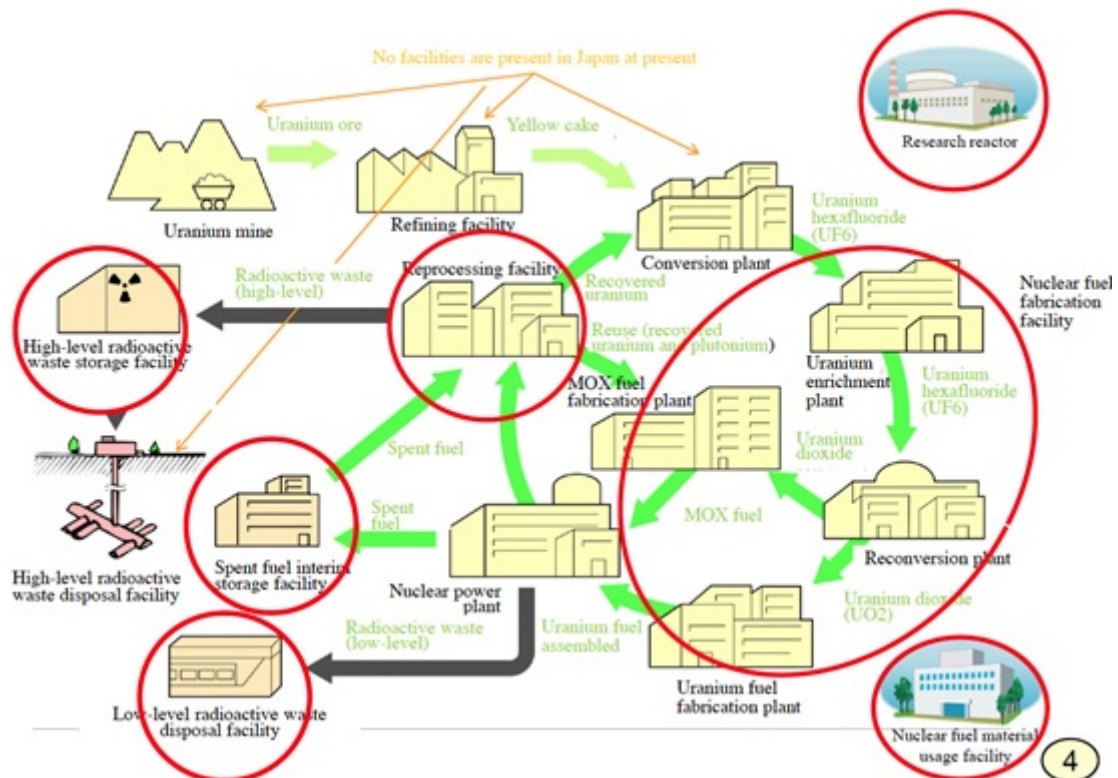


JAPAN'S NEW REGULATORY STANDARDS FOR NUCLEAR POWER AND REPROCESSING PLANTS: TECHNICAL, SOCIAL AND POLITICAL ASPECTS



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Tadahiro Katsuta

June 1 2017

I. INTRODUCTION

In this essay, Tadahiro Katsuta concludes that: "Security measures have been strengthened following the Fukushima accident. More detailed discussions on security at nuclear facilities that include addressing issues specific to Japan, however, are needed."

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Banner Image Credit: Tadahiro Katsuta

II. SPECIAL REPORT BY TADAHIRO KATSUTA

JAPAN'S NEW REGULATORY STANDARDS FOR NUCLEAR POWER AND REPROCESSING PLANTS: TECHNICAL, SOCIAL AND POLITICAL ASPECTS

JUNE 1 2017

1.0 INTRODUCTION

1.1 Background

After the Fukushima Daiichi nuclear power plant accident caused by the Great East Japan Earthquake of March 11, 2011, Japan's nuclear energy safety/security regulations were revised drastically.

The Atomic Energy Basic Act was revised in June 2012, and a new objective of securing nuclear safety was added in Article 2 of Chapter I. This revision to the act was enacted "for the purpose of protecting the life, health, and property of citizens and contributing to environmental conservation and the security of our country in light of established international standards."[\[1\]](#) In addition, in the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors, an additional goal of the regulation was added in Article 1 of Chapter I, which was enacted "for providing necessary regulations assuming the occurrence of large-scale natural disasters, terrorism, and other criminal acts".[\[2\]](#)

The Nuclear and Industrial Safety Agency (NISA) of the Ministry of Economy, Trade and Industry (METI), along with the Nuclear Safety Commission Japan, were dismantled, and a new regulatory body, the Nuclear Regulation Authority (NRA), was established in September 2012. Subsequently, the NRA began enforcing the new regulatory standards for nuclear power plants in July 2013, and for fuel cycle facilities in December 2013.

