CONVENTION ON NUCLEAR SAFETY
NATIONAL REPORT OF JAPAN
FOR 7TH REVIEW MEETING

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NRA , Japan
Nuclear Regulation Authority

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Convention on Nuclear Safety National Report of Japan for the Seventh Review Meeting
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List of Abbreviations

ABWR	Advanced Boiling Water Reactor
APWR	Advanced Pressurized Water Reactor
ATR	Advanced Thermal Reactor
BWR	Boiling Water Reactor
CAO	Cabinet Office
ConvEx	Convention Exercise
CV	Containment Vessel
EAL	Emergency Action Levels
ECCS	Emergency Core Cooling System
EPREV	Emergency Preparedness Review
FBR	Fast Breeder Reactor
GCR	Gas Cooled Reactor
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiation Protection
INES	International Nuclear and Radiological Event Scale
IRRS	Integrated Regulatory Review Service
IRS	Incident Reporting System
JAEA	Japan Atomic Energy Agency
JANSI	Japan Nuclear Safety Institute
JAPC	Japan Atomic Power Company
JEAC	Japan Electric Association Code
JNES	Japan Nuclear Energy Safety Organization, an incorporated administrative agency
LOCA	Loss of Coolant Accident
METI	Ministry of Economy, Trade and Industry
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MOFA	Ministry of Foreign Affairs of Japan
NAC	National Assistance Capability
NCA	National Competent Authority
NIRS	National Institute of Radiological Science
NISA	Nuclear and Industrial Safety Agency (former nuclear regulator)
Notification on Doses	Notification to Establish Dose Limits in accordance with the Provisions of the NRA Ordinance Concerning the Installation, Operation of Commercial Power Reactors
NPP	Nuclear Power Plant
NPS	Nuclear Power Station
NRA	Nuclear Regulation Authority
NRA Ordinance on	NRA Ordinance concerning the Installation and Operation, of

Commercial Reactors	Commercial Power Reactors
NRA Ordinance on Standards for the Location, etc.	NRA Ordinance prescribing Standards for the Location, Structure, and Equipment of Commercial Power Reactors and their Auxiliary Facilities
NRA Ordinances on Quality Control Methods	NRA Ordinances on Technical Standards for Quality Control Methods Concerning the Design and Construction of Commercial Power Reactors for Licensees of Power Reactor Operation and Systems for their Inspection
NRA Ordinance on Technical Standards	NRA Ordinance prescribing Technical Standards for Commercial Power Reactors and their Auxiliary Facilities
NSC	Nuclear Safety Commission, former safety related governmental organization resolved on September 2013
Nuclear Emergency Act	Act on Special Measures Concerning Nuclear Emergency Preparedness
OECD/NEA	the Organization for Economic Co-operation and Development Nuclear Energy Agency
OIL	Operational Intervention Level
OSART	Operational Safety Review Team
PAZ	Precautionary Action Zone
PPA	Plume Protection Planning Areas
PRA	Probabilistic Risk Assessment
PWR	Pressurized Water Reactor
RANET	Response Assistance Network
Reactor Regulation Act	Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors
SPEEDI	System for Prediction of Environmental Emergency Dose Information
SSC	System, Structure and Component
TEPCO	Tokyo Electric Power Company
TRU Waste	Low Heat Production and a Long Half-life Waste
UPZ	Urgent Protective Action Planning Zone
USIE	Unified System for Information Exchange in Incidents and Emergencies

A Introduction

1 Overview of Nuclear Program in Japan

Based on the definition in Convention on Nuclear Safety, there were a total of 58 reactors (24 Pressurized Water Reactors, 33 Boiling Water Reactors and one Fast Breeder Reactor) in Japan. Six reactors in TEPCO's Fukushima Daiichi Nuclear Power Station (Units 1, 2, 3, 4, 5 and 6), one reactor of JAPC's Tsuruga Nuclear Power Station (Unit 1), two reactors of Kansai Electric Power Company Mihama Nuclear Power Station Units 1 and 2, one reactor of Chugoku Electric Power Company Shimane Nuclear Power Station Unit 1, one reactor of Kyushu Electric Power Company Genkai Nuclear Power Station Unit 1, one reactor of Shikoku Electric Power Company Ikata Nuclear Power Station Unit 1, twelve reactors in total were permanently shutdown to take decommissioning measures, and decommissioning of another four reactors(JAPC's Tokai Unit 1, Chubu Electric Power Company's Hamaoka Nuclear Power Station Units 1&2, JAEA's Fugen (ATR)) are currently underway.

In Japan, following the accident of TEPCO's Fukushima Nuclear Power Station, nuclear regulation regime was renewed, the Reactor Regulation Act and related legislation were revised and the NRA was established on September, 2012. The new regulatory requirements for nuclear power reactors came into force on July, 2013. Licensees are required to obtain authorization of NRA through the Conformity Review which assesses on whether the reactor meets the regulatory requirements to resume operation. The NRA has accepted applications of Conformity Review for 26 units of nuclear reactor in 16 sites by the end of March, 2016. Commercial operation of Kyushu Electric Power Company's Sendai nuclear power station Units 1&2 have been resumed after the Conformity Review has been completed.

