



## Japan's Nuclear Safety Governance after Fukushima

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### Summary

*One of the main causes of the Fukushima nuclear accident was the failure of the nuclear regulatory system in Japan. In 2012, a new independent Nuclear Regulation Authority (NRA) was established which revised the nuclear regulatory standards based on the lessons learned from the Fukushima accident. This paper reviews both the structural reform and technical revision of Japan's nuclear regulatory system, that is "nuclear regulatory governance." For structural reform, the most important reform was to guarantee the "independence" of the regulatory agency. Unifying various regulatory functions and improving transparency were additional important reforms. The new regulatory standards introduced stricter accident management measures, in particular against tsunamis and earthquakes. New measures against nuclear terrorism are also now required under the new standards. And yet public trust in nuclear power has not improved greatly. Remaining policy issues include improvement of regulatory systems; lack of independent organization to evaluate the NRA; enhancement of "safety awareness" of all organizations involved; assessment of evacuation programs which is not a part of the NRA's licensing process; political pressure from the pro-nuclear government; and lack of public confidence in nuclear safety.*

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1. On 11 March 2011, the Great East Japan Earthquake disaster was caused by a magnitude 9.0 earthquake that occurred in the Pacific Ocean. The Fukushima Daiichi nuclear power plant of the Tokyo Electric Power Company

(TEPCO) located in Fukushima prefecture was hit by the tsunami caused by the earthquake. Subsequently, the four units suffered severe accidents such as a core meltdown and hydrogen explosion due to a total station blackout.

2. The Japanese government classified the Fukushima accident on the International Nuclear Event Scale (INES) of the International Atomic Energy Agency (IAEA) as the maximum level 7, the same level as the Chernobyl nuclear power plant accident of 1986. As of the end of 2016, about 80,000 residents of Fukushima prefecture who were evacuated after the accident were still living away from their hometowns as a result of large-scale environmental contamination.

3. Although the Japanese government has stated that it will take 30 to 40 years to complete the decommissioning measures, the process has not been going smoothly. According to the estimate released by the Ministry of Economy, Trade and Industry (METI) at the end of December 2016, the total accident-related costs will reach 22 trillion yen (US \$220bn): the decommissioning cost will reach \$80bn, compensation expenses will reach \$80bn and decontamination costs will reach \$60bn. This total amount is equivalent to about one-fifth of Japan's annual general accounting budget.

4. According to the public opinion poll results released by the Japan Atomic Energy Relations Organization in 2013,<sup>1</sup> the opinion that nuclear

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<sup>1</sup> Japan Atomic Energy Relations Organization (JAERO), "Genshiryoku Riyo no Chishiki Fukyu Keihatsu ni Kansuru Seron Chosa" (Public Opinion Survey on Knowledge Diffu-

power generation is “necessary” had been steadily increasing until it accounted for 49.1 per cent in 2010. However, it decreased to 15.7 per cent in 2011, namely after the Fukushima accident. On the other hand, the opinion that nuclear power is “not necessary” had increased from 16.7 per cent in 2010, to 35.9 per cent in 2011.

5. One of the main causes of the accident was the failure of the safety regulatory system. The Fukushima Nuclear Accident Independent Investigation Commission of the National Diet of Japan strongly criticized the lack of an independent regulatory system, and called it “regulatory capture”, as the nuclear regulatory agency was “captured” by the interests of nuclear electric utilities.<sup>2</sup>

6. This Policy Brief provides an overview of Japan’s nuclear safety regulations that were revised drastically after the Fukushima accident. We first describe the new regulatory structure and systems, followed by a description of the new regulatory standards and conclude with the challenges of the new regulation system.

### Japan’s Regulatory Structure Reform and Establishment of the Nuclear Regulation Authority

7. Based on the experience of the Fukushima accident and the reports of the investigation commissions of the national Diet and the government, an additional purpose of the law was added to the two laws concerning nuclear energy in 2012. First, the following sentence was added to the Atomic Energy Basic Act in June as its purpose in regard to securing safety: this act is enacted “for the purpose of protecting the life, health, and property of citizens and contributing to environmental conservation and the security of our country.”