1.2 Purpose

In this report, a summary of the new regulatory standards for nuclear reactors and the nuclear fuel cycle is provided in Section 2. Following this summary, as an example of the re-start problems faced by reactors in Japan, the circumstances of the Kyushu Electric Power's Sendai nuclear power plant, which re-started operation this August, are described in Section 3. In Section 4, the current situation and problems related to spent nuclear fuel management and security are shown as common policy problems for nuclear power reactors and reprocessing facilities in Japan.

2.0 Summary of the new regulation standards

2.1 New safety regulation standards for nuclear power plants

A summary of the new regulatory standards for nuclear power plants is provided in Figure 1 [3].

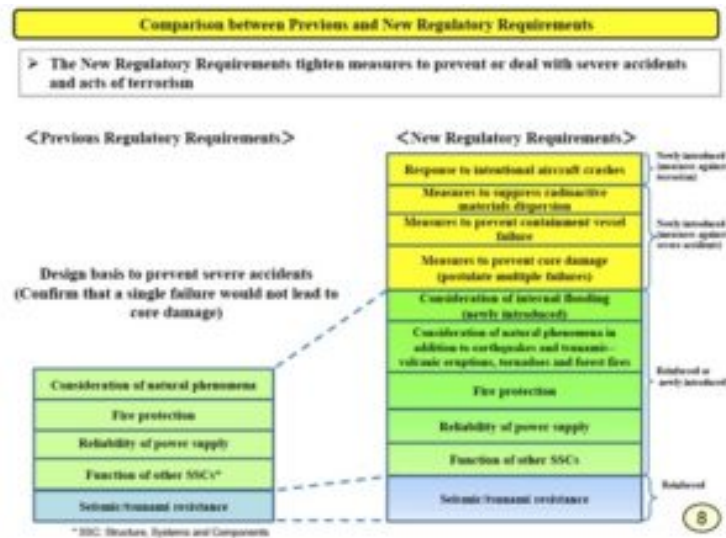


Figure 1: Comparison between Previous and New Regulatory Requirements for Nuclear Power Plants

Under the new regulations, the following requirements were reinforced: 1) assumptions that must be made during nuclear safety planning with regard to the strength and impact of natural phenomena (earthquakes, tsunamis, volcanic eruptions, and other events) that can bring about common cause failures in nuclear power plants, 2) countermeasures to be implemented in response to problems other than natural phenomena (countermeasures for internal water overflow, blackout, and other circumstances).

In addition, the following requirements were newly added to the regulations with regard to measures to be implemented to respond to and mitigate the impacts of severe accidents, and as counterterrorism measures: 1) prevention of nuclear core damage, pressure vessel maintenance, and management of pressure release by the use of vents in the event of gas pressure build-up within reactor buildings, 2) reliability improvement through the use of a combination of a set of permanent monitoring and measurement equipment installations backed up with the ability to carry out monitoring and measurements with portable equipment maintained at the reactor site for use in emergencies (as in the approach adopted in the U.S.), 3) reinforcement of the measures for spent fuel pool protection, 4) accident-resistant reinforcement of emergency response facilities, 5) hardware (facilities) and software (on-site work by technicians) unification, and 6) aircraft attack countermeasures (through dispersion in different places in nuclear facilities of portable equipment for monitoring, emergency cooling of reactors and spent fuel pools, and other functions), and the introduction of the "specialized safety facility". Specialized safety facilities constitute collections of back-up systems to provide safety countermeasures. Such facilities are designed to enable

necessary equipment, such as emergency systems, power supplies, and coolant pumps, be function in the event of an accident (see Figure 3).

Currently, three assessments are carried out at the same time following an application by a nuclear reactor to re-start operation: an assessment to obtain permission for installation of safety and other infrastructure (change of equipment), a construction plan assessment, and a maintenance code assessment. When the applicants pass these assessments, two inspections follow: a pre-use inspection after the authorization of the construction plan, and a safety inspection after the authorization of the maintenance code[4].