In the amendment of the Reactor Regulation Act on June, 2012, the operational period of power reactor is limited up to 40 years, in principle. NRA has accepted applications for extension of the operational period for three units of two Nuclear Power Stations by the end of March, 2016. Among two units (Kansai Electric Power Company Takahama unit 1 and unit 2) are approved by the NRA in 20 June, 2016.

Figure A-1 shows the location and status of nuclear power reactors in Japan.

Fukushima Daiichi nuclear power Station Units 1, 2, 3, &4 were designated as the Specified Nuclear Facilities by the NRA, and based on the Implementation Plan, specialized safety measures are implemented. Five years have passed from the accident,

the process has shifted to the stage for which measures of waste management and decommissioning of reactor is being advanced deliberately. The work to transfer the fuel assemblies stored in spent fuel pool in the reactor building of Unit 4 to the Common Pool located in the site has been completed in December, 2014. Contaminated water is being treated by Multi-Nuclide Removal Facility (ALPS) which is supposed to remove the radioactive materials other than tritium, but the disposed water is still stored inside the site.

Because of the accident, residents around the nuclear power station have been forced to evacuate from their homes for long time, and decontamination works outside the site has been continued. The decontamination works in Tamura city, Kawauchi-village Naraha-town, Katsurao-village and Minamisoma city were completed and evacuation order was lifted as of 25 July, 2016.

In Japan, retail of electric power is fully liberalized in April 2016 in order to keep stable electric power supply and suppressing electricity charges. Electric power supplying system reform was conducted, and the monopolistic electric power supply regime by the conventional local electric power companies was abolished. New entry to the electric power industry is promoted by this, and electric power companies have been put under the competition environment. In the 4th Strategic Energy Plan of Japan[1] stated that the government should consider the appropriate business environment so that a nuclear operator can also take the best measure for safety, contribute to a counter measures for global warming and stable power supply even in the competition environment, maintain technology and work force in high level and proceed decommissioning of reactor smoothly.

In the discussion at the Nuclear Energy Subcommittee, which is the advisory organization of Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry of Japan, the risk that operators will not be able to recover/secure funds they have invested in a liberalized market were pointed out, since nuclear energy business are characterized by a recovering huge initial investment through long term project period.

With this, the possibility of disturbing to invest for measures for higher safety than regulatory requirements due to the fear of failing to recover investment, the possibility that the financial status of operator is aggravated remarkably by the financial loss due to the back-fit requirement, and the anxiety of relation between cost and safety for the

[1] Strategic Energy Plan, April 2014
(http://www.enecho.meti.go.jp/en/category/others/basic_plan/pdf/4th_strategic_energy_plan.pdf)

sustainability of nuclear business were pointed out. It can be said that Japan entered the new steps in nuclear energy use. Agency for Natural Resources and Energy is considering settlement of environment of nuclear business such as how accounting system of decommissioning should be in the competition environment.

2 Implementation of the Convention on Nuclear Safety in Japan

Japan has been fulfilling its obligations described in from article 6 to article 19 of the Convention on Nuclear Safety (CNS), including improvements in nuclear regulation by the revision of the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (The Reactor Regulation Act), and the establishment of the NRA in order to ensure the independence of the regulatory body. Situations regarding the fulfillments of these obligations of CNS are reported respectively in Chapter C.
As for the obligation in the CNS article 4, Japan accepts that the CNS has the same legal binding power as domestic laws, through the approval by the National Diet and promulgation of Japan. In addition, with domestic legal frameworks such as Reactor Regulation Act, necessary measures are taken, which are described in Chapter C. The obligation of CNS article 5 is fulfilled by this report documentation.
As for the article 24, Japan has participated in meetings of the Contracting Parties of CNS, and fulfills its obligation as a government. However, there is room for improvement in terms of full participation of CNS review process. Especially, considering that the full participation to the review process was a concern among the Contracting Parties in the 6th Review Meeting, it is a big challenge for Japan to improve the quality of participation.

3 Development of the National Report

The National Report of Japan for 7th Review Meeting is based on the guideline[2], and consists of “Introduction”, “Summary”, “Reporting article by article” and “Annexes”.
In principle, this report is based on the information as of March, 2016.
For well-understandable review by the Contracting Parties, measures for identified challenges and suggestions in the last review meeting are concentrated and reported in Chapter B” The summary of measurements during the seventh review process period”.
Summary of various regulatory issues and measures in Japan is also included in this Chapter.

[2] INFCIRC/572/Rev.5

In the National Report for 7th Review Meeting, in order to improve review process of CNS, identification of good practice is given priority in the review plan in Japan. In the Guidelines regarding the Review Process under the Convention on Nuclear Safety[3], "Good practice" is defined as "A Good Practice is a new or revised practice, policy or program that makes a significant contribution to nuclear safety. A Good Practice is one that has been tried and proven by at least one Contracting Party but has not been widely implemented by other Contracting Parties; and is applicable to other Contracting Parties with similar programs". In the National Report for 7th Review Meeting, we interpret this definition as "A Good Practice is a practice that makes a significant contribution to enhance nuclear safety and has worth to be shared by all over the world".