8. Subsequently in September, the following sentence was added to the Law for the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (the Nuclear Reactor Regulation Law) as its purpose: this act is enacted “for providing necessary regulations assuming the occurrence of large-scale natural disasters, terrorism, and other criminal acts.”<sup>3</sup> Furthermore, the following items were also added to the Nuclear Reactor Regulation Law:

- Severe accident measures are subject to regulation based on this law.
- The back-fit system, a system that obliges nuclear facilities that have already been permitted to operate to comply with the latest regulatory standards, is to be adopted.
- The operation period of a nuclear power plant shall be forty years. (However, it is possible to extend this period for another 20 years at the maximum.)

9. At the same time, the Act for Establishment of the Nuclear Regulation Authority was issued<sup>4</sup> in June and the Nuclear Regulation Authority (NRA) was established as an external agency of the Ministry of the Environment in September. Meanwhile, the Nuclear Safety Commission of the Cabinet Office and the Nuclear and Industrial Safety Agency of METI, which were responsible for safety regulations based on a double-check system, were abolished. Both organizations were regarded as problematic not only due to their inadequate responses following the Fukushima accident, but also because of their continuous close relationship with pro-nuclear organizations that had already existed before the accident.

10. The establishment of the NRA is based on a reflection on these two organizations (see Figure 1). The committee consists of five members. At the time of the selection, the members must declare to the Diet the amount of donations, if any, received from nuclear businesses or any other nuclear-related organization. Three key

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sion on Nuclear Energy Utilization), February 2013, <http://www.jaero.or.jp/data/01jigyuu/pdf/tyousakenkyu23/6.pdf>

<sup>2</sup> The National Diet of Japan, “The official report of the Fukushima Nuclear Accident Independent Investigation Commission,” 2012, [https://www.nirs.org/wp-content/uploads/fukushima/naic\\_report.pdf](https://www.nirs.org/wp-content/uploads/fukushima/naic_report.pdf)

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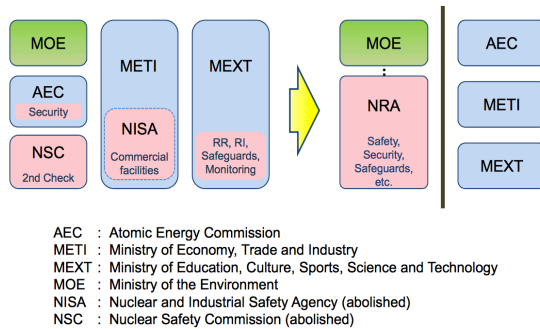
<sup>3</sup> Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors,

<https://www.nsr.go.jp/data/000067232.pdf>

<sup>4</sup> Act for Establishment of the Nuclear Regulation Authority, <https://www.nsr.go.jp/data/000067231.pdf>

features deserve to be highlighted: guaranteed independence, integrated regulation and improved transparency.

**Figure 1: Nuclear Regulatory Governance – Integrated and Independent**



Source:

<https://www.nsr.go.jp/data/000067048.pdf>

**11. Guarantee of independence.** Based on the National Government Organization Act, it is guaranteed that NRA will exert its authority independently without supervision from higher-level organizations. Also, people who have served or have been serving as officers or employees of nuclear businesses during the last three years are not eligible to become NRA staff members. In addition, a rule that prohibits NRA employees to be reassigned to a government office that promotes nuclear energy use, “the no-return rule,” has been adopted. Furthermore, the extent of the prime minister’s right to give orders has been clarified because the prime minister at the time of the Fukushima accident intervened excessively in the response activities and caused confusion.

**12. Unification of regulatory tasks.** All regulatory-related administrative tasks, that had been carried out separately by the Nuclear Safety Commission, the Nuclear and Industrial Safety Agency and other organizations, have been unified. As a result, the NRA is performing all the administrative tasks regarding safety regulations, safeguards for nuclear non-proliferation and other nuclear-related regulations.