Subsequently, re-start is enabled after reaching an agreement with the local government of the nuclear power plant location although it is not a legal requirement that the operator reach such an agreement.

Currently, 25 reactors at 15 nuclear power plants are undergoing compatibility assessments regarding the new safety and operating regulations. In addition to the Sendai nuclear power plant units 1 and 2, owned by Kyushu Electric Power, which have re-started operation, reactor installation changes have been permitted for Takahama units 3 and 4, owned by Kansai Electric Power, and for Ikata unit 2, operated by Shikoku Electric Power.

According to the *Asahi Shimbun*, the total costs of safety measures implemented by Japanese reactor operators post-Fukushima had reached approximately 2,400 billion yen (US\$ 24 billion) as of this August[5].

2.2 New regulation standard for nuclear facilities

The types of fuel cycle facilities subject to regulation are shown in Figure 2.[6] The operation of Monju, the fast breeder test reactor, has been prohibited because the operator's omission of apparatus inspection was considered a serious problem. No decision has been made for the Monju plant on when to apply for an assessment of compliance with the new nuclear safety standards.

Similar to the new regulatory requirements for nuclear power plants, stricter evaluation of the potential plant-level impacts of and responses to earthquakes and tsunamis, in addition to evaluations of the potential impacts of and responses to volcano eruptions and tornados, plus the development countermeasures in response to terrorist attack, are required for nuclear fuel cycle facilities. In addition, reprocessing plants and MOX (mixed oxide nuclear fuel fabrication) plants are newly required to have response measures in place to respond to severe accidents.

Japan Nuclear Fuel Ltd. (JNFL) applied to the NRA in January 2014 for an assessment of compatibility with the new nuclear safety requirements for its Rokkasho reprocessing plant and its MOX fabrication facility. Forty assessments have been carried out as of September 4, but many of the measures implemented to respond to severe accidents still need to be discussed. JNFL has stated that it will most likely not be possible to start operation of the Rokkasho plant from next March (2016) as planned[7].

Because of the pending implementation of laws restructuring and liberalizing electricity markets in Japan starting from the next fiscal year (2016), METI is concerned that the burden of reprocessing costs on electric power companies will increase. As a result, METI is evaluating whether or not to change JNFL from a company into an "authorized corporation"[8].

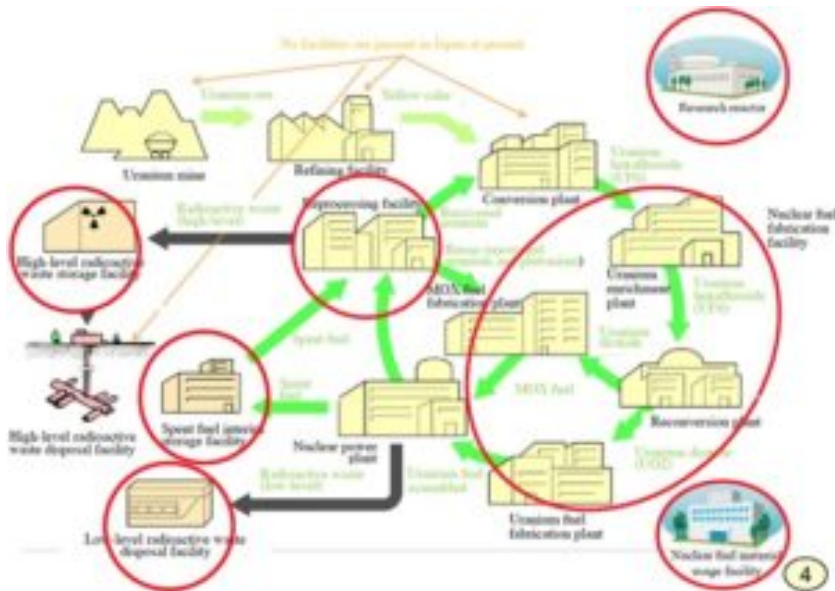


Figure 2: Facilities Subject to the New Regulatory Requirements

If this change in status for JNFL materializes, the involvement of the government in reprocessing and other nuclear fuel cycle activities will become stronger, while electric power companies will be obliged to continue to contribute funds toward reprocessing and related activities. In addition, it may become difficult for electric power companies to withdraw from the reprocessing business, even as market liberalization, and thus, theoretically, pressure on utilities to control costs, continues.