When seeking solution against difficulties for safety improvement, it's constructive to make an effort to identify such practice in a review process, increases the attractiveness of the review process and results in the improvement of the quality of participation to review process. For reviewing this report, the review process is expected to focus on the identification of not only challenges or suggestions as ever, but also good practices.

Reports for each article of CNS are mainly intended to explain the compliance status of obligations of CNS. These provide comprehensive information about a regulatory system in Japan as well as complement the contents indicated in Chapter B.

[3] INFCIRC/571/Rev.7

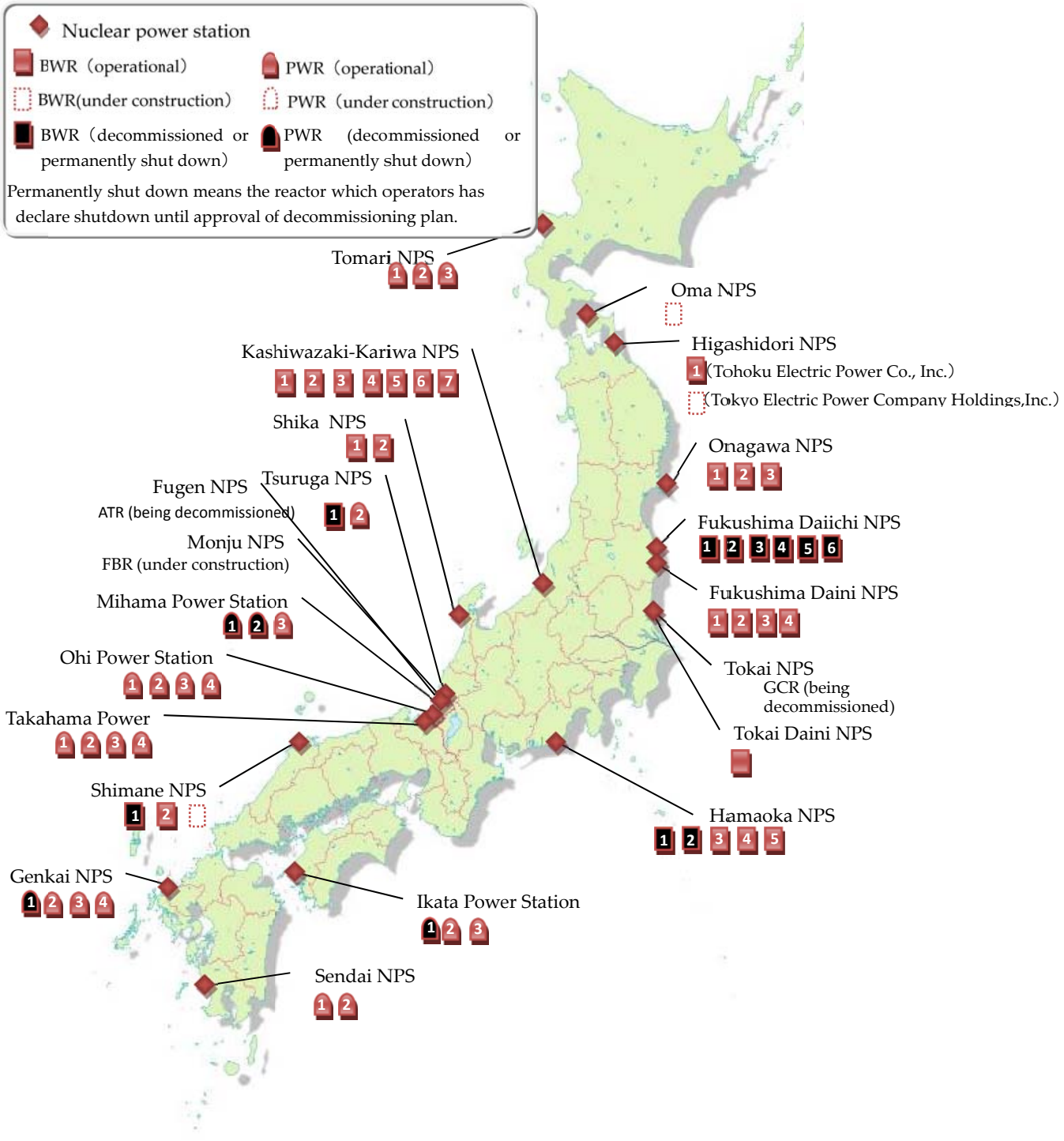

Figure A-1 Location and Status of Reactor Facilities

B Summary of Major Activities during the 7th Reporting Period

1 Activities related Nuclear Regulation

1-1 Review on Compliance to New Regulatory Requirements

The new regulatory requirements related to power reactors have been entered into force in July 2013 by NRA. Licensees must submit applications on compliance to the new regulatory requirements to the NRA to obtain authorization for their operation of reactors.

To install and operate a new reactor in Japan, it is necessary to obtain Installation Permit and make a specific design; obtain approval on a construction plan and carry out construction work; and finally obtain approval on Operational Safety Programs prior to start of operation. In addition, for reactors on which authorization have been already obtained, based on the back-fitting system introduced with the amendment of the Reactor Regulation Act in 2012, a review regarding conformity to the new regulatory requirements (Conformity Review) is to be conducted; approval of amendment of a Reactor Installation Permit already issued is to be obtained; and approval on a Construction Plan and Operational Safety Programs based on the approval of amendment is also to be obtained.

In the Conformity Review, a review for Amendments on a Reactor Installation Permit, a review on a Construction Plan, and a review on Operational Safety Programs are conducted in parallel so as to review efficiently on both hardware and software in a unified manner.

The NRA implements a Conformity Review by holding an Examination Meeting where Commissioners participate. The Examination Meeting is made open to the public by allowing their attendance and Internet broadcasting, along with material for the examination basically disclosed, thus maintain transparency of the review. In a process of the review, there are chances to hear the opinions of manufacturers and external experts depending on judgment by Commissioners.

In addition to the Examination Meeting, hearings from a licensee as appropriate are occasionally held for purposes such as confirmation of facts related to matters included in an application. A summary of hearing proceeding is made open along with related material basically disclosed. A licensee who has opinions to a summary of hearing proceeding made open by the Secretariat of the NRA may present its opinions in a specified period of time.

The Examination Meeting started review on July 16, 2013, and since then it has been conducting review on applications submitted to the NRA in order of precedence, holding more than 300 meetings as of the end of March 2016.
As of the end of June 2016, permission was given to total seven nuclear power plants: Sendai Nuclear Power Station Units 1 and 2 of Kyushu Electric Power Co., Inc., Takahama Nuclear Power Station Units 1, 2, 3, and 4 of Kansai Electric Power Co., Inc., and Ikata Nuclear Power Station Unit 3 of Shikoku Electric Power Co., Inc.
As an example of Conformity Review, a summary of the review on the Sendai Nuclear Power Station Kyushu Electric Power Co., Inc. is presented in the Annex 3.

1-2 Review on Extension of Operation Period of Commercial Power Reactors

According to provisions of the Reactor Regulation Act, the period of allowable operation of power reactors is 40 years from the date they passed Pre-service Inspections. During this period, it is possible to extend it once, for a period of no more than 20 years, if approval is obtained from the NRA. The NRA received application for operation period extension approval from Kansai Electric Power Company for Takahama Nuclear Power Station Units 1 and 2 on April 30, 2015 and Mihama Power Station Unit 3 on November 26, 2015.

Each of Takahama Nuclear Power Station Units 1 and 2 is a pressurized water reactor with electric output of 826 MW; commercial operation started in 1974 for Unit 1 and in 1975 for Unit 2. The licensee applied for 20 year extension of the operation period of each Unit, specifically, till 2034 for Unit 1 and till 2035 for Unit 2.
Along with filing this application, the licensee conducted a Special Inspection and technical evaluation of deterioration conditions and formulated a Maintenance Management Program.
In the Special Inspection, they focused on reactor vessels, containment vessels, and concrete structures as follows:

- Reactor vessels

  For 100% of base material and weld parts in core regions, a check on defects is made by adopting ultrasonic inspection with focus on neutron irradiation embrittlement. For the corner parts of the primary coolant nozzle, a check on defects is made by penetration testing or eddy current flaw detection with focus on fatigue. For all the number of in-core instrument piping, a check was made on defects at weld parts by visual inspection with focus on stress corrosion cracking, and also check was made on defects at the welding heat-affected zone inside the

in-core instrument piping by applying eddy current flaw detection. This work was carried out using a CCD camera and an ECT probe suspended from a crane of the refueling platform.

- Containment vessels

  Over all the areas of steel plates of containment vessels that can be approached for inspection, a check was made on coating conditions with focus on corrosion by visual inspection.

- Concrete structures

  Targeting reactor containment facilities, reactor auxiliary buildings, etc., checks were made on strength, shielding ability, neutralization, salt penetration, and alkali-aggregate reaction using core samples with focus on deterioration of strength and decrease in shielding ability.

Deterioration condition evaluation is performed through following steps; identifying and categorizing target equipment from equipment having safety functions, equipment against sever accidents; selecting typical one from the equipment; and extracting aging degradation phenomenon to be paid attention to from a viewpoint of taking measures to deal with the aging of facilities. Following review standards on operation period extension, the licensees identify degradation phenomenon, such as low-cycle fatigue cracks; neutron irradiation embrittlement of reactor vessels; irradiation-assisted stress corrosion cracking; thermal aging of duplex stainless steel; insulation deterioration of electric and instrumentation devices; deterioration of strength and decrease in shielding ability of concrete.

To these identified aging degradation phenomenon, licensees conduct degradation assessment or integrity evaluation regarding 60 years operation and then, the assessment is deployed to the equipment which classified in same category. On this occasion, evaluation of the aging degradation trend and evaluation of maintenance records, which are additional evaluation items at the 40th year of taking measures for aging management, and evaluation of effectiveness of long-term Maintenance Management Program at its 30th year are reflected.

In addition, seismic safety evaluation and tsunami safety evaluation are added to formulate a Maintenance Management Program.

Maintenance Management Program is consisted with measures, methods, and timing of maintenance works to be newly added along with extension of an operation period. The Takahama nuclear power station has decided to implement middle and long-term monitoring tests against neutron irradiation embrittlement at the core area of reactor

vessels, taking into account operation hours and irradiance levels; reevaluation and replacement of products equivalent to actual potting material and outer leads of the triple axial type of electric penetration for their insulation degradation within five years; and for against corrosion of piping, supports are reinforced while its seismic resisting performance is kept, but till completion of the reinforcement, seismic safety evaluation of piping are conducted by grasping a tendency of pipe-wall thinning.
As of June 20, 2016, the NRA approved operation period extension of Takahama Nuclear Power Station Units 1 and 2.

2 Integrated Regulatory Review Service (IRRS)

IAEA provides the Integrated Regulatory Review Service (IRRS), as one of the IAEA's international peer review services, upon request of Member States. IRRS covers broad issues related to nuclear regulation e.g., legal framework, organization, etc., and it provides comprehensive review. The Japanese Government declared to invite an IAEA's IRRS review mission in December 2013, started self-assessment in May 2014, completed a self-assessment report in October 2014, and invited a review mission between January 11 and 22, 2016. The report of this review was provided by IAEA for the Japanese Government on April 22, 2016. The IRRS report and related material used in the IRRS review mission are made public in Web sites of the NRA[4].

The report introduces the following two items as good practices.

- The legal framework for setting up the regulatory agency where independence and transparency are embodied and whose authority is strengthened was built and positioned in governmental organizations.
- In the fields of natural hazard response, severe accident measures, response to emergency as well as intensification of safety of existing facilities, the NRA reflected swiftly and effectively lessons learned from the Fukushima Daiichi NPS accident to the new regulatory framework.

The report also stresses a need for the Japanese Government and the NRA to continue efforts to implement a new regulatory framework where nuclear power and radiation safety are intensified, and it presents 13 recommendations and 13 suggestions to the Japanese Government and/or the NRA where it is indicated that it is necessary or desirable for the Japanese framework to be improved so as to continually harmonize with IAEA's safety standards.

[4] http://www.nsr.go.jp/english/cooperation/organizations/IAEA_20160423_01.html

Among recommendations and suggestions stated in the report, major ones and responses to them the NRA is planning are as follows:

2-1 Response to findings on the inspection system

- In the present inspection program, items and frequencies of inspections are specified by law in detail, and a check list method to confirm prescriptive inspection items is adopted. NRA should ensure further effectiveness of inspection program by amending law and NRA Ordinances
  - NRA plans to amend Reactor Regulation Act in order to introduce mechanism which allows effective inspection. Under the clear allocation of primal responsibility of safety to licensee, NRA plans that Inspection Division is able to make decision to select inspection items depend on licensee's efforts to ensure safety.
- Inspectors are to be given authority to swiftly decide corrective measures when they find safety-related problems. Furthermore, it is recommended that additional resources need to be deployed to address increased inspection work load in addition to current enormous examination workload.
  - NRA plans to provide clear definition of implementation plan/procedures, and strengthen organization on corrective actions as well as deploying capable and expertized inspectors, thus Inspection Division can take corrective actions depend on inspection results with prompt and responsible manner.
- Law should define the authority of inspectors to have free access to any places in a power plant at any time.
  - NRA plans to amend the Reactor Regulation Act to ensure inspector's free-access to anywhere in the nuclear power plant.
- To change the inspection system so as to stop using a current check list method, it is necessary to further enhance capability and ability of inspectors however, time for initial training of inspectors is limited.
  - NRA plans to strengthen training system in order to enhance capability of inspectors by applying year base training period.

2-2 Response to findings on radiation source regulation

- Arrangement to address radiological emergency by radiation sources should be prepared. Supervision of radiation protection measures taken by licensees should be prioritized, and further resources should be allocated into this area.

- NRA plans to amend Radiation Hazard Prevention Act to take following measures; arranging emergency response measures by high risk radiation sources; reconstruction of radiation source regulation including security measures; strengthen regulation such as examination and on-the-spot inspection.

2-3 Response to findings on human resources

- Following efforts should be made to maintain capable and experienced staff; enrich trainings; enhance attractiveness of office to be advantage of employ new staff; develop strategy to retain existing experts.
  - NRA plans to enrich staff training programs including achieving inspection staff can take long-term training. In parallel with strengthen NRA's organizational system, NRA makes effort to prepare appropriate treat to maintain capable and experienced staff by continuous employment. In addition, legal experts will be maintained to strengthen legal business including administrative decision made by NRA.

In May 2016, a study team was established including external experts to study details of the inspection program and radiation source regulation, with an estimate to compile results of the study around autumn of the year. According to a schedule, necessary proposed laws expected to be submitted to the National Diet around February 2017 and part of it seek to be enforced around April of the year.
In addition to taking these measures, it is planned to invite a follow-up mission around 2019. A list of recommendations, etc. of IRRS is shown in the Annex 4.

3 Vienna Declaration[5]

The Vienna Declaration was adopted in a diplomatic conference for discussion of the revision of the Convention on Nuclear Safety (CNS) on February 9, 2015. Elements of the Vienna Declaration are as follows:

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

[5] INFCIRC/872

radioactive releases large enough to require long-term protective measures and actions.

- Comprehensive and systematic safety assessments are to be carried out periodically and regularly for existing installations throughout their lifetime in order to identify safety improvements that are oriented to meet the above objective. Reasonably practicable or achievable safety improvements are to be implemented in a timely manner.
- National requirements and regulations for addressing this objective throughout the lifetime of nuclear power plants are to take into account the relevant IAEA Safety Standards and, as appropriate, other good practices as identified *inter alia* in the Review Meetings of the CNS.

In Japan, conventionally it has been required to take prevention measures on disaster caused by nuclear power reactors as a regulatory requirement, and as a result of the amendment of the Reactor Regulation Act in 2012, measures against severe accidents, etc. were stipulated as regulatory requirements, resulting in tightening of regulations. Furthermore, this revision made it newly compulsory to conduct evaluation for safety improvement, report its results, and make them open to the public. Accordingly periodical implementation of comprehensive and systematic safety evaluation and timely implementation of necessary improvement measures have come to be ensured along with application of Periodic Facility Inspections, Periodic Safety Management Reviews, and Operational Safety Inspections. Evaluation to enhance safety is reported in Article 14, and Periodic Facility Inspections, Periodic Safety Management Reviews, and Operational Safety Inspections are reported in Article 19.

In the 2012 amendment of Reactor Regulation Act, back-fit requirement was introduced. In case of regulatory requirements are revised, licensees have obligation to meet their existing power reactors to new regulatory requirements. The NRA Ordinances where back-fitting is applied are the NRA Ordinance on Reactor Installation Permit and the NRA Ordinance on Technical Standards, which are reported in Articles 17, 18, and 19.

The back-fit system corresponds to measures taken to prevent operation of power reactors where safety is not ensured, reported in Article 6.

In the formulation process of regulatory requirements laid down by the NRA, the IAEA Safety Standards and other international standards have been taken into account.

As stated above, Japan has already taken measures corresponding to elements of the Vienna Declaration.

4 Activities by Licensees

4-1 Compliance to the new regulatory requirement

In response to entering into force of the regulatory requirements in July 2013, the licensees have taken measures based on lessons learned from the Fukushima Daiichi NPS accident in order to conform to the requirements. For example, they have taken necessary measures to improve fragility of protection against tsunamis, including installation of coast levees, installing watertight doors to important areas, enhancement of resistance to pressure and the waterproof property of outside walls of buildings. As measures for the case of water injection means at the time of station black out, they have arranged alternative power sources, such as air-cooled gas turbine generator vehicles, to high ground, increased the number of batteries, and constructed water reservoirs. In addition, as measures to mitigate influences of core damage, they have taken measures such as installation of top-vent facilities on reactor buildings, top-head flange cooling lines to fill water into the top part of containment vessel, filter vent facilities, etc. As for measures on the software side, emergency-response organizations have been reorganized so that they can respond to accidents when severe accidents or the likes should occur simultaneously in two or more units, so that a necessary number of the personnel for immediate response are ensured to enable initial response on emergency.

The new regulatory requirements require that preparation of necessary functions (of facilities or procedures) should be completed at the enforcement stage in July 2013 based on the lessons learned from the accident. This condition is a further demand that preparation of backup facilities (a Specialized Safety Facility and a permanent DC power supply facility as the third power system) to further enhance reliability should be completed within five years from the date of approval of a construction plan related to measures to deal with severe accidents, etc. that are needed at the enforcement stage of the new regulatory requirements. The Specialized Safety Facility is a facility for measures against acts of terrorism such as intentional large-airplane crashes to the reactor building. It is required to have a facility necessary to prevent containment vessel failure at a location about 100 meters or more from a reactor building.

4-2 Safety Improvement Activities

The NRA holds a dialog where to exchange views concerning safety improvement with responsible managers of major licensees that have nuclear facilities. The objectives of this dialog are promoting efforts to foster safety culture and hearing basic policy for

safety improvement activities in licensees, and perspectives on current regulatory system. This dialog is open to public. In this dialog, licensees report their voluntary efforts to enhance safety. NRA and licensees discuss about licensees' voluntary efforts to enhance safety, licensees' idea for improving regulatory system, and licensees' policy on mechanism of voluntary safety improvements based on the recommendations provided by JANSI.

5 Effort to Address the Challenges Identified in Country Group Discussions of the 6th Review Meeting

In Country Group discussions of the 6th Review Meeting, the following items are identified as the "challenges" for Japan:

- NRA is to be recognized as reliable source of safety information in the frame of discussions on the future role of nuclear power in Japan
- Stabilization and resolving the situation at the severely affected site in Fukushima Daiichi is a long-term challenge that can last for decades.
- Treatment of a large amount of contaminated water
- Implement the legally required back-fittings and improvements to reactor facilities for restarting NPP
- Fostering Licensees' safety culture through dialogues. Emphasis on the leadership of the top- management of Utilities will be essential
- Enhancing management system and human resource development of NRA, utilizing the merger with JNES
- Improvement of NRA's inspection functions, including corresponding inspections for restarting the NPPs

In addition, the following items were identified as "suggestions":

- To invite Operational Safety Review Team(OSART)and Emergency Preparedness Review(EPREV) missions
- Continue to develop independent regulatory information on the situation at the Fukushima
- NRA should consider the need to enhance co-operation with regulators of countries introducing the similar technologies

The following part explains how these items are being tackled.

5-1 The NRA's states, as taken up in discussions on future roles of nuclear power generation in Japan, to be positioned as a reliable supplier of information related to safety

The NRA formulated medium-term targets in February 2015, presenting its action policy for five years between April 2015 and March 2020. In the medium-term targets, it is upheld as the organization objective to "protect people and environment through trusted regulation on nuclear power," and as one of objectives of measures and policies, it is stipulated to "ensure confidence in nuclear regulation administration." The basic idea in this objective of measures and policies is ensuring independence, neutrality, and transparency of nuclear regulation administration; continual improvement of the organization and activities; partnership and cooperation with other countries and international agencies, etc.

As for ensure independence, neutrality, and transparency of nuclear regulation administration, various efforts are made, including independent decision making from a scientific and technological viewpoint; rigorous operation of code of conducts, etc. set up to ensure neutrality; achievement of accountability through full disclosure of information related to regulation, including decision-making processes; and hearing of various opinions inside and outside Japan through exchange of opinions related to safety improvement with organizations subject to regulation, actively inviting public comments on issues not required in the Administrative Procedures Act, and through exchange of views with international advisors.

As for continual improvement of the organization and operations, organizational structure and operation related to nuclear regulation are to be continually improved by fixing the Management System whose operation was fully started in 2015 into the whole organization through continual improvement of the system aimed at fostering of safety culture and enhancement of regulation, acceptance of an international peer review (the IRRS) managed by the IAEA, etc. Furthermore, in order to achieve the medium-term targets, resource allocation is always checked so as to make the organizational system effective and efficient.

As for partnership with the international community, contribution is made to international nuclear safety through consistent, continuous, reliable, and active international activities and reflection in nuclear regulation of Japan as well as cultivation of human resources acceptable in light of international standards by promoting partnership with the IAEA, OECD/NEA, etc. and also through activities by the regulatory body based on agreements in bilateral cooperation, cooperation with

regulatory bodies of emerging nations that are introducing nuclear energy, etc.

5-2 Stability and solution of serious site conditions of the Fukushima Daiichi NPS

Since the accident in TEPCO's Fukushima Daiichi NPS, about five years have passed, and it is recognized that the status of the Fukushima Daiichi NPS has currently changed from an "Emergency Response Stage" where various troubles were responded to in an emergency manner to a "Planned Action Stage" where each plan is fully determined, covering management of wastes and entire measures toward reactor decommissioning so as to steadily implementation of the measures.

The NRA made a mid-term risk reduction target map in order to clarify items to be solved with priority for the safety, and make them clear by past items and future items. The NRA revises this map periodically and evaluates the achievement of the targets.

Subsequently, TEPCO has planned and implemented each step of fuel removal from the spent fuel storage pools inside the reactor buildings, removal of fuel debris, dismantlement of reactor facilities, etc., following the medium and long-term road maps, revised in June 2015, toward implementation of decommissioning measures, etc. of the Fukushima Daiichi NPS. Removal of fuel assemblies from the spent fuel storage pool inside the reactor building of Unit 4 was completed in December 2014, and now it is planned to carry out removal of fuel assemblies from the spent fuel storage pools inside the reactor building of Unit 3, 1, and 2 in a sequence.

As stated in the National Report of Japan for 6th Review Meeting, the Fukushima Daiichi NPS had a large amount of groundwater flowing into the reactor buildings, etc., resulting in an increase of water contaminated by radioactive material, so that additional contaminated water storage facilities have been installed and other necessary measures have been taken to prevent inflow of groundwater into the buildings and securely operate contaminated water disposal facilities. TEPCO got engaged in treatment of contaminated water using the Advanced Liquid Processing System (ALPS) as a means for the decontamination, and it completed processing of RO[6] concentrated water stored in tanks in May 2015.

The removal of contaminated water left in the seaside trench was completed in July, 2015. Decontaminated water by the ALPS is stored in the storage tanks in the site because

[6] Reverse osmosis

tritium is still remained in the water. The NRA has announced decontaminated water should be released to the ocean in the condition which complied with regulatory requirements, under the consideration that continuous storage of treated water inside the site is not favorable for proceeding safe and smooth decommissioning of Fukushima Daiichi NPS.

In addition, it has implemented construction of impermeable walls on the land side using the Frozen Ground Method to prevent groundwater from flowing into the buildings; the groundwater bypass to pump up groundwater before it reaches the building and release it to the sea; and impermeable walls on the sea side to prevent contaminated water from flowing into the port; in addition, TEPCO has also put into operation underground drain (sub-drain) that pumps up contaminated groundwater being accumulated inside the impermeable walls for cleaning treatment. These measures against contaminated water have achieved certain effects, contributing to stability of conditions of the Fukushima Daiichi NPS.

The NRA established "The Commission on Supervision and Evaluation of the Specified Nuclear Facilities" to supervise and evaluate a medium and long-term safety ensures in TEPCO's Daiichi Fukushima site. In addition to that, the NRA established "Study Team for Specified Nuclear Facilities Radioactive Waste Regulation" on December 2015, to study items related stable management of radioactive waste disposal in 1F site , including study in the early design phase of implementation plan, considering long term decommissioning in the future from the viewpoint of safety regulation.

5-3 Implementation of back-fitting measures and safety improvement based on laws to resume operation of nuclear power stations

As reported in the National Report of Japan for 6th Review Meeting, existing nuclear power stations are now obliged to conform to the new regulatory requirements due to the amendment of the Reactor Regulation Act in 2012. The regulatory requirements the NRA formulated were reported in the National Report of Japan for 6th Review Meeting. Conventional regulatory requirements (design basis) and measures against natural disasters have been reinforced, and at the same time, new requirements for measures against severe accidents have been introduced, which has resulted in significant improvement of safety.

Immediately after the enforcement of the new regulatory requirements in July 2013, licensees submit to the NRA applications concerning conformance to the new regulatory

requirements; actually, applications for 26 reactors were submitted as of the end of March 2016.

There are three elements for the Conformity Review: "Application for amendment of Reactor Installation Permit," "Application for Construction Plan Approval," and "Application for amendment of Operational Safety Program Approval." Licensees must complete these authorization procedures before resuming operation of reactors. Moreover, unless it is confirmed that power reactor facilities at issue conform to the approved construction plan in a Pre-service Inspection to be conducted after the Conformity Review. Licensee cannot use power reactor facility without pass the Pre-service Inspection.

The NRA is in charge of review of these applications, and as of the end of March 2016, Conformity Reviews and Pre-service Inspections were completed with Sendai Nuclear Power Station Units 1 and 2 of Kyushu Electric Power Co., Inc. and Takahama Nuclear Power Station Unit 3, of Kansai Electric Power Co., Inc. which accordingly resumed commercial operation. (However, Takahama Nuclear Power Station Unit 3 has been in shutdown because a petition by residents of Shiga Prefecture for a provisional disposition order to stop operation of the Takahama Unit 3 that was approved by Otsu District Court on March 9.)

Aiming at safety improvement after restart of NPPs, the amended Reactor Regulation Act provides a new safety improvement assessment system. In this system, the licensees are requested to make an assessment by themselves in a period within six months of the date when a Periodic Facility Inspection on safety of the power reactor facilities at issue is completed, and after the assessment, they are requested to submit report of the assessment results to the NRA without delay and make them open to the public.

5-4 Enhancement of safety culture in licensee through dialogues and fostering of leadership especially needed for management layers of facilities

The NRA holds a dialog where to exchange views concerning safety improvement with responsible managers of major licensees that have nuclear facilities. The objectives of this dialog are promoting efforts to foster safety culture and hearing basic policy for safety improvement activities in licensees, and perspectives on current regulatory system. This forum is open to public. In this forum, licensees report their voluntary efforts to enhance safety. NRA and licensees discuss about licensees' voluntary efforts to enhance safety, licensees' idea for improving regulatory system, and licensees' policy

on mechanism of voluntary safety improvements based on the recommendations provided by JANSI.

The forum started in October 2014, and NRA completed the opinion exchange with 12 licensees by September 2015. In light of the results, the NRA reached to the conclusion that the forum was a meaningful occasion for NRA to hear various views and also for licensees to enhance recognition of licensees' primal responsibility for safety, through discussion on summarizing the forum and policy for continue the opinion exchange. NRA also pointed out a challenge that deeper discussion wasn't performed in some cases due to limit of discussion points. As a response to this challenge, NRA decided that trying to discuss about any regulatory issues including issues proposed by licensees without limitation to achieve fruitful discussion with active participation of managers of licensees. Following this policy, the opinion exchