 households lost electricity and almost all phone lines were down.
  11. International Food Safety Authorities Network, "Information on Nuclear Accidents and Radioactive Contamination of Foods" (30 March 2011), online: INFOSAN <<http://www.fao.org>>.
  12. See *supra* note 1 at 2.
  13. Fukushima Dai-ni 1, 2, 3, 4, Tohoku's Onagawa 1, 2, 3, and Japco's Tokai operating units were also successfully shut down.
  14. Three other reactors that did not melt are now in cold shutdown.
  15. *Supra* note 1 at 2.
  16. See Mark J. RAMSEYER, "Why Power Companies Build Nuclear Reactors on Fault Lines: The Case of Japan" (2012) 13 *Theoretical Inquiries in Law* 457.
  17. See "How Does Fukushima Differ From Chernobyl" BBC (16 December 2011), online: BBC <<http://www.bbc.co.uk/news/world-asia-pacific-13050228>>. So far 370,000 terabecquerels (as of 12 April) of radiation were realized. At Chernobyl 5.2 million terabecquerels were realized.
  18. See NSC, *supra* note 4.

“Chernobyl-type graphite reactors that continue to operate not only in Ukraine but also in Russia and Lithuania”.<sup>19</sup> It is considered to be an “incentive convention” prescribing general safety rules without directly interfering in the competence of the national regulatory bodies. This is underlined in its Preamble, which states that the “Convention entails a commitment to the application of fundamental safety principles for nuclear installations rather than of detailed safety standards”.<sup>20</sup> As is the case with many other conventions regulating civilian nuclear energy,<sup>21</sup> the rules of the NSC are heavily based “on the technical standards contained in the Safety Fundamentals by the IAEA in 1993”.<sup>22</sup> Although these standards<sup>23</sup> are not considered to be binding and the NSC does not explicitly refer to them, some authors still believe states must comply with the standards since “they had undoubted influence on the regulation of nuclear risks at the national level and regulating nuclear facilities”.<sup>24</sup> The main objective of NSC is “to achieve and maintain a high level of nuclear safety worldwide through the enhancement of national measures and international co-operation including, where appropriate, safety-related technical co-operation”.<sup>25</sup> Since IAEA standards provide a detailed account of measures aimed at fulfilling this objective, they need to be relied upon in interpreting and implementing the NSC provisions.<sup>26</sup> These standards also provide indispensable guidance for states in complying with the convention, which requires prescribing of national safety standards. They also represent “an international consensus on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation”.<sup>27</sup> Due to all these reasons, they will be taken into consideration in assessing Japan’s compliance with the NSC.

The NSC requires each contracting party to “take the appropriate steps to ensure the safety of nuclear installations”,<sup>28</sup> which necessitates that a country fulfils several obligations. The word “appropriate” may seem to be an unclear and rather

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19. Menno KAMMINGA, “The IAEA Convention on Nuclear Safety” (1995) 44 *International and Comparative Law Quarterly* 872 at 875.

20. NSC, *supra* note 4.

21. *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*, 5 September 1997 (entered into force 18 June 2001), online: IAEA <<http://www.iaea.org/ns/tutorials/regcontrol/refs/13jointconv.pdf>>.

22. Kamminga, *supra* note 19 at 875.

23. See IAEA, “IAEA Safety Standards: The Global Reference for Protecting People and the Environment from Harmful Effects of Ionizing Radiation” (June 2009), online: IAEA <<http://www-ns.iaea.org/downloads/standards/iaea-safety-standards-brochure.pdf>>. Depending on the safety matter, the IAEA differentiates three categories of Safety Standards covering different issues in relation to this type of radiation: (1) the Safety Fundamental prescribing the main safety and protection objectives, (2) the Safety Requirements to be fulfilled by a country for the “protection of the people and environment both now and in future” which are divided into general safety and specific safety requirements, and (3) the safety guides which provide “recommendations and guidance on how to comply with the safety requirements”.

24. Patricia BIRNIE, Alan BOYLE, and Catherine REDGWELL, *International Law & The Environment*, 3rd ed. (New York: Oxford University Press, 2009) at 495–6.

25. NSC, *supra* note 4, art. 1(i).

26. Birnie, Boyle, and Redgwell, *supra* note 24 at 497.

27. IAEA, “Factsheets & FAQs: Nuclear Safety” (16 June 2011), online: IAEA <<http://www.iaea.org/Publications/Factsheets/English/ns.html>>.

28. NSC, *supra* note 4, art. 6.

unfortunate choice of word but the NSC represents a reflection of “internationally formulated safety guidelines”<sup>29</sup> which may change as safety standards evolve.<sup>30</sup> A contracting party shall, as its first obligation, “establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations”<sup>31</sup> which is intended to cover the plant, equipment, materials, and personnel. The IAEA Safety Guide on the Governmental, Legal and Regulatory Framework for Safety<sup>32</sup> provides a comprehensive checklist of issues to be prescribed by national legislation<sup>33</sup> and a list of competences and functions to be entrusted to the regulatory body.

The second obligation for a contracting party relates to the regulatory body “entrusted with the implementation of the legislative and regulatory framework”,<sup>34</sup> which includes the following four main activities: (1) authorization, (2) review and assessment, (3) inspection, and (4) enforcement. The regulatory body must not be charged with the promotion or utilization of nuclear energy.<sup>35</sup> Bearing in mind that the variety of issues to be regulated in the domain of civilian nuclear energy covers several multifunctional areas, the IAEA guide on the Governmental, Legal and Regulatory Framework for Safety encourages national regulatory bodies to co-operate with other relevant authorities:

The regulatory body shall make arrangements for analysis to be carried out to identify lessons to be learned from operating experience and regulatory experience, including

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29. Kamminga, *supra* note 19 at 875.
30. Birnie, Boyle, and Redgwell, *supra* note 24 at 501.
31. NSC, *supra* note 4, art. 7(1).
32. IAEA, “IAEA Safety Standards for Protecting People and the Environment: Governmental, Legal and Regulatory Framework for Safety”, No. GS-R-1 (September 2010), online: IAEA <[http://www-pub.iaea.org/MTCD/publications/PDF/Pub1465\\_web.pdf](http://www-pub.iaea.org/MTCD/publications/PDF/Pub1465_web.pdf)>.
33. *Ibid.*, at 5–6. The checklist of issues to be prescribed includes the following:
1. The safety principles for protecting people—individually and collectively—society and the environment from radiation risks, both at present and in the future;
  2. The types of facilities and activities that are included within the scope of the framework for safety;
  3. The type of authorization that is required for the operation of facilities and for the conduct of activities, in accordance with a graded approach;
  4. The rationale for the authorization of new facilities and activities, as well as the applicable decision making process;
  5. Provision for the involvement of interested parties and for their input to decision making;
  6. Provision for assigning legal responsibility for safety to the persons or organizations responsible for the facilities and activities, and for ensuring the continuity of responsibility where activities are carried out by several persons or organizations successively;
  7. The establishment of a regulatory body, as addressed in Requirements 3 and 4;
  8. Provision for the review and assessment of facilities and activities, in accordance with a graded approach;
  9. The authority and responsibility of the regulatory body for promulgating (or preparing for the enactment of) regulations and preparing guidance for their implementation;
  10. Provision for the inspection of facilities and activities, and for the enforcement of regulations, in accordance with a graded approach;
  11. Provision for appeals against decisions of the regulatory body;
  12. Provision for preparedness for, and response to, a nuclear or radiological emergency;
  13. Provision for an interface with nuclear security;
  14. Provision for an interface with the system of accounting for, and control of, nuclear material.
34. NSC, *supra* note 4, art. 8(1).
35. *Ibid.*, art. 8(2).

experience in other States, and for the dissemination of the lessons learned and for their use by authorized parties, the regulatory body and other relevant authorities.<sup>36</sup>

It is also worth mentioning the IAEA safety guide on the Organisation and Staffing of the Regulatory Body for Nuclear Facilities,<sup>37</sup> which provides recommendations for national authorities regarding the management and the organization of a national regulatory body.

Under the NSC general safety requirements, the contracting parties shall take appropriate steps to ensure the priority of safety,<sup>38</sup> adequate financial and human resources,<sup>39</sup> limitations of human performance,<sup>40</sup> quality assurance,<sup>41</sup> assessment and verification of safety,<sup>42</sup> radiation protection,<sup>43</sup> and emergency preparedness and response.<sup>44</sup> Taking into account the events that occurred prior and subsequent to the Fukushima accident, as well as the fact that the “prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence”,<sup>45</sup> provisions related to adequate resources, quality assurance, and emergency preparedness and response will be discussed in more detail.