The costs of safety measures expected to be implemented at the reprocessing plant post-Fukushima, as estimated at the time of the assessment application submission, was 24,300 million yen (US\$ 243 million).

3.0 Challenges of Japan's New Nuclear Age Implied by the Restarting of the Sendai Nuclear Power Plant

The first of Japan's nuclear reactors—Kyushu Electric Power Company's Sendai nuclear power plant (NPP) Units 1 and 2—were restarted beginning in August 2015. Unresolved questions concerning nuclear safety regulation and the relationship between local economies and nuclear power stations, however, render the decision to restart the Sendai reactors problematic. The Sendai nuclear power plant definitely does not have a history as "an honor student" regarding safety. The utility that owns the Sendai power plant was given the first priority for restart even through it continues to avoid dealing with three significant issues regarding nuclear safety and host community acceptance. Rather, the restart of the Sendai units has been approved in part because of Kyushu Electric's historical dependence on nuclear power and the dependence of the local community on income from the Sendai plants. The restart of the Sendai nuclear power plant therefore in no way suggests the start of a new era of nuclear energy use in Japan.

(1) A key assumption in the approval of restart for the Sendai reactors is that pressurized water reactors are considered safe: Based on the new regulation standards for nuclear safety, enforced starting in July 2012, regulations were put into place regarding measures to be taken to prepare for severe accidents - a belated adoption of global standards. According to the Nuclear Regulation Authority (NRA), which was newly established after the Fukushima Daiichi nuclear power plant accident, accident response measures are required based on a strict standard based on experience and practices adopted from overseas. In the new requirements, NRA deemed Pressurized Water Reactors (PWRs) such as the Sendai NPP, safer than Boiling Water Reactors (BWRs), such as those at the Fukushima Daiichi NPP. On this basis, the new regulations afford PWRs a time margin of five

years for the introduction of severe accident measures from the enforcement date of the new standards, while BWR units are required to implement such measures earlier. For example, utilities are not required to immediately install on PWRs Filtered Containment Venting Systems (FCVS), devices to release radioactive gases to the outside air, in the event of an accident, through a filter to prevent large-scale radioactive contamination caused by the breaching of a damaged containment vessel. The NRA considers that the risk of containment vessel damage for a PWR is low, and thus there will be a considerable amount of time before accident response measures, such as implementation of FCVS, must be enforced, because the containment vessels of PWRs are larger than those of BWRs. Owing to the temporary exemption from enforcing the implementation of severe accident response measures for PWRs—implementation of which is a heavy burden financially and in terms of preparation work for the power plant owner—all 10 NPPs of the 6 electric companies that had applied for the regulation standard compatibility evaluation by July 8, 2015, the enforcement date of the new standards, were PWRs.

In many European countries, including France, Germany and Sweden, however, the filtered containment venting system has been already been voluntarily introduced, regardless of the reactor type. Though the U.S. Nuclear Regulatory Commission (NRC) has not adopted the FCVS, it has clearly presented the results of a cost-benefit analysis and the decision process related to adoption of FCVS. In a number of ways, PWRs are not safe at all, and thus safety measures for PWRs deserve a similar level of scrutiny as for BWRs. For example, the Steam Generator (SG) in PWRs is a concern. In 1991, the SG was damaged and the Emergency Core Cooling System (ECCS) was activated in Mihama Unit 2, operated by Kansai Electric Power, Japan. Though the SG damage in this case was caused by a mere metal fittings mount failure, it resulted in a serious accident and was rated level 3 on the International Nuclear Event Scale (INES, which ranks nuclear incidents/accidents from level 1 to level 7 in severity). In 2013, the San Onofre nuclear power plant Unit 2 and Unit 3 in the U.S. were closed for decommissioning due to a radiation leak from a SG. There is no available scientific literature on the potential influence of a great earthquake on this delicate device.

(2) A second key assumption in the approval of restart for the Sendai units is that natural disasters are presumed to be predictable. One of the key issues in this regard, specifically for the Sendai units but for many Japanese reactors in general, are problems concerning prediction of volcanic activity. The risk of a nuclear accident brought on by volcanic activity within an area of 160 km radius from nuclear power plant sites must be considered, based on the new nuclear safety standards. There are many volcanoes and calderas near the Sendai NPP. According to a survey conducted by Kyushu Electric Power, catastrophic eruptions have been occurring on a 90,000-year cycle at the Aira Caldera located 53 km from the Sendai site, with the latest eruption occurring 30,000 years ago. Furthermore, sediment from pyroclastic flows has been discovered in the area within a 5 km radius from the NPP (nuclear power plant) site. Kyushu Electric Power, however, contended that eruptions can be predicted, and the NRA accepted this argument. Many volcanologists, on the other hand, are insisting that more discussion of this contention is necessary because it is scientifically impossible to predict volcanic eruptions.