**13. Enhancement of transparency.** Information is released voluntarily without waiting for information disclosure requests. The agency’s meetings are opened to the public in prin-

ciple and discussions with regulated entities regarding the decision making process are also made public.

## Overview of New Regulatory Standards

14. One of the major projects of the NRA was to establish the new regulatory standards for nuclear reactors that took effect in July 2013. The meetings included external experts and were open to the public. Furthermore, the new regulatory standards were completed after twice going through the procedure of collecting public comments.

15. After the Fukushima accident, 49 nuclear power plant units, that is, all units in Japan excluding the four units of the Fukushima Daiichi nuclear power plant were shut down. These nuclear power plants cannot be re-started unless they obtain approval by successfully completing the compliance review process based on the new regulatory standards (so-called “back-fit” regulation which was not a part of the regulation before the Fukushima accident).

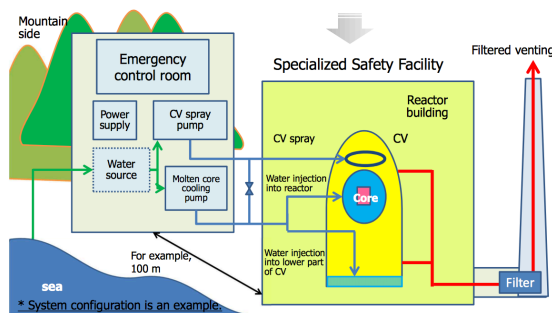
16. At the time of the Fukushima accident, multiple pieces of equipment and systems lost their safety function simultaneously due to the earthquake and tsunami. For example, external power supply was lost due to the earthquake, and internal power supply was lost or damaged due to the tsunami. Furthermore, TEPCO and the government could not stop the subsequent deterioration resulting in severe accidents. For example, cooling system failure, core melting, and hydrogen generation/leakage/explosion occurred.

17. Based on these experiences, the new regulatory standards strengthened conventional counter-measures. For example, the regulation requires the installation of a tsunami barrier and a tide-proof door for protection against large-scale natural disasters. Also, as a countermeasure against earthquakes, it requires power plant operators to confirm active geological fault activities since the Late Pleistocene (about 120 to 130 thousand years ago). Furthermore, it requires counter-measures against severe accidents, such as core damage prevention, preservation of the containment function

of containment vessels and suppression of radioactive materials diffusion, including filtered ventilation for Boiling Water Reactors, which were not regulatory requirements before the Fukushima accident.

18. It also requires counter-measures against terrorism and aircraft collisions. For example, it requires the establishment of specific safety facilities equipped with facilities, such as a second control room with a distance at least 100 metres away from the main building, to maintain safety functions even in case of large-scale damage due to terrorist attacks or the like (see Figure 2).

**Figure 2 Measures against Intentional Aircraft Crash, etc.**



Source:

<https://www.nsr.go.jp/data/000067048.pdf>

19. New regulatory standards for nuclear fuel cycle facilities have also been enforced. The standards cover large reprocessing facilities and fuel processing facilities as well as waste disposal facilities and research reactors. In particular, large scale reprocessing facilities and MOX fuel<sup>5</sup> processing facilities are required, for the first time, to take severe accident counter-measures. Japan Nuclear Fuel Ltd.'s reprocessing plant and MOX fuel processing plant located in Rokkasho village, Aomori prefecture are subject to its regulation under these new regulatory standards. The fast breeder prototype reactor Monju is also regulated by the same standard as a commercial reactor, although it is a research and development reactor.

<sup>5</sup> **Mixed oxide (MOX) fuel** is nuclear fuel containing more than one oxide of fissile material, for example plutonium blended with natural uranium, reprocessed uranium or depleted uranium.

20. As of the end of January 2017, 10 units have obtained approval after successively completing the compliance review process and 16 units, including 1 unit under construction, are currently under review. All review meetings are open to the public. Furthermore, not only are the meeting documents and minutes posted online, but the meetings are also streamed live.