The requirement to ensure *adequate human resources* involves the “provision of sufficient numbers of qualified staff with appropriate education, training and retraining for all safety-related activities in or for each nuclear installation, throughout its life”.<sup>46</sup> In the light of the IAEA standards, the personnel should possess capabilities and competences for all aspects of plant operation.<sup>47</sup> The obligation also entails their attitudes towards the safe functioning of the plant.<sup>48</sup> Operational safety is closely connected with the safety culture within a nuclear installation. Additionally, the IAEA published a safety standard on the Recruitment, Qualification and Training of Personnel for Nuclear Power Plants,<sup>49</sup> which lays out factors to be taken into account in ensuring effective and well-trained personnel within the plant. Safety culture is an additional safety requirement that is understood both as the obligation of a contracting party to ensure the priority of safety and as the obligation to ensure adequate human resources. The IAEA Fundamental Safety Principles interpret this prerequisite as the:

[I]ndividual and collective commitment to safety on the part of the leadership, the management and personnel at all levels; accountability of organisations and of

36. See *supra* note 32 at 16.

37. IAEA, “IAEA Safety Standards Series: Organization and Staffing of the Regulatory Body for Nuclear Facilities”, No. GS-G-1.1 (August 2002), online: IAEA <<http://www-pub.iaea.org>>.

38. NSC, *supra* note 4, art. 10.

39. NSC, *ibid.*, art. 11.

40. NSC, *ibid.*, art. 12.

41. NSC, *ibid.*, art. 13.

42. NSC, *ibid.*, art. 14.

43. NSC, *ibid.*, art. 15.

44. NSC, *ibid.*, art. 16.

45. NSC, *ibid.*, art. 9.

46. NSC, *ibid.*, art. 11(2).

47. IAEA, “Promoting Safety in Nuclear Installations”, 2003, online: IAEA <<http://www.iaea.org>>.

48. *Ibid.*

49. IAEA, “IAEA Safety Standards Series: Recruitment, Qualification and Training of Personnel for Nuclear Power Plants”, No. NS-G-2.8 (November 2002), online: IAEA <<http://www-pub.iaea.org>>.

individuals at all levels for safety; and measures to encourage a questioning and learning attitude and to discourage complacency with regard to safety.<sup>50</sup>

No less important is the obligation of *quality assurance* that includes both the safety assessment before the construction and commissioning of a nuclear installation and throughout its life; as well as the regular analysis, surveillance, testing, and inspection of the physical state and the operation of a nuclear installation.<sup>51</sup>

The obligation of *emergency preparedness and response* is one of the issues that was much discussed after the Fukushima accident. Under the Convention, each contracting party shall take appropriate steps to ensure that there are “on-site and off-site emergency plans which are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency”.<sup>52</sup> The contracting party should also provide information for emergency planning and response to its own population and the competent authorities of the states in the vicinity of the nuclear installation.<sup>53</sup> In March 2002, the IAEA’s Board of Governors approved the safety standards on Preparedness and Response for a Nuclear or Radiological Emergency, which “established the requirements for an adequate level of preparedness and response to a nuclear or radiological emergency in any State”.<sup>54</sup> Moreover, in 2007 the IAEA additionally published the safety guide on Arrangements for Preparedness and Response for a Nuclear or Radiological Emergency which should assist Member States in the application of the requirements on preparedness and response to a nuclear or radiological emergency,<sup>55</sup> as well as the Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency, which provides generic criteria for preventive actions and other response actions.<sup>56</sup>

Apart from these general safety requirements,<sup>57</sup> the NSC provides more detailed safety rules concerning the siting,<sup>58</sup> design and construction,<sup>59</sup> and operation<sup>60</sup> of installations. These rules on the safety of installations represent a major component of the NSC. Stricter rules apply to existing nuclear plants where “each contracting party shall take the appropriate steps to ensure that the safety of nuclear installations ... is

50. IAEA, “IAEA Safety Standards for Protecting People and the Environment: Fundamental Safety Principles”, No. SF-1 (November 2006), online: IAEA <<http://www-pub.iaea.org>>.

51. See IAEA, “Quality Assurance for Safety in Nuclear Power Plants and Other Nuclear Installations: Code and Safety Guides Q1-Q14” (September 1996), online: IAEA <<http://www.lei.lt/insc/quality/PDF-Files/SS-50-C-SG-Q-CD.pdf>>.

52. NSC, *supra* note 4, art. 16(1).

53. *Ibid.*, art. 16(2).

54. IAEA, “IAEA Safety Standards Series: Preparedness and Response for a Nuclear or Radiological Emergency”, No. GS-R-2 (November 2002), online: IAEA <<http://www-pub.iaea.org>>.

55. IAEA, “IAEA Safety Standards for Protecting People and the Environment: Arrangements for Preparedness and Response for a Nuclear or Radiological Emergency”, No. GS-G-2.1 (May 2007), online: IAEA <<http://www-pub.iaea.org>>.

56. IAEA, “IAEA Safety Standards for Protecting People and the Environment: Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency”, No. GSG-2 (May 2011), online: IAEA <<http://www-pub.iaea.org>>.

57. NSC, *supra* note 4, arts. 10–16.

58. NSC, *ibid.*, art. 17.

59. NSC, *ibid.*, art. 18.

60. NSC, *ibid.*, art. 19.

reviewed as soon as possible”.<sup>61</sup> The obligation will include, if possible, all reasonably practicable improvements and the shutdown of the plant if upgrading is not possible.<sup>62</sup>

Concerning the siting, design, and operation, the IAEA provided states with numerous safety standards which “have been very influential and serve as important guidelines for most states in regulating their nuclear facilities”.<sup>63</sup> Those specific safety standards have been further clarified and described in several safety guides,<sup>64</sup> which apply both to existing (at the time when the Convention entered into force) and new power plants.

Unlike many other conventions, which have certain non-compliance mechanisms,<sup>65</sup> the NSC relies solely on review of national reports at periodic review meetings of contracting parties in order to resolve safety problems.<sup>66</sup> This raises questions about its efficient enforcement. Moreover, review is not carried out by independent experts as was recommended by the IAEA’s own International Nuclear Safety Advisory Group, but by state officials. According to Kamminga “the Convention thereby fails to reflect the basic recommendation made by the IAEA’s own International Nuclear Safety Advisory Group (INSAG) that the reviewers should be internationally recognized experts who are independent from the organisations directly responsible for the management of national nuclear safety programmes”.<sup>67</sup>

61. NSC, *ibid.*, art. 6.

62. *Ibid.*

63. Birnie, Boyle, and Redgwell, *supra* note 24 at 496.

64. See e.g. IAEA online publications at <<http://www-pub.iaea.org>>: “IAEA Safety Standards Series: The Safety of Nuclear Power Plants—Design”, No. NS-R-1 (September 2000) [*Safety of Nuclear Power Plants—Design*]; “IAEA Safety Standards Series: The Site Evaluation for Nuclear Installations”, No. NS-R-3 (November 2003) [*Site Evaluation for Nuclear Facilities*]; “IAEA Safety Standards for Protecting People and the Environment: Safety of Nuclear Power Plants—Commissioning and Operation”, No. SSR-2/2 (July 2011); “IAEA Safety Standards Series: Design of Reactor Containment Systems for Nuclear Power Plants”, No. NS-G-1.10 (September 2004) [*Design of Reactor Containment Systems*]; “IAEA Safety Standards for Protecting People and the Environment: Protection Against Internal Hazards Other than Fires and Explosions in the Design of Nuclear Power Plants”, No. NS-G-1.11 (September 2004); “IAEA Safety Standards for Protecting People and the Environment: Design of the Reactor Core for Nuclear Power Plants”, No. NS-G-1.12 (April 2005) [*Design of the Reactor Core*]; “IAEA Safety Standards Series: Instrumentation and Control Systems Important to Safety in Nuclear Power Plants”, No. NS-G-1.3 (March 2002); “IAEA Safety Standards Series: Design of Fuel Handling and Storage Systems for Nuclear Power Plants”, No. NS-G-1.4 (August 2003); “IAEA Safety Standards Series: External Events Excluding Earthquakes in the Design of Nuclear Power Plants”, No. NS-G-1.5 (November 2003); “IAEA Safety Standards Series: Seismic Design and Qualification for Nuclear Power Plants”, No. NS-G-1.6 (November 2003); “IAEA Safety Standards Series: Design of Emergency Power Systems for Nuclear Power Plants”, No. NS-G-1.8 (August 2004); “IAEA Safety Standards Series: Design of the Reactor Coolant System and Associated Systems in Nuclear Power Plants”, No. NS-G-1.9 (September 2004) [*Design of the Reactor Coolant System*]; “IAEA Safety Standards for Protecting People and the Environment: Evaluation of Seismic Safety for Existing Nuclear Installations”, No. NS-G-2.13 (May 2009); “IAEA Safety Standards for Protecting People and the Environment: Seismic Hazards in Site Evaluation for Nuclear Installations”, No. SSG-9 (August 2010).

65. E.g. *Montreal Protocol on Substances that Deplete the Ozone Layer*, 16 September 1987, 1522 U.N.T.S. 3 (entered into force 1 January 1989) [*Montreal Protocol*]; *Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters*, 28 June 1998, 2161 U.N.T.S. 447 (entered into force 30 October 2001) [*Aarhus Convention*]; and the *Kyoto Protocol to the United Nations Framework Convention on Climate Change*, 11 December 1997 (entered into force 16 February 2005), online: UNFCCC <<http://unfccc.int/resource/docs/convkp/kpeng.pdf>> [*Kyoto Protocol*]. See Birnie, Boyle, and Redgwell, *supra* note 24.

66. NSC, *supra* note 4, art. 5.

67. Kamminga, *supra* note 19 at 880.

### III. IMPLEMENTATION OF THE CONVENTION ON NUCLEAR SAFETY AND IAEA STANDARDS IN JAPAN

The Fukushima nuclear accident called for a re-examination of the safety rules prescribed by the NSC, as well as the safety standards developed by the IAEA. As the circumstances surrounding the catastrophe slowly come to light, it is worth analyzing the measures taken by the Japanese government to apply the NSC in order to assess its compliance with the Convention; notably the steps undertaken to implement certain NSC provisions concerning the regulatory body, safety culture, siting, design, and construction of the plant.<sup>68</sup> Although the NSC “seeks to pursue its objectives by enhancing national measures”,<sup>69</sup> the obligations embodied in the Convention, together with the IAEA’s standards, provide sufficient guidance concerning the types of measures that need to be adopted. Moreover, the failure to adopt certain national measures may raise a question about the violation of the international obligation contained in the NSC.

#### A. Was NISA an Independent and Efficient Regulatory Body?

Under the NSC, each contracting party shall establish or designate a regulatory body, entrusted with the implementation of the legislative and regulatory framework, which will be independent from the body entrusted with the promotion of nuclear energy.<sup>70</sup> The establishment of such regulatory body both *de jure* and *de facto* has proven to be a difficult challenge for almost all contracting parties. Hence, the issue was discussed at several review meetings concerning the implementation of the NSC, especially at the third review meeting where the governments raised serious concerns regarding the independence and capabilities of national regulatory bodies in the light of austerity measures worldwide.<sup>71</sup>

Following the reorganization of the Japanese central government in 2001, the Ministry of Economy, Trade, and Industry (METI) was given responsibility for the safety regulation of all nuclear energy facilities, while the Nuclear and Industrial Safety Agency (NISA) was established as a special organization integrated within METI<sup>72</sup> entrusted with the administration of nuclear safety regulations. Besides NISA, there were several other bodies with various competences within the field of nuclear energy: the Nuclear Safety Commission and the Atomic Energy Commission, both within the Prime Minister’s Office.<sup>73</sup> The Japan

68. There were concerns after the Fukushima accident regarding the implementation of the NSC provisions on the legislative and regulatory framework, human resources, and emergency preparedness. However, the author decided to analyze only the most evident deficiencies in the implementation of the NSC.

69. Birnie, Boyle, and Redgwell, *supra* note 24 at 501.

70. NSC, *supra* note 4, art. 8(1)–(2).

71. IAEA, “Summary Report of the Third Review Meeting of the Contracting Parties to the Convention on Nuclear Safety” (April 2005), online: IAEA <[http://www-ns.iaea.org/downloads/ni/safety\\_convention/conv-2005.pdf](http://www-ns.iaea.org/downloads/ni/safety_convention/conv-2005.pdf)>.

72. Nuclear Regulatory Authority, “Convention on Nuclear Safety—National Report of Japan for the Second Review Meeting” (October 2001), online: NSR <<http://www.nsr.go.jp>> at 8.1.

73. *Ibid.*, at 8.2–8.3.

Nuclear Energy Safety Organization was created in 2003 under the auspices of METI to provide infrastructure together with NISA to ensure the safe use of nuclear energy.<sup>74</sup>

Even before the Fukushima accident there were serious concerns about the independence and efficiency of NISA and these became more pronounced and articulated following the catastrophe, especially through media coverage.<sup>75</sup> Moreover, these concerns raised the question of the compliance of the Japanese government with Article 8 of the NSC, which governs the establishment and competences of the national regulatory body, and the safety requirements prescribed by the IAEA safety guide on Organization and Staffing of the Regulatory Body for Nuclear Facilities.<sup>76</sup>

Under Article 20 of the Act for Establishment of the METI,<sup>77</sup> NISA was exclusively in charge of ensuring “safety of nuclear and other energies and industrial safety”.<sup>78</sup> The Japanese national reports on the implementation of the NSC underlined the competences of NISA, which are intended to guarantee its independence and do not include the promotion of nuclear energy.<sup>79</sup> However, in several instances NISA was not only performing these tasks but was also engaged in the promotion of nuclear energy.<sup>80</sup> This practice also raises the question of a potential conflict of interest in NISA’s work as a result of its competence to monitor the implementation of safety rules and its interest in promoting the use of nuclear energy in Japan. NISA’s independence from the body promoting nuclear energy was additionally questionable due to the fact that NISA was an “agency of METI, the ministry in charge of promotion of nuclear energy”.<sup>81</sup> The Act for Establishment of the METI entrusts another METI agency, the Agency of Natural Resources and Energy, with the “promotion of appropriate utilisation of mineral resources and energy”.<sup>82</sup> This demonstrates the lack of proper separation of powers when it concerns the promotion of nuclear energy and the breach of the obligation prescribed by Article 8 of the NSC.

The effective delegation of powers to NISA is another issue to be addressed. It essentially requires “the delegation of regulatory powers to some agency distinct

74. Nuclear Regulatory Authority, “Convention on Nuclear Safety—National Report of Japan for the Fourth Review Meeting” (September 2007), online: NSR <<http://www.nsr.go.jp>> at 8.1.

75. See, for instance, “Japan Sacks Three Nuclear Power Officials in Shake-up” BBC (4 August 2011), online: BBC <<http://www.bbc.co.uk/news/world-asia-pacific-14398645>>, and “‘Nuclear Safety Agency’ is Patchwork Without Policy Change” *Japan Press Weekly* (3 August 2011), online: Japan Press Weekly <<http://www.japan-press.co.jp/modules/news/index.php?id=2103>>.

76. *Supra* note 37.

77. See *infra* note 82 at A.3–4.

78. Nuclear Regulatory Authority, “Convention on Nuclear Safety—National Report of Japan for the Fifth Review Meeting” (September 2010), online: NSR <<http://www.nsr.go.jp>> at 42.

79. See *infra* note 82 at 8.3, and *supra* note 74 at 8.1.

80. There were several incidents where NISA requested electric power companies to arrange pro-nuclear energy questions during seminars organized by the government. See e.g. “NISA Asked Chubu Electric to Manipulate Public Opinion” *Asahi Shimbun* (29 July 2011), online: <<http://ajw.asahi.com/article/0311disaster/fukushima/AJ201107295038>>.

81. AOKI Masahiko and Geoffrey ROTHWELL, “Coordination Under Large Uncertainty: An Analysis of the Fukushima Catastrophe”, Social Science Research Network, Stanford University, Working Paper, 15 October 2011 at 12.

82. Nuclear Regulatory Authority, “Convention on Nuclear Safety—National Report of Japan for the Third Review Meeting” (October 2001), online: NSR <<http://www.nsr.go.jp>> at 8.3.

from the government itself”.<sup>83</sup> This requirement stems also from the obligation of a country to “establish a regulatory authority provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities”.<sup>84</sup> According to Majone, this is a feature of modern public administration where the “rules are made and enforced by expert agencies operating at arm’s length from government”.<sup>85</sup> However, in the case of NISA and METI, the Minister of METI has, *inter alia*, the authority to issue licences for the establishment of the nuclear installations and revoke them in cases of violations of the Reactor Regulation Act. The Minister may also pass ordinances on operational safety, technical standards, operation plans, and pre-service inspection,<sup>86</sup> while NISA at the time conducted “clerical works concerning the competence of the Minister of METI”.<sup>87</sup> This runs counter to the IAEA’s requirements on legislative aspects of regulatory independence, which empower a “regulatory body to have the authority to take decisions, including decisions on enforcement actions”.<sup>88</sup>

The other concern relates to the inefficiency of NISA in performing its duties, especially in overseeing the state of nuclear installations. In various national reports on the implementation of the NSC, the Japanese government explained NISA’s response to certain incidents that occurred in nuclear power plants. Unfortunately, in most of the cases the response was belated and demonstrated a lack of trained staff within NISA and a lack of openness, raising concerns about the implementation of Article 11 of the NSC. The obligation of efficiency of the regulatory body in discharging its responsibilities and performing its functions was clarified by the IAEA’s general safety requirements, which precisely entail the promotion of enhancements in safety, and the fulfilment of its obligations in an appropriate, timely, and cost-effective manner so as to build confidence.<sup>89</sup>

TEPCO’s falsification of self-controlled inspection records represents a very good illustration of NISA’s inefficiency. In 2000, METI obtained information about falsified records and, immediately after the creation of NISA, entrusted it with the task of verifying these allegations.<sup>90</sup> Unfortunately, the records were not kept after a certain period of time and NISA’s employees were unable to act promptly. Even though one may argue that NISA was a new institution within METI, the question remains as to why it took two years for NISA to disclose this information to the public.<sup>91</sup> The inefficiency of NISA was also evident during the Fukushima accident when this regulatory body demonstrated its inability to act in an emergency situation. The interim report of the independent investigation into the Fukushima disaster, led by Professor Hatamura Yotaro, concluded that NISA did not possess

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83. Giandomenico MAJONE, “The Agency Model: The Growth of Regulation and Regulatory Institutions in the European Union” (1997) 3 *EIPASCOPE* 1 at 1–6.

84. *NSC*, *supra* note 4, art. 8(1).

85. *Supra* note 83 at 1.

86. *Supra* note 82 at 8.2.