A second issue related to natural disasters and their potential impact on a nuclear plant is related to modeling assumptions regarding basic earthquake ground motion, namely the setting of the maximum acceleration at the time of an earthquake, as it affects the safety of reactors and other nuclear facilities. The NRA announced a policy to give priority to certain NPPs for their evaluation to reduce the burden of evaluating all NPPs at the same time, and then decided to give priority to the Sendai NPP in March 2014. One of the reasons for making this decision was the value used for the basic earthquake ground motion in evaluating the safety of the Sendai units. Almost all electric companies continue to be cautious regarding the requirements imposed by the NRA because setting

the value of the basic earthquake ground motion is difficult scientifically, and revising this value has been a cause of safety design revisions and the resulting financial burden of additional reactor modifications and restart delays. Kyusyu Electric Power Company, however, raised this value to 620 gals (centimeter per second squared) from 540 gals in its evaluation application, and as a result the NRA concluded that the value used by Kyushu was sufficient to indicate a sufficient safety margin for the reactors. Nonetheless, Kyushu Electric's reasoning in referring in its restart application to the earthquake data of the north end of Japan—the Sendai nuclear power plant is located at the south end of Japan—is unclear, and some seismologists insist that the value is still insufficient.

(3) A third key issue overlooked in the approval of restart for the Sendai units has been that agreements between the utility and the communities hosting the Sendai plant have been made in disregard of the opinions of the neighboring local governments: The final barrier to ultimate approval for restart following the approval of satisfaction of safety requirements by the NRA was to conclude agreements with local governments hosting the NPP, in this case, Kagoshima prefecture and Satsumasendai city, to obtain their approval for restart. Although Kagoshima and Satsumasendai city approved restarts, the neighboring local governments of six cities and two towns continued to strongly demand that the prefecture and the city should include them in the list of "local governments of the nuclear power plant site", and therefore take their opinions into account. The demands of these eight local jurisdictions were based on the premise that radioactive contamination caused by the Fukushima accident spread as far as a little over 25 0km from the Fukushima Daiichi site, and that as a result of that experience, the requirements for Nuclear Disaster Prevention Plans were revised to expand the area of Urgent Protective Action Planning Zones (UPZs) to a 30k m radius from NPP sites. Prior to the Fukushima accident, guidance on preparation of nuclear disaster prevention plans did not assume the impact of a severe accident, and therefore the target area of the plan was confined to an area within only 8 to 10 km from the NPP site.

In addition, part of a neighboring city, Ichikikushikino city, is located only 5 km from the Sendai NPP. Despite the proximity of these other cities and towns, the Kagoshima prefecture governor, Yuichi Ito, and the mayor of Satsumasendai city, Hideo Iwakiri, rigidly denied the demands for input into the restart decision by representatives of the other local jurisdictions. This refusal is assumed to have been based on two main reasons: in addition to the difficulty of summarizing the additional different opinions on the nuclear restart, Ito and Iwakiri were concerned about the decrease in the distribution of the benefits of the subsidies that are provided to local governments by the NPP operators, as described below.

In the end, among local towns and cities, only Kagoshima prefecture and Satsumasendai city approved the restart in November 2014, following the permission issuance by the NRA on September 10th (2014) and the restart request submission by the Director-General of the Agency for Natural Resources and Energy on September 12th. Statements by the prefectural governor, however, caused additional confusion. The prefecture's disaster prevention plan was to include an evacuation program for people requiring special assistance who are resident in medical or welfare facilities located within 30 km of the NPP. The prefectural governor, however, declared that the area within 10 km of the NPP is more than sufficient as the target area for the evacuation program. As a result, the number of applicable facilities for the evacuation plan was reduced to only 17 facilities from 244, less than one-tenth of the original number. Furthermore, it was found that an evacuation facility, which had been constructed by repairing an old elementary school, had insufficient radioprotection measures—and, further, the radioprotection measures installed were based on no particular standard—even though the total construction cost to repurpose the school building was 760 thousand U.S. dollars.

Rather than being based primarily on the outcomes of safety tests and the progress of arrangements for nuclear security at and near the reactor site, the decision to restart the Sendai reactors appears to have been rooted in the two economic issues, as described below.

(1) Kyushu Electric Power has an excessive economic dependence on nuclear power.

Following the Fukushima accident and the shutdown of its reactors, the company raised the price of electricity due to the increase in fuel costs for its thermal power plants. Despite the increase in tariffs, Kyushu Electric continues to run a deficit of more than 2 billion U.S. dollars per year^[9], but expects to become profitable when its NPPs are restarted. In addition, Kyushu Electric Power has used various apparently unethical means to promote nuclear power. For example, at an information meeting for local residents about NPP operations only three months after the Fukushima accident, Kyushu Electric Power demanded that several of their affiliated companies send "fake e-mails" by anonymous persons that insisted on the restarting of NPPs. The president of Kyushu Electric Power resigned in order to take responsibility for the fake e-mails.

Meanwhile, Kyushu Electric Power is continuing to refuse to hold talks with citizen groups and representatives of neighboring local governments even after the Sendai plant has been cleared to restart. Kyushu Electric refused an offer from nearly 100 citizen groups, in March 2015, to hold a discussion regarding the restart, and did not accept a petition on the topic bearing more than 10 thousand signatures of local residents. Furthermore, Kyushu Electric continues to refuse the requests of many local governments within a distance of 30 km from the site to have a voice in the discussions over plant restart.

(2) The prefecture and the city that are promoting the Sendai restarts are financially dependent on nuclear energy. The prefectural governor has been stating clearly that he endorses the restart. In September 2014, before the approval of the restarts, the governor insisted at the prefectural assembly that the Sendai NPP's safety had been ensured. Moreover, after the prefectural assembly elections in April 2014, the governor revealed that the reason why Kagoshima prefecture approved the restart in November 2014 was to avoid the restart to become an issue in the April 2015 election.

Satsumasendai city maintains many of its public and educational facilities through grants from Kyushu Electric of more than 12 million U.S. dollars every year. In total, over the years that it has hosted the Sendai NPP, the amount received by Satsumasendai city has risen to 270 million U.S. dollars. According to the city's Chamber of Commerce and Industry, the annual economic benefit of the restart/reoperation of the Sendai NPPs to the city is approximately 25 million U.S. dollars.

According to an article published this January by the *Asahi Shimbun*, it was found that four construction companies, which two Kagoshima prefectural assembly members and their relatives ran, received 26 orders (totaling 2.5 million U.S. dollars) for services such as construction work for the Sendai NPP in the three years after the Fukushima accident. These two members of the prefectural assembly received remuneration from these companies and were endorsing the restart of the Sendai NPP^[10].

According to a questionnaire survey conducted in May 2015 by a major local newspaper, opinions against restart among residents of the area around the Sendai plants accounted for 59.9% of responses. As with the socially vulnerable groups such as people requiring nursing care, however, the opinions of local residents may not be regarded as important because they have "no economic significance." In this way, application of strict nuclear safety regulations are being avoided even after the Fukushima accident, and economic impacts are being considered more important than risks to human life. The economic benefits to the utility and to some of the local jurisdictions have been the keys to restarting of the Sendai NPP, rather than an objective assessment of the plant's

safety.

4.0 Common problems of nuclear power plants and reprocessing plants: spent fuel management and terrorism

4.1 Spent fuel storage pools

Two types of severe incidents/accidents involving spent fuel storage pools are assumed both by nuclear power plants and reprocessing plants in evaluating nuclear safety: 1) loss of cooling or flooding functions, and 2) water loss from the spent fuel pool.

In both accident scenarios revised during the evaluation of Kyushu Electric Power's Sendai NPP, it was assumed that water will start boiling 14 hours after the onset of the accident. In addition, it is assumed that the radiation dose received by the surrounding environment will exceed the limit set by the utility (0.15mSv/h) 2.4 days after the accident, and that the water level in the pool will still be 4 m above the top of the fuel assemblies even at this point[11]. The company concluded that plant operators would have enough time to taking safety response measures before the fuel was exposed and radiation levels near the pool exceeded exposure limits.

The accident scenarios used in evaluating the safety of the spent fuel pools at the Rokkasho Reprocessing Plant also had similar assumptions. It was assumed that water will start boiling in the 3,000-ton spent fuel pool 50 hours after the onset of the accident. In addition, it was assumed that the radiation dose of the surrounding environment will not exceed the limit (0.05mSv/h) set by the plant operators until 7 to 8 days after the accident, and that the water level will still be 3.5 m above the top of the fuel assemblies even at this point[12].

These scenarios do not include assumptions of large-scale collapse of the spent fuel pool, resulting in rapid loss of cooling water, as a result of a natural disaster or a terrorist attack. Such a rapid loss of cooling could lead, in some circumstances, to heating of the exposed fuel to the point of fuel element failure and/or ignition of the fuel cladding, which could result in large releases of radioactivity.

4.2 Dry cask storage

The new nuclear safety regulation standards do not require a shift to dry cask storage of spent nuclear fuel, but there is also nothing in the new regulations that would prevent electric power companies from making the shift to dry cask storage of cooled spent fuel voluntarily. No electric power company has to date (late 2015), however, has made or announced a shift to dry cask storage. Chairperson Tanaka of the NRA has stated his own personal view that dry cask storage is safer than pool storage for cooled spent fuel, but changes in practice have not yet been forthcoming.

Onsite dry cask storage has not been discussed sufficiently as a technical and policy option for storing spent nuclear fuel in Japan, and as a result, some misconceptions remain. For example, some argue that there is insufficient space near NPPs in Japan to construct on-site dry cask storage facilities. Since on-site land development at NPP sites is needed to implement the additional safety measures required by post-Fukushima regulations the argument of insufficient space may not "hold water", as the necessary land to accommodate dry cask storage could be set aside at the same time as space for installation of new safety measures is allocated.

In addition, before the Fukushima accident, METI insisted that subsidies for hosting nuclear power plants would not be provided to local communities if nuclear power generation was halted as a result of not performing reprocessing. The logic here was that once spent fuel pools were full, if there were no reprocessing, spent fuel could not be moved to the reprocessing plant, and therefore would

have nowhere to go. At that point, since no alternatives to reprocessing were available, the plant would have to cease generating power. Halting generation, in turn, would cause economic hardship for the local communities hosting the plants, because subsidy payments would cease. METI, however, is still paying subsidies to local government NPP hosts, even while most generation at most plants has been halted for safety reviews. The total value of the subsidies paid by METI to nuclear facility host communities in FY2014 was approximately 100 billion yen (US\$ 1 billion)[13]. Placed in perspective, this amount is equivalent to the construction cost of the Mutsu interim storage facility (storage capacity: 5,000 tons of spent fuel).

The US NRC conducted a cost-benefit analysis (CBA) of the shift to dry cask storage for spent fuel storage in response to the concerns about the safety of spent fuel pools that were raised following the Fukushima accident[14]. The results of this analysis showed that there was little net benefit, in economic terms, in moving to dry cask storage under US conditions.

It is difficult, however, to fully and even-handedly evaluate both the advantages as well as costs of dry cask storage using with the CBA technique. This is in part because the monetary value of one of the main benefits of dry cask storage over pool storage—reduced risk of radiological release in the event of accidents involving spent fuel storage—is extremely hard to quantify. Furthermore, the conclusion reached in the NRC study cannot be directly applied to the situation in Japan because costs and other assumptions differ between the two cases.

4.3 Counterterrorism

The new regulation standards require nuclear plants to have portable safety equipment, including emergency electricity generation and water pumping equipment, to be stored in dispersed locations and configured with multiple independent connections to electricity and water sources as a counterterrorism measure against intentional aircraft attack, and to install specialized safety facilities as backup measures to enhance reliability. Figure 3 shows the outline of the new counterterrorism standards[15].

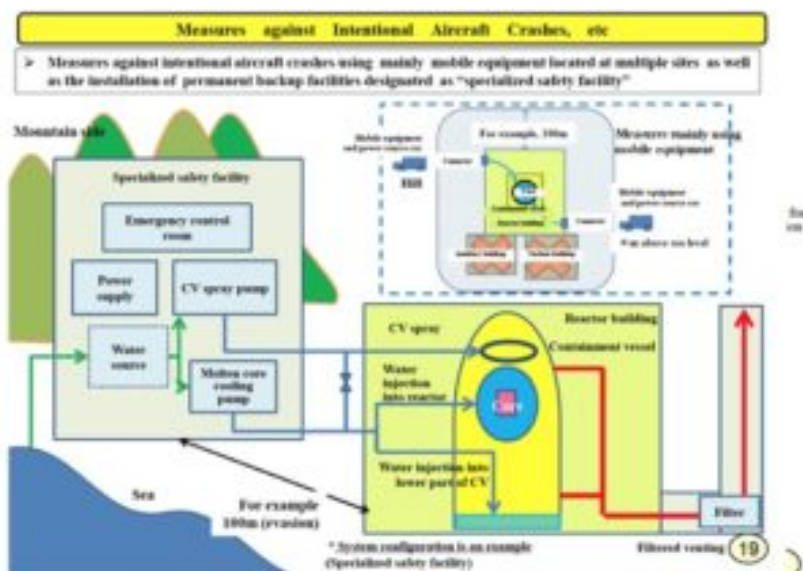


Figure 3: Measures against Intentional Aircraft Crashes, and Similar Threats

The specialized safety facility or facilities is/are to be installed more than 100 m away from the reactor and must be designed to have enough ability to enable necessary reactor and spent fuel pool

equipment to function for at least seven days after the onset of an accident[16].

Before the Fukushima accident, Japan's security measures for nuclear facilities, like its nuclear safety measures, were not sufficient, and lagged behind the security standards put in place in other nations. For example, the US NRC imposed requirements regarding counterterrorism measures (as described in its February 2002 Order, Section B.5.b) after the terrorist attacks of September 2001, and the Commission affirmed the importance of those measures after the Fukushima accident[17].

Although NISA studied these measures in 2006 and 2008, they were not applied to Japan's safety regulation[18].

In addition, the NRA received a review report on Japan's nuclear security measures from the International Atomic Energy Agency (IAEA) this February (2015)[19]. In the report, the IAEA states that the Japanese nuclear security system and nuclear material protection measures have improved notably. It is notable, however, that the International Physical Protection Advisory Service (IPPAS) provided by the IAEA, and by which the review report was prepared, was started in 1995, and Japan, with the third largest nuclear reactor fleet among nations, is the 42nd country that received this service from the IAEA. In addition, while background checks of nuclear power plant workers are already being routinely performed in other countries, discussions have just begun in Japan to establish a law mandating background checks for NPP workers.

The new nuclear regulation standards emphasize safety measures based on worker activities. It is important to discuss the vulnerability of such worker-reliant safety measures to terrorism.

Japan is a rare country in that while it experienced an act of domestic terrorism using a chemical material, the sarin gas attack in the Tokyo subway carried out by the Aum Shinrikyo cult in 1995, it has been relatively free of domestic terrorism incidents. As a result, there has been relatively little emphasis placed on determining whether and how nuclear facilities might be targets for terrorism. More discussions on terrorism and counterterrorism are needed in Japan.

5.0 Conclusion

Below is a summary of the present conditions and problems regarding the re-start of nuclear power plants and facilities in Japan.

- **Through the enforcement of the new nuclear safety regulation standards, the safety of nuclear plants and facilities should improve in comparison with the conditions before the Fukushima accident.** There are concerns, however, that the safety measures will be less effective than anticipated due to the potential vulnerability of Japanese nuclear facilities to scientifically unpredictable natural phenomenon (earthquakes, tsunamis, and volcanic eruptions, for example), and the hasty re-start of plants/facilities.
- **Security measures have been strengthened following the Fukushima accident.** More detailed discussions on security at nuclear facilities that include addressing issues specific to Japan, however, are needed.
- **Nuclear policies excluding safety regulations, such as social and political issues, have not improved in the aftermath the Fukushima accident.** These ongoing issues may serve to undermine the efficacy of new nuclear safety and security regulations.

III. ENDNOTES

- [1] <http://law.e-gov.go.jp/htmldata/S30/S30HO186.html>
- [2] <http://law.e-gov.go.jp/htmldata/S32/S32HO166.html>
- [3] <http://www.nsr.go.jp/data/000067212.pdf>
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- [10] Satoshi Otani, "Assembly members' family ties to contracts given at Sendai nuclear plant raise eyebrows," Asahi Shimbun, Asia and Japan Watch, January 13, 2015, at: <http://www.fukushima-i-still-news.com/2015/01/raising-eyebrows.html>
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