21. Of the ten approved units, only five units have been re-started after obtaining agreement from the local governments. Although the electric power companies are not legally required to obtain agreement from local governments, the companies give importance to this process due to the informal understanding between the utilities and local governments. The operation of two units has been suspended due to the granting of a temporary injunction requested by residents. Among these approved units, three out of ten have also been permitted to extend the operation period by 20 years after successfully completing another review process for this purpose.

22. Safety costs to satisfy the new regulatory standards are a big burden for the electric power companies. According to the survey conducted by the *Asahi Shimbun*, a Japanese newspaper company, the total cost rose to about \$33bn as of July 2016. As a result, since low output and aging nuclear power plants cannot expect to achieve cost-effective safety measures, decisions have been made to decommission six plants.

23. In terms of nuclear fuel cycle facilities as well, decisions have been made to decommission one research reactor and Tokai reprocessing facility for the same reason. In 2015, the NRA issued a recommendation regarding the appropriateness of operating Monju owned by Japan Atomic Energy Agency following the latter's repeated failure to implement sufficient safety measures. Meetings to discuss this issue were subsequently held mainly by METI and ultimately a decision was made at the end of 2016 to decommission Monju.

24. Despite the future of nuclear power usage being unclear, the government has declared its intention to secure the operation of existing nuclear power plants based on the new regula-

tory standards. It is stated in the Strategic Energy Plan released by the government in April 2014 that the new regulatory standards are “the most stringent standards in the world” and that nuclear power is “an important base-load power source.”<sup>6</sup> Prepared on the basis of this plan, the Long-term Energy Supply and Demand Outlook released by METI in July 2015 states that the ratio of electric power to be produced in FY2030 by nuclear power will be set at about 20-22 per cent.<sup>7</sup> With regard to the nuclear fuel cycle policy, it is similarly stated in the strategic energy plan that the government will continue to promote reprocessing and MOX programs as in the past.

### Remaining Policy Issues

25. The current regulatory framework is still in the process of being improved in comparison to some of the international safety standards and practices. In January 2016, the NRA agreed to be assessed by the IAEA’s Integrated Regulatory Review Service that evaluates the nuclear safety regulation of a member country. As a result, 13 recommendations and suggestions were provided regarding management, inspection and other systems.

26. Currently, improvements are being made based on these results. For example, because it was pointed out that the current system does not monitor the operators at all levels and at all times, the NRA is considering introducing a system similar to that of the United States, in which inspectors are given the right to access plants freely at any time.

27. Besides, there is no independent organization that objectively evaluates the NRA. Though the Reactor Safety Examination Committee and the Nuclear Fuel Safety Examination Committee serve as advisory bodies, the committees do not monitor the NRA as a third party organ-

ization. These two committees can only give advice on matters upon being requested to do so by the NRA.

28. The Japanese government insists that the new regulatory standards are at the world’s highest level, but this is an overstatement. As a matter of fact, the country’s safety system has only just reached the same level as that of the systems of other countries around the world. For example, severe accident countermeasures had been implemented in other countries before the Fukushima accident. The filtered vent had been introduced in Europe before it was adopted in Japan. The introduction of the specific safety facilities and portable power supply vehicles was based on the nuclear terrorism countermeasures that had already been adopted in the United States following the terrorist attacks of 11 September 2001.

29. No matter how much the *safety regulation system* is improved, it is essential for regulated entities, local governments and the national government to make every effort to improve their *safety awareness* in order to assure public confidence in nuclear safety, that is the “culture of safety” needs to be assured. Unfortunately, the current practices of nuclear industry do not seem to satisfy such conditions. For example, power companies show no sense of commitment at the conformity review meetings and they are trying to meet the new regulatory standards at the lowest safety level required in order to successfully complete the compliance review process and obtain approval.

30. As a result, the NRA has repeatedly pointed out this disposition of the power companies and this has led to prolonging the review process. Some power plants have been under review for more than three-and-a-half years. The new regulatory standards are only regulatory requirements, which are “minimum requirements” to operate the plant. Since the operators legally bear the prime responsibility for preventing accidents, they must implement safety measures actively on their own initiative to go beyond regulatory standards.