87. *Ibid.*

88. *Supra* note 37 at 4.

89. *Supra* note 32 at 20.

90. *Supra* note 82 at Preface-3.

91. *Ibid.*

sufficient organizational capabilities and expert knowledge to deal with the consequences of the disaster and that it demonstrated a lack of transparency and independence in its actions,<sup>92</sup> which prompted the committee to recommend the strengthening of the regulatory body in its final report.<sup>93</sup> A good illustration is the failure of NISA to provide the SPEEDI (The System for Prediction of Environmental Emergency Dose Information) results to the public, which was an essential element in planning the prevention of radiation exposure and the evacuation of the local population.<sup>94</sup> A more demonstrative example is the failure of NISA to act upon TEPCO's safety evaluation report on the impact of a tsunami on the nuclear installation. This is examined below in relation to the implementation of the NSC provision on siting, design, and construction.

Doubts in relation to the establishment and functioning of NISA were expressed in a series of reports after the accident, which clearly demonstrates Japan's failure to comply with the NSC's obligation on the regulatory body. The Integrated Regulatory Review Service (IRRS) of the IAEA raised this concern in 2007 and made several recommendations to the Japanese government that were, unfortunately, not taken into account at the time.<sup>95</sup> A more critical assessment was contained in the Diet's report, where it was concluded that the "independence of the regulatory body from the political arena, the ministries promoting nuclear energy, and the operators was a mockery".<sup>96</sup> The Commission stated that NISA lacked expertise, openness in decision-making, and commitment to ensuring safety. The Japanese government, in its report on the Fukushima accident, announced that there was a need to reinforce the safety regulatory bodies by separating NISA from METI and to review implementing frameworks, including the NSC and relevant ministries.<sup>97</sup> Media coverage suggested that NISA would be incorporated within the Ministry of Environment. This was finally carried out on 19 September 2012 with the establishment of the Nuclear Regulation Authority. This body replaced NISA and the Nuclear Safety Commission and constitutes a part of the Ministry of Environment. Time will show if this represents an adequate solution as a result of the ministry's competences in the promotion of clean energy, such as nuclear energy.<sup>98</sup> An additional challenge is the fact that the initial plan

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92. Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company, "Interim Report" (26 December 2011), online: ICANPS <<http://icanps.go.jp/eng/interim-report.html>>.

93. Investigation Committee on the Accident at the Fukushima Nuclear Power Stations of Tokyo Electric Power Company, "Final Report on the Accident at Fukushima Nuclear Power Stations of Tokyo Electric Power Company—Recommendations" (23 July 2012), online: ICANPS <<http://icanps.go.jp>> at 10. Seven main recommendations were made in the Final Report: (1) the need for independence and transparency; (2) organizational preparedness for swift and effective emergency response; (3) recognition of its role as a provider of disaster-related information to Japan and the world; (4) development of competent human resources and specialized expertise; (5) efforts to collect information and acquire scientific knowledge; (6) active relationship with international organizations and regulatory bodies of other countries; and (7) strengthening of the regulatory body.

94. *Supra* note 92 at 297.

95. Ministry of Economy, Trade and Industry, "Convention on Nuclear Safety—National Report of Japan for the Second Extraordinary Meeting" (July 2012), online: METI <<http://www.meti.go.jp>> at 27.

96. *Supra* note 3 at 20.

97. See *Report of Japanese Government*, *supra* note 10.

98. See *supra* note 75.

to phase out the use of nuclear energy by 2040 failed to receive the full support of the Japanese cabinet.<sup>99</sup>

### B. *Safety Culture in the Nuclear Power Industry in Japan*

The issue of safety culture<sup>100</sup> was often on the agenda of meetings of the contracting parties to the NSC.<sup>101</sup> This component is considered to be essential for the proper implementation of the NSC provisions since it represents a precondition for the preparation and review of NSC safety standards within both the operating organization and the regulatory body. As it is emphasized by the IAEA guide on the Management System for Facilities and Activities safety requirements, the “management safety standards, incorporated into national legislation and regulations and supplemented by international conventions and detailed national requirements, establish a basis for protecting people and the environment”.<sup>102</sup>

Even before the accident there were certain concerns about the lack of a safety culture within the operating organizations and national regulatory body in Japan.<sup>103</sup> Certain alarming allegations made in relation to TEPCO demonstrated not only the complete lack of a safety culture within the operator but a level of incompetence and collusion within the national regulatory body. Although TEPCO’s falsification of self-controlled inspection records was certainly one of the most obvious examples, there were several others. One incident concerned the falsifying of a reactor containment leakage test that occurred in 1991 and 1992 that was revealed as late as 2002. Even more alarming was the fact that the inspection at the time was attended by inspectors of the national regulatory body.<sup>104</sup>

Although the Japanese government, in its second national report of 2001, admitted that there was a need to reassess the management safety issue, it tried to justify the actions of the regulatory body with the “ambiguity of regulatory procedure on self-controlled inspection by license holders, lack of formulated acceptance criteria of cracks, and insufficient penalty for organizational illegal acts”.<sup>105</sup> This explanation is indicative of the failure of the Japanese government not only to establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations as is prescribed by Article 7 of the NSC but also shows a lack of a safety culture. This criticism was finally confirmed in the Diet’s report where the Independent Investigation Commission characterized the “cosy relationship between the operators, the regulators and academic scholars as totally inappropriate” and found that “it was far from being a

99. Jonathan SOBLE, “Doubts Rise on Japan’s Nuclear Phase-out” *Financial Times* (19 September 2012), online <<http://www.ft.com/intl/cms/s/0/ccb75eb0-0268-11e2-8cf8-00144feabdc0.html#axzz2GLZmHlir>>.

100. See *supra* note 50 at 8. It is defined as a culture that “governs the attitudes and behaviour in relation to safety of all organizations and individuals concerned [and which] must be integrated in the management system”.

101. See *supra* note 6.

102. IAEA, “Safety Standards for Protecting People and the Environment: The Management System for Facilities and Activities”, No. GS-R-3 (July 2006), online: IAEA <<http://www-pub.iaea.org>> at 12.

103. This issue was extensively discussed in the media. See Citizen’s Nuclear Information Center, “Not Again’: Yet another TEPCO Scandal” (March/April 2007), online: CINC <<http://cnic.jp>>.

104. *Supra* note 82 at 6.2.

105. *Ibid* at Preface-4.

safety culture” with frequent lobbying by the Federation of Electric Power Companies.<sup>106</sup> The Diet concluded by calling it “a regulatory capture in which the oversight of the industry by regulators effectively ceases”.<sup>107</sup>

### C. *Were There any Deficiencies Related to the Siting, Design, and Construction of the Fukushima Daiichi Nuclear Power Plant?*

Regarding new power plants, the NSC requires each contracting state to “take appropriate steps to ensure that appropriate procedures are implemented concerning the siting, design and construction and operation of the nuclear plant”.<sup>108</sup> As for existing power plants, the contracting parties shall take measures to carry out all practical improvements to upgrade the plants or, if not possible, to shut them down.<sup>109</sup> Although the NSC does not contain detailed obligations concerning the siting of a nuclear power installation, there are certain IAEA general and specific requirements for contracting parties to take into consideration. Since the Fukushima nuclear power plant dates from 1971, the rules on existing nuclear power plants apply first. However, the assessment of the existing plants also requires a contracting party to comply with all recent IAEA safety requirements, which are the results of evolving safety standards concerning the use of nuclear energy. Moreover, the assessment should be in the “form of critical self-assessments with outside assistance, peer reviews, or in-depth evaluations involving experts from other countries or international bodies”.<sup>110</sup>

#### I. *Siting of the plant*

One of the obligations laid down by the Convention requires a party to evaluate all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime.<sup>111</sup> The choice of siting for any plant in Japan requires a very strict evaluation of the seismological and geological conditions in the region, as well as the engineering geological aspects and geotechnical aspects of the proposed site, as a consequence of Japan’s geological structure. Japan represents a “weak and unstable segment of the earth’s crust where readjustments of deep-lying rock masses are constantly occurring, resulting in hundreds of volcanoes and more than 1500 earthquakes shocks occurring annually”.<sup>112</sup> Moreover, being situated at the “boundaries of four tectonic plates: the North American, Eurasian, Pacific and Philippine Sea plates, the Japanese archipelago receives strong compression from two directions caused by subductions of the Pacific and Philippine Sea plates”.<sup>113</sup>

106. *Supra* note 3 at 43.

107. *Ibid.*

108. NSC, *supra* note 4, arts. 17–19.

109. *Ibid.*, art. 6.

110. IAEA, “Summary Report of the 1st Review Meeting of Contracting Parties to the Convention on Nuclear Safety” (12–23 April 1999), online: IAEA <<http://www.iaea.org>> at para. 28.

111. NSC, *supra* note 4, art. 17.

112. Glenn T. TREWARTHA, *Japan—A Geography* (Madison, WI: University of Wisconsin Press; London: Methuen & Co. Ltd, 1970) at 17.

113. See *supra* note 10 at III-1.

As a result, the siting phase should involve the assessment of these external occurrences, primarily the impact of earthquakes and tsunamis occurring in the region. These requirements should also be applied when the conditions on design and construction were assessed and reassessed for existing nuclear installations. According to the IAEA's specific standards on Site Evaluation for Nuclear Installations, the country should first "collect pre-historical, historical and instrumentally recorded information and records, as applicable, of the occurrences and severity of important natural phenomena activities for the region that will be carefully analyzed for reliability, accuracy and completeness".<sup>114</sup> A country should also assess the frequency and severity of any naturally induced event and phenomenon that could impact the safety of the plant.<sup>115</sup> In the case of countries such as Japan, the IAEA's specific site standards require not only the assessment of seismological and geological conditions in the region but also the phenomenon of water waves induced by earthquakes or other geological phenomena.<sup>116</sup> This involves evaluating the potential effect of tsunamis on the safety of a nuclear installation site, as these are a combination of geological and meteorological natural hazards and these represent separate natural phenomena. The fact that the contingency of a severe combination of external events was not anticipated in the design, operation, resourcing, and emergency arrangements was also criticized by the IAEA in its preliminary report subsequent to the Fukushima accident.<sup>117</sup> As will be shown below, both the regulatory body and the operator were also aware of the fact that the Fukushima Daiichi Nuclear Plant was not capable of withstanding the effects of the earthquake and the tsunami but tacitly approved of the existing situation.<sup>118</sup>

The frequency of earthquakes in Japan led to the development of an extensive legislative framework and methodology governing seismic impacts on the siting and design of nuclear power plants. The Japan Meteorological Agency even developed its own seismic scale, known as the JMA Seismic Intensity Scale.<sup>119</sup> The Environmental Impact Assessment Act, the Reactor Regulation Law, and the Regulatory Guide for Reviewing Nuclear Reactor Siting Evaluation and Application Criteria are the main pieces of legislation governing the evaluation of all site-related factors.<sup>120</sup> However, in its preliminary report of June 2011, the IAEA reported that "Japan underestimated the tsunami hazard for several sites ... Nuclear designers and operators should appropriately evaluate and provide protection against the risks of all natural hazards, and should periodically update these assessments and assessment methodologies in light of new information, experience and understanding."<sup>121</sup> While the IAEA primarily

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114. See *Site Evaluation for Nuclear Installations*, *supra* note 64 at 7.

115. *Ibid.*

116. *Ibid.*, at 13.

117. *Supra* note 1 at 4.

118. See *supra* note 3.

119. See Japan Meteorological Agency, "Tables Explaining the JMA Seismic Intensity Scale" (2012), online: JMA <<http://www.jma.go.jp/jma/en/Activities/inttable.html>>.

120. *Supra* note 82 at A3–81. The Japanese Regulatory Guide for Safety Design prescribes that structures, systems, and components with safety functions shall be designed to sufficiently withstand appropriate design basis seismic forces.

121. *Supra* note 1 at 4.

criticized the estimation of a possible tsunami, there were also some concerns regarding defence against earthquakes.<sup>122</sup> These concerns question the compliance with the NSC provisions on siting and the applicable IAEA standards.

The Fukushima nuclear plant is located in the Fukushima prefecture that lies in the Tohoku Region of Honshu Island. It is a region that has frequently been affected by large tsunamis<sup>123</sup> and has also experienced major earthquakes followed by tsunamis that struck the Sanriku coast in 1896 and 1933. The reactors in the Fukushima plant were designed to withstand an earthquake up to magnitude 7.9 and tsunami waves of up to 5.7 metres. All the eleven reactors at four affected nuclear power plants operating at the time in the region shut down automatically when the earthquake occurred.

Despite the fact that the defence system against the earthquake did work in this instance, there are concerns about the methodology used for calculating the effects of the earthquakes. According to Geller, the estimation of earthquakes is based on flawed methods for long-term forecasts which follow the seismic-gap hypothesis conjectures that “zones where no large earthquakes have occurred for a while, dubbed ‘seismic gaps’, are ripe for imminent large events”.<sup>124</sup> By using this methodology, it was calculated that three regions—Tokai, Tonankai, and Nankai—represent the most dangerous zones of three hypothetical “scenario earthquakes”.<sup>125</sup> The same conclusion was reiterated in the Additional Report of the Japanese Government to the IAEA—Accident at TEPCO’s Fukushima Nuclear Power Stations.<sup>126</sup> However, in the last 100 years no earthquakes occurred in any of these regions, but they have occurred in places designated as low probability regions. Geller adds that the right approach should have also factored in global seismicity and the historical record in Tohoku in estimating seismic hazards and gives examples of “five subduction-zone earthquakes of magnitude 9.0 or greater (Kamchatka 1952, Chile 1960, Alaska 1964, Sumatra 2004, Tohoku 2011)”.<sup>127</sup> In addition, the earthquakes with tsunamis that struck the Sanriku coast in 1896 and 1933 show the same pattern in Japan.

More worrying findings were presented in the Diet’s report, which demonstrated NISA’s and TEPCO’s knowledge of weak plant structure that was unable to withstand a powerful earthquake.<sup>128</sup> NISA accepted TEPCO’s interim anti-seismic back check report although “the scope of the assessment included the reactor building and only seven of many other important safety installations and equipment”.<sup>129</sup> The report was a response to the Nuclear Safety Commission guidelines and showed a need for many reinforcements to meet the standards of the new guidelines. Despite this finding, NISA subsequently approved the postponement of any future seismic checks until 2016.

122. See Robert J. GELLER, “Shake-up Time for Japanese Seismology” (2011) 472 *Nature* 407.

123. *Ibid.*, at 408.

124. *Ibid.*

125. *Ibid.*

126. See *Report of Japanese Government*, *supra* note 10.

127. Geller, *supra* note 122 at 408.

128. *Supra* note 3 at 27.

129. *Ibid.*

With regard to the tsunami defence system, Geller points at the historical records for tsunamis, namely the “well-documented 1896 Sanriku tsunami with a maximum height of 38 metres causing more than 22,000 deaths and the 1869 Jogan tsunami documented to have had a height roughly comparable to, or perhaps slightly less than, that of the 11 March tsunami”.<sup>130</sup> Bearing in mind the obligation of a country to collect pre-historical, historical, and instrumentally recorded information and records, failure to act upon this knowledge would certainly alter the chain of events in the Fukushima case. Moreover, the responsible regulatory bodies also failed to properly organize the planning process in several instances when tsunami impact was assessed. In 2001, the Nuclear Safety Commission commenced the “revision process of the seismic design regulatory guide through its Sub-committee but no tsunami specialist was included”; this demonstrated a lack of awareness of the significance of tsunamis in nuclear safety.<sup>131</sup> Furthermore, after receiving TEPCO’s safety evaluation report based on the “Tsunami Assessment Method for Nuclear Power Plants in Japan”, NISA failed to provide specific points or instructions for action.<sup>132</sup> This also occurred in September 2009 and March 2011 when NISA received TEPCO’s results on evaluating the tsunami impact metrics.<sup>133</sup> In addition, the failure to calculate the accurate height of a potential tsunami also rests with the operator TEPCO. Although the initial licences for Fukushima Daiichi were “awarded in 1966 with the design base of 3.1 meters as the tsunami wave height above the sea level”,<sup>134</sup> subsequent testing led to the threshold being raised to a height of 5.7 metres.<sup>135</sup> In February 2002, the Tsunami Evaluation Subcommittee, established under the Nuclear Civil Engineering Committee and the Japan Society of Civil Engineers, compiled the tsunami evaluation methodology for estimating the maximum wave height of a tsunami based on existing historical records.<sup>136</sup> According to this methodology, TEPCO reassessed potential tsunami impact and concluded that the reactor should be capable of withstanding the impact of a tsunami exceeding 15 metres, but failed to take any steps in altering the existing line of defence. There were even some concerns that this methodology was “decided through an unclear process, and with the improper involvement of the electric power companies”, and that NISA accepted it “without examining its validity”.<sup>137</sup>

Not only was the impact of a tsunami badly assessed, but the siting of the plant was modified to accommodate TEPCO’s needs in the construction phase. Namely, the natural 35-metre seaside cliff was reduced to 5.7 metres, which was considered to be a sufficient height to withstand the projected force of a tsunami. After the

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130. Geller, *supra* note 122 at 408.

131. *Supra* note 92 at 586.

132. *Ibid.*, at 587.

133. *Ibid.*

134. See *supra* note 92 at 585. According to this report, this height was set based on the maximum wave height observed at the Onahama Port (about 40 kilometres south of the Fukushima Daiichi NPS) at the time of the Chile Earthquake in 1960.

135. See *supra* note 1 at 1.

136. *Supra* note 92 at 587.

137. *Supra* note 3 at 27–8.

Fukushima accident there was speculation regarding the reason for lowering the natural seawall. According to media reports, it was partly done to facilitate the transport of equipment to the site and the pumping of seawater to the reactors.<sup>138</sup> The other reason concerned the potential impact of earthquakes, since it was estimated that the reduction of the seawall would be an “efficient way to build the complex atop the solid base of bedrock needed to better protect the plant from earthquakes”.<sup>139</sup> Even though this may seem a reasonable decision at the time, it is evident now that the environmental impact assessment was not properly carried out.

In addition, it raises the question of whether the environmental, seismic, and meteorological events were properly taken into account, not only during the design and construction of the plant, but also throughout the life-cycle of the plant.<sup>140</sup> As was pointed out in the arbitration proceedings in the *Mox Plant Case*:

[T]he objectives of a proper environmental assessment are, *inter alia*, to ensure that the activities comply with the applicable international environmental obligations, to ensure that appropriate protective and response measures may be taken, to ensure that alternative proposals have been fully considered, and to ensure that interested parties and concerned States are fully informed of the environmental implications of the project.<sup>141</sup>

Furthermore, this runs counter to the obligation of the party under the NSC to re-evaluate the likely safety impact of all relevant site-related factors on individuals, society, and the environment.

## 2. *Design and construction of the plant*

There were serious concerns about improvements to the plant that were obliged to be done in accordance with Article 6 of the NSC concerning existing nuclear installations and Article 18 concerning the design and construction of the installation. Likewise, compliance with the relevant IAEA’s standards on power plant design,<sup>142</sup> the design of the reactor coolant system,<sup>143</sup> the design of reactor containment systems for nuclear power plants,<sup>144</sup> and the design of the reactor core was also questionable.<sup>145</sup> Several issues were raised by both the international experts and the representatives of the Japanese government concerning the design and construction of the installation. Inadequate defence in depth, the design of fuel ponds, the loss of power supply, and an inadequate cooling system were some of the major deficiencies identified in the design of the nuclear installation. Moreover, the media again speculated about the failure of

138. See “Fateful Move Exposed Japan Plant” *Wall Street Journal* (12 July 2011), online <<http://online.wsj.com/article/SB10001424052702303982504576425312941820794.html>>.

139. *Ibid.*

140. See *Case Concerning the Gabčíkovo-Nagymaros Project (Hungary v. Slovakia)*, [1997] I.C.J. Rep. 7. See also Birnie, Boyle, and Redgwell, *supra* note 24 at 170.

141. *The MOX Plant Case (Ireland v. United Kingdom)*, Permanent Court of Arbitration, Memorial of Ireland (Segment II) (26 July 2002), online: PCA <[http://www.pca-cpa.org/showpage.asp?pag\\_id=1148](http://www.pca-cpa.org/showpage.asp?pag_id=1148)> at para. 7.2.

142. See *Safety of Nuclear Power Plants—Design*, *supra* note 64.

143. See *Design of the Reactor Coolant System*, *supra* note 64.

144. See *Design of Reactor Containment Systems*, *supra* note 64.

145. See *Design of the Reactor Core*, *supra* note 64.

TEPCO to improve Units 1–5 at the Daiichi installation, although General Electric, which designed the initial boiling water reactors,<sup>146</sup> known as the Mark 1 containment, offered a “reactor with a sleeker design—the Mark II”.<sup>147</sup> This refusal was considered to be in gross violation of Article 6 of the NSC, which prescribes the strict obligation of contracting parties to improve existing nuclear installations.

A major criticism concerns the design of the reactor coolant system, which should, as prescribed by the NSC, provide reliable levels and methods of protection. This obligation is further clarified and explained in the IAEA’s standards on Reactor Coolant System and Associated Systems. This safety guide requires the operator to provide the appropriate “emergency power supply as necessary to components that are needed for system actuation or operation”.<sup>148</sup> Moreover, the “emergency core cooling system should be designed to ensure that enough coolant is available for adequate long term core cooling”.<sup>149</sup> As a rule, the backup power is supplied from on-site emergency diesel generators that provide electricity. Unfortunately, in the Fukushima accident, the loss of the backup power system and the flooding of the seawater pumps caused by the tsunami was the result of an additional design flaw. Since it was estimated that the tsunami waves would not be higher than 5.7 metres, the seawater pumps and the emergency diesel generators and switchboards installed in the basement floor of the reactor buildings and the turbine buildings were placed at heights ranging from 0 to 5.8 metres.<sup>150</sup> When the tsunami struck, except for the one diesel generator in Unit 6 which was placed at a higher altitude, the rest were immediately submerged. Although the assessment from 2002—based on the Tsunami Assessment Method for Nuclear Power Plants in Japan and proposed by the Japan Society of Civil Engineers—showed that the maximum water level would be 5.7 metres, TEPCO only raised the height of the seawater pump installation and diesel generators in Unit 6 in response to that assessment.<sup>151</sup> The lack of power supply subsequently led to the overheating of the reactor cores and the spent fuel pools. Seawater was used as an alternative coolant for the spent fuel pools.

As a result of the failure to implement the defence-in-depth requirement<sup>152</sup> prescribed by Article 1(ii) of the NSC, loss of power supply occurred. Both the report of the IAEA<sup>153</sup> and the report of the Japanese government<sup>154</sup> identified that defence in depth was not developed for extreme events such as an earthquake followed by a tsunami. The IAEA guide on the Safety of Nuclear Power Plants—Design<sup>155</sup> differentiates five layers of

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146. Reactors became operational in the period from 1971 to 1975.

147. See “Design Flaw Fuelled Nuclear Disaster” *Wall Street Journal* (1 July 2011), online <<http://online.wsj.com/article/SB10001424052702304887904576395580035481822.html>>.

148. See *Design of the Reactor Coolant System*, *supra* note 64 at 7.

149. *Ibid.*, at 37.

150. See *Report of Japanese Government*, *supra* note 10 at III-33.

151. *Ibid.*, at III-31–2.

152. According to the IAEA *Safety of Nuclear Power Plants—Design*, the concept of defence in depth in the design of a plant provides a series of levels of defence (inherent features, equipment, and procedures) aimed at preventing accidents and ensuring appropriate protection in the event that prevention fails.

153. *Supra* note 1 at 4.

154. See *Report of Japanese Government*, *supra* note 10 at 36.

155. See *Safety of Nuclear Power Plants—Design*, *supra* note 64 at 5.

defence in depth whereby the fourth level of defence was the weakest in the case of the Fukushima accident. The fourth level of defence should address “severe accidents in which the design basis may be exceeded and to ensure that radioactive releases are kept as low as practicable ... The most important objective of this level is the protection of the confinement function.”<sup>156</sup> Regrettably, the Fukushima nuclear power plant did not possess an adequate fourth level and experienced problems in the operability of the containment venting system in the face of a severe accident. As was stated in the report of the Japanese government subsequent to the accident, “the primary containment vessel (PCV) was not equipped with a filter with sufficient radiation decontamination capability that will enable ventilation facilities to prevent an explosion in the nuclear reactor building due to hydrogen leakage from the PCV”.<sup>157</sup> In addition, the water containing dissolved radioactive materials that were released from inside the Reactor Pressure Vessel (RPV) leaked into the PCV and accumulated inside the reactor buildings and the turbine buildings.<sup>158</sup> In time, the radioactive water was released into the sea.

The question of cooling and supplying water to the spent fuel pool was also discussed in relation to the Fukushima power plant design. The accident initiated a re-examination of the NSC and the IAEA requirements regarding the design of the coolant system for the spent fuel pools. As was stated at the briefing before the US Senate, “one of the core areas of concern and potential future action has to do with backup power with spent fuel rod pools and in particular with battery power capacity”<sup>159</sup> which needs to be increased for longer than four or eight hours. This was the battery lifespan in the case of Fukushima power plant. Finally, the actual location of the spent fuel at the higher part of the reactor building was another issue to examine in future. It remains to be seen whether spent fuel pools at ground level would facilitate the response to severe accidents.

During the briefing before the Committee on Energy and Natural Resources of the United States Senate, the issues of fuel pools design and the inadequate cooling system for the pools were raised. This discussion again reiterates the importance of this safety requirement. According to American nuclear energy experts, one of the issues to be addressed is the optimization of the “ways to fill the spent fuel pool and keep water injected into the reactor vessel to keep the core cool”.<sup>160</sup> The experts also pointed out the need to reconsider the storage of fuel rods in the pool. They also recommended that the spent fuel rods stored in pools on site should be “arranged to place old, cool fuel rods next to newer hotter rods to prevent hot spots and fires in the event that the pools lost enough water to cover the rods”.<sup>161</sup> According to the World Nuclear Association, “reactor unit ponds (2 & 4) were unusually full”,<sup>162</sup> while the pond at the Unit 4 also held a full core load of 1,535 fuel assemblies.<sup>163</sup>

156. *Ibid.*, at 6.

157. See *Report of Japanese Government*, *supra* note 10 at 270.

158. *Ibid.*, at 323.

159. See *US Senate Briefing*, *supra* note 5 at 21.

160. *Ibid.*, at 17

161. *Ibid.*, at 20.

162. See *supra* note 9.

163. See *Report of Japanese Government*, *supra* note 10 at IV-107.

#### D. *The Quality of the Emergency Response*

The primary state obligation in relation to the emergency response is to ensure that “on-site and off-site emergency plans are functioning in the case of an emergency” and to “provide its own population and the competent authorities of the States in the vicinity of the nuclear installation with appropriate information for emergency planning and response”.<sup>164</sup> The off-site emergency plans that—according to the NSC and the IAEA Safety Standards on Preparedness and Response for a Nuclear or Radiological Emergency—should be prepared and routinely tested did not adequately function after the accident. The investigation committee identified several reasons that led to the evacuation of the off-site centre:

[D]ifficulty in assembling its staff members due to damaged transportation and heavily congested traffic caused by the earthquake; loss of telecommunication infrastructures, power cut, shortages of food, water and fuel; and elevated radiation levels in the building which was not equipped with air cleaning filters.<sup>165</sup>

Emergency preparedness and response after the accident was rather poor. This deficiency was identified in the IAEA’s preliminary report after the Fukushima accident,<sup>166</sup> the Additional Report of the Japanese government<sup>167</sup> of June 2011, the interim<sup>168</sup> and final report<sup>169</sup> of the investigation committee set up by the Japanese government, and the Diet’s report.<sup>170</sup> Both the governmental authorities and TEPCO’s staff failed to fulfil this obligation in an emergency environment of both a large-scale natural disaster and a nuclear accident.<sup>171</sup> None of these bodies acted as planned due to the fact that the system was not designed to sustain such extreme natural circumstances.<sup>172</sup>

As soon as the state of nuclear emergency was declared, the Prime Minister established the Nuclear Emergency Response Headquarters (NERH) and the Local Nuclear Emergency Response Offices, which experienced serious difficulties in their work. Communication between the NERH and the local offices, as well as between the NERH and NISA and other relevant governmental bodies, was impeded due to the lack of communication tools. Moreover, there were concerns about the delegation of powers between the NEHR and the local offices.<sup>173</sup> The emergency response was also aggravated by disruption in the official communication flow

164. NSC, *supra* note 4, art. 16.

165. *Supra* note 92 at 565.

166. *Supra* note 1 at 4.

167. See *Report of Japanese Government*, *supra* note 10.

168. *Supra* note 92.

169. *Supra* note 93.

170. *Supra* note 3.

171. The following governmental bodies were involved in the emergency response: the Prime Minister’s Nuclear Emergency Response Headquarters, the Secretariat of the Nuclear Emergency Response Headquarters of NISA, and the Local Nuclear Emergency Response team.

172. See *supra* note 3 at 33–6.

173. See *Report of Japanese Government*, *supra* note 10 at 36.

between TEPCO, NISA, and the Prime Minister's Nuclear Emergency Response Headquarters, where TEPCO, contrary to emergency rules, had to simultaneously inform both bodies.<sup>174</sup> Furthermore, information collected by SPEEDI on the discharge of radioactive materials was neither disclosed to the public nor adequately utilized by the Ministry of Education, Culture, Sports, Science, and Technology, the competent ministry for SPEEDI.<sup>175</sup> The absence of this information also influenced the decision-making process concerning the evacuation of residents.<sup>176</sup> The investigation committee set up by the government also highlighted the insufficient and incomplete information regarding the "status of the reactor cores, the critical conditions of Unit 3, and explanations on radiation effects on health such as 'No immediate impacts on human health'".<sup>177</sup> TEPCO's officials also failed to provide adequate information about the situation in the nuclear installations.<sup>178</sup> Moreover, some senior managers failed to return to Tokyo hours after the earthquake occurred.<sup>179</sup>

Likewise, the information was not provided to the states in the vicinity and the wider international community was not informed in a timely manner about the decision of the Japanese government to release contaminated water into the sea. The notification was sent several minutes after the discharge commenced, while the embassies of the People's Republic of China, South Korea, and Russia were informed of the impact of the discharge two days after the discharge began.<sup>180</sup> The other illustration was the inability of the International Affairs Office of the Policy Planning and Coordination Division of NISA to promptly inform neighbouring countries on all the aspects of the nuclear accident due to the fact that it lacked staff in the Emergency Response Centre (ERC) of METI.<sup>181</sup> One could question whether this may be considered as a breach of an international obligation<sup>182</sup> prescribed by the 1986 Early Notification Convention,<sup>183</sup> which requires a state party in cases of a nuclear accident to:

[F]orthwith notify, directly or through the International Atomic Energy Agency, those States which are or may be physically affected as specified in Article 1 and the Agency of the nuclear accident, its nature, the time of its occurrence and its exact location where appropriate.<sup>184</sup>

174. See *supra* note 3 at 34. The best illustration was the lack of communication regarding the vent in Unit 1 and the injection of seawater.

175. *Supra* note 92 at 579.

176. *Ibid.*, at 297 and 583.

177. *Ibid.*, at 419.

178. See *supra* note 3 at 18. The most striking example was concerning the situation of the vent in Unit 1 which was not communicated to NISA or the prime minister's office.

179. Aoki and Rothwell, *supra* note 81 at 3.

180. *Supra* note 93 at 341.

181. *Ibid.*

182. See 2001 *Articles on Responsibility of States for Internationally Wrongful Acts*, UN GAOR, 56th Sess., Supp. No. 10 at 43, U.N. Doc. A/56/10 (2001), art. 12.

183. *Convention on Early Notification of a Nuclear Accident*, 26 September 1986, 1457 U.N.T.S. 133, 25 I.L.M. 1369 (27 October 1986) [*Early Notification Convention*].

184. *Ibid.*, art. 2(1).

#### IV. RESPONSE OF THE INTERNATIONAL COMMUNITY TO THE FUKUSHIMA ACCIDENT

Following the immediate aftermath of the disaster and by the time various investigation committees gathered necessary information about the accident, the 2nd Extraordinary Meeting of the Contracting Parties to the Convention was held in August 2012. The objective of the Convention was to “review and discuss lessons learned so far from the accident at TEPCO’s Fukushima Daiichi nuclear power plant, to review the effectiveness of the provisions of the Convention” and to provide appropriate recommendations.<sup>185</sup> The six main issues addressed at the meeting (which correspond with those raised in this article) concerned external events, design issues, severe accident management and recovery (on-site), national organizations, emergency preparedness and response and post-accident management (off-site), and international co-operation.<sup>186</sup>

The outcome of the meeting was encouraging and it indicated an international agreement to revisit the NSC. As a first step, the contracting parties discussed the proposals to amend several important guidelines such as the Guidelines Regarding the Review Process Under the Convention on Nuclear Safety,<sup>187</sup> Guidelines Regarding National Reports Under the Convention on Nuclear Safety,<sup>188</sup> and the Convention on Nuclear Safety: Rules of Procedure and Financial Rules.<sup>189</sup> Moreover, parties discussed a set of action-oriented objectives for strengthening nuclear safety based on the lessons learned from the Fukushima accident.<sup>190</sup> Those objectives recognized the need to reinforce compliance with the NSC, especially with regard to the independence and functioning of national regulatory bodies and the importance of IAEA standards in complying with the NSC. The contracting parties unequivocally recommended strengthening the independence, efficiency, and effectiveness of regulatory bodies that have to be able to decide independently on the basis of scientific and technological knowledge.<sup>191</sup> Furthermore, the idea of an international peer review of the regulatory framework governing the safety of nuclear installations, if the contracting party has an operating nuclear installation, was endorsed.<sup>192</sup> The significance of IAEA standards was also a point of agreement between the parties and it was recommended that parties “take into account the IAEA Safety Standards in enhancing nuclear safety”<sup>193</sup> and “inform how they intend to take the IAEA Safety

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185. IAEA, “2nd Extraordinary Meeting of the Contracting Parties to the Convention of Nuclear Safety: Final Summary Report” (27–31 August 2012), online: IAEA <<http://www-ns.iaea.org>>, para. 2.

186. *Ibid.*, at para. 3

187. IAEA, “Guidelines Regarding the Review Process Under the Convention on Nuclear Safety” (8 October 1998), online: IAEA <<http://www.iaea.org>>.

188. IAEA, “Guidelines Regarding National Reports Under the Convention on Nuclear Safety” (8 October 1998), online: IAEA <<http://www.iaea.org>>.

189. IAEA, “Convention on Nuclear Safety: Rules of Procedure and Financial Rules” (4 April 2011), online: IAEA <<http://www.iaea.org>>.

190. See *supra* note 185. These objectives are annexed to the Summary Report after the meeting.

191. *Supra* note 185 at paras. 3–6.

192. *Ibid.*, at para. 8

193. *Ibid.*, at 1.

Standards into account in implementing the NSC”.<sup>194</sup> Another one of the main achievements is the establishment of the working group, open to all contracting parties, which is tasked with “reporting to the next review meeting on a list of actions to strengthen the NSC and on proposals to amend, where necessary, the Convention”.<sup>195</sup>

More specific recommendations that are in line with Kamminga’s view on the need for expert review as a supervisory tool were made by the Swiss Confederation and the Russian Confederation. Both contracting parties also recognized the importance of international peer review missions involving external experts from other contracting parties, which can play an important role in achieving and maintaining a high level of nuclear safety. Although this is not a binding obligation, it is promising to see that on this occasion the Swiss Confederation proposed several amendments to the NSC, including, *inter alia*, amendments to Articles 8, 14, 17, 18, and 19. Interestingly, all proposed amendments concern NSC obligations that Japan failed to meet. In regard to the work of the regulatory body, the Swiss Confederation proposed periodic review of the regulatory body by external experts with regard to its compliance with the requirements of the IAEA. This also applies to the design, construction, and operation of the installation. Bearing in mind the importance of taking into account the development of relevant technical standards, the Swiss Confederation proposed the amendment of Articles 14 and 17, whereby the assessment and verification of safety and the reevaluation of siting is to be carried out in accordance with state-of-the-art science and technology and other significant new safety information.<sup>196</sup>

The proposal of the Russian Federation was more explicit and included “taking into account IAEA safety standards” in relation to Article 14 on the assessment and verification of safety, which would finally resolve the doubt about the legally binding nature of these standards. This recommendation, in line with the argument about the importance of IAEA safety standards in assessing compliance with the NSC, is reflected in the recognition of the technical and scientific support organizations, and continuous development of the IAEA safety standards in the light of the Fukushima accident, as well as encouragement for contracting parties to take IAEA safety standards into account in enhancing nuclear safety.

Most of the recommendations were accepted by the Japanese government, which undertook extensive institutional and legislative reform which, *inter alia*, included the establishment of the Nuclear Regulation Authority and the training of staff, and amending the Reactor Regulation Act, including legislation on external events<sup>197</sup> and severe accident measures, as well as strengthening the safety culture at all levels. The Japanese government also recognized the need to develop domestic standards and rules consistent with international standards, especially the IAEA standards, and to

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194. *Ibid.*, at 2.

195. *Ibid.*, at 33.

196. *Ibid.*

197. See *supra* note 95. For example, the NSC reconsidered the Regulatory Guide for Reviewing Seismic Design, and proposed their amendment proposals to this Regulatory Guide in March 2012.

have frequent IAEA international peer review missions.<sup>198</sup> Likewise, in July 2011 NISA requested a stress test to be conducted on all Japan's nuclear power plants in line with the efforts of the EU to verify the safety of its own plants. This development should improve the understanding of the current safety of all nuclear installations in Japan.

## V. CONCLUSION

The Convention on Nuclear Safety always generated a certain ambivalence due to the vagueness of its provisions, which require subsequent adoption of national measures, and its poor enforcement mechanism. Kamminga considers it to be a disappointing convention which:

[C]ontains neither the precise standards of the Convention on the Transboundary Effects of Industrial Accidents, the flexible amendment and gentle non-compliance procedures of the Montreal Protocol on Substances that Deplete the Ozone Layer, nor the incentive provisions of the Convention on Climate Change.<sup>199</sup>

Despite this lack of specific and detailed rules prescribed by the NSC, it still contains obligations for contracting parties that are to be implemented in respect of both existing and new nuclear installations. It may be questionable what kind of obligation it raises for states as only "specific obligations resulting from treaties impose upon the contracting States the obligation to take the necessary measures through exercising due diligence in order to prevent the nuclear damage, either by prohibiting or by regulating such activities".<sup>200</sup> Bearing in mind the need to clarify rules contained in the NSC, the IAEA developed various safety installation standards that cover all areas governed by the Convention. Although they are not binding, they provide sufficient technical guidelines for contracting parties in developing required national measures. The IAEA nuclear safety standards are considered to be the "cornerstone for an international nuclear safety and security mechanism which provides the basis for states to perform their duties relating to nuclear safety".<sup>201</sup> Furthermore, the obligation of the installation state to "establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations"<sup>202</sup> stems from both the principle of due diligence and the principle of prevention of environmental damage.<sup>203</sup> In addition, the NSC prescribes the party's obligation to ensure that each licence-holder meets its responsibility.

198. See *supra* note 93 at 470.

199. Kamminga, *supra* note 19 at 881.

200. Alexandre KISS, "State Responsibility and Liability for Nuclear Damage" (2006) 35 *Denver Journal of International Law and Policy* 67 at 77.

201. Sayed ZEIDAN, "The Procedural Rules and Obligations under International Law for Construction of a Nuclear Installation: Prevention and Reduction of Environmental Damage" (2011) 23 *Georgetown International Environmental Law Review* 263 at 286.

202. NSC, *supra* note 4, art. 7.

203. See Jutta BRUNNEE, "Of Sense and Sensibility: Reflections on International Liability Regimes As Tools For Environmental Protection" (2004) 53 *International and Comparative Law Quarterly* 351.

The Fukushima nuclear accident raised questions about the implementation of the Convention by the Japanese government and identified the need to reassess the obligation of each contracting party deriving from the NSC provisions in the light of lessons learned from the accident. Several major deficiencies, such as the lack of independence of the regulatory body from the body entrusted with the promotion of nuclear energy and its ineffectiveness in dealing with severe accidents, may demonstrate the failure of the Japanese government in exercising the obligation of due diligence. Moreover, serious oversight in evaluating all relevant site- and design-related factors, the design and construction of the installation, and effectively responding to the emergency additionally validate the argument about the lack of due diligence. This obligation involves the responsibility of a state to ensure the safe operation of all nuclear installations in the country through licensing, assessment and verification of safety, quality assurance, and the development of emergency plans and procedures, regardless of the fact that the plant was operated by a private company. Moreover, Japan's failure to inform countries in the vicinity that were likely to be affected by the ongoing nuclear accident about the release of the radioactive materials into seawater may also raise questions about meeting its international obligation towards these countries.<sup>204</sup>

This catastrophic accident also reiterated the importance of the due diligence principle in regard to the question of compliance with the Convention on Nuclear Safety and the IAEA safety standards. As was stated in the *Pulp Mills Case*,<sup>205</sup> the due diligence obligation represents “an obligation which entails not only the adoption of appropriate rules and measures, but also a certain level of vigilance in their enforcement and the exercise of administrative control applicable to public and private operators, such as the monitoring of activities undertaken by such operators”.<sup>206</sup> Since these rules and measures must be “in accordance with applicable international agreements” and “in keeping, where relevant, with the guidelines and recommendations of international technical bodies”,<sup>207</sup> it becomes evident that Japan breached its due diligence obligation by failing to comply with the NSC and the relevant IAEA standards. This obligation would particularly require Japan to follow the technical standards developed by the IAEA, which ensure the NSC's “objective of securing the safe use of nuclear energy”.

As after the Chernobyl disaster, these claims may encourage academic discussion on state responsibility for nuclear damage, although there are very few precedents in relation to this issue. The existence of both elements of state responsibility for a wrongful act involving the breach of an international obligation of the state and the attribution of the conduct to the state were demonstrated in relation to several NSC provisions. However, the fact remains that so far no states have raised the question of

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204. See *supra* note 95 at 39. Even in its national report for the 2nd Extraordinary Meeting of the NSC, Japan recognized the cases in which information—such as the outflow of water with high-level radioactivity and the discharge of stagnant water with low-level radioactivity to the sea in April 2011—was not always fully shared in advance with neighbouring countries.

205. *Pulp Mills on the River Uruguay (Argentina v. Uruguay)*, [2010] I.C.J. Rep. 14.

206. *Ibid.*, para. 197.

207. *Ibid.*

Japan's state responsibility for nuclear damage, which can be explained by several reasons. Authors agree that one of the main reasons that may explain this is the absence of state practice.<sup>208</sup> So far only the claim in the case of the *Cosmos 954*<sup>209</sup> crash can be distinguished. Some authors also point out the case of the Japanese fisherman, although it involved the payment of compensation without the US admitting legal responsibility.<sup>210</sup> Perhaps a more convincing reason is the tacit solidarity between states, especially those who are extensive users of nuclear energy. As Guruswamy points out, "it is perfectly feasible that states declined to prefer claims for fear of establishing precedents that could be used against them".<sup>211</sup> Finally, more successful international private law mechanisms channelled through the notion of civil liability may explain the behaviour of states in cases of a nuclear damage.<sup>212</sup>

The accident exposed the ineffectiveness of the Convention's preventive monitoring mechanisms; a stronger monitoring regime would seem indispensable in preventing another Fukushima. This could be rectified by the introduction of expert peer review, as suggested by Kamminga, or by amending the NSC provisions.<sup>213</sup> In the aftermath of the Chernobyl disaster, states felt ready to adopt the NSC in an effort to provide the legislative and regulatory framework for the safety of nuclear installations. This latest nuclear incident motivated states to reconsider existing safety rules and render them more precise and detailed. At the 2nd Extraordinary Meeting of the Contracting Parties to the NSC,<sup>214</sup> the contracting parties made several suggestions which demonstrated their willingness to improve the effectiveness of the Convention. The proposals to introduce external expert review, the assessment and verification of safety in accordance with state-of-the-art science and technology and the IAEA standards reiterated the need to revisit the Convention and to further develop the IAEA standards and use them in assessing compliance with the NSC. However, time will tell if the contracting parties are ready to do what is needed to achieve the Convention's objective of ensuring a high level of nuclear safety worldwide.

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208. See Philippe SANDS, *Principles of International Environmental Law*, 2nd ed. (Cambridge: Cambridge University Press, 2003) at 877; Lakshman GURUSWAMY, *International Environmental Law in a Nutshell*, 2nd ed. (Eagan, MN: Thomson/West, 2003) at 629.

209. It was a Soviet nuclear-powered surveillance satellite that crashed over Canada on 24 January 1978.

210. Birnie, Boyle, and Redgwell, *supra* note 24 at 518.

211. Guruswamy, *supra* note 208 at 629.

212. See Kiss, *supra* note 200 at 77.

213. Kamminga, *supra* note 19 at 6.

214. *Supra* note 185.

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