31. The new regulatory standards do not cover the validity of the evacuation plans of the regions where nuclear power plants are located.

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<sup>6</sup> Agency for Natural Resources and Energy of Ministry of Economy, Trade and Industry, *Strategic Energy Plan*, April 2014,

[http://www.enecho.meti.go.jp/en/category/others/basic\\_plan/pdf/4th\\_strategic\\_energy\\_plan.pdf](http://www.enecho.meti.go.jp/en/category/others/basic_plan/pdf/4th_strategic_energy_plan.pdf)

<sup>7</sup> Ministry of Economy, Trade and Industry, *Long-term Energy Supply and Demand Outlook*, July 2015,

[http://www.meti.go.jp/english/press/2015/pdf/0716\\_01a.pdf](http://www.meti.go.jp/english/press/2015/pdf/0716_01a.pdf)

Instead, the safety of the local community, which will receive the most damage in case of an accident, is left up to the local governments and the national government. Prefectural governors hold more cautious views than local governments which host nuclear power plants primarily due to their excessive economic dependence on nuclear power caused by the subsidies given by the national government for accepting a nuclear power plant.

32. This excessive dependence had already been regarded as problematic prior to the Fukushima accident. The problem has continued to exist and as a result, it creates a situation where the local community tends to agree to re-starting the local nuclear power plant despite safety concerns expressed by citizens of other communities which do not host nuclear power plants.

33. Satsuma-Sendai city, Kagoshima prefecture, which permitted nuclear power plants to re-start for the first time after the Fukushima accident in August 2015, has received \$300mn until now as subsidies given for accepting the nuclear power plants and has used the money for education and regional vitalization projects. Although the region has no nuclear power advisory committee composed of outside experts, as opposed to other local governments of regions with nuclear power plants, and the residents were highly concerned, the mayor and the prefectural governor permitted the nuclear power plants to re-start, probably due to the region's economic dependence on nuclear power, without holding discussions on safety.

34. It is difficult to deny the possibility that the Japanese government's pro-nuclear attitude is indirectly pressuring the NRA. For example, the chairperson of NRA must always participate in the National Diet's Special Committee for Investigation of Nuclear Power Issues and give a report on the current situation of the protracted process of re-starting nuclear power plants. Furthermore, the government revised the criteria for the subsidy calculation method in 2016 to give preferential treatment to local governments that allowed nuclear power plants to re-start.

35. However, the majority of the public seem to have critical opinions about re-starting nuclear power plants. According to the public opinion poll conducted by the Japan Atomic Energy Relations Organization in 2015,<sup>8</sup> which is the year when two nuclear power plants, Sendai nuclear power plants unit 1 and 2, were re-started for the first time after the Fukushima accident, 47.9 per cent responded that the use of nuclear energy "should be abolished gradually" and 14.8 per cent responded that it "should be abolished immediately." On the other hand, 10.1 per cent responded that the use of nuclear energy "should be maintained at the same level as before the Great East Japan Earthquake" and 1.7 per cent responded that it "should be increased."

## Conclusion

36. As a result of creating a new regulatory framework based on the lessons learned from the Fukushima accident, independence and transparency of the system have been improved significantly as compared with the conditions in the past. The safety of nuclear power plants and nuclear fuel cycle facilities is expected to improve if regulated entities fully comply with the new regulatory standards.

37. However, satisfying regulatory standards is a minimum requirement and efforts to improve safety must be continued reflecting past experiences and new knowledge. Also, the regulatory organizations and regulated entities may become less alert as time passes and the Fukushima accident is forgotten. Public trust which was lost due to the Fukushima disaster has not been restored as such efforts are not visible to the public eye. Consequently, monitoring by citizens will become increasingly important from now on.

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<sup>8</sup> JAERO, 2015.  
<http://www.jaero.or.jp/data/01jigyuu/pdf/tyousakenkyu27/r2015.pdf>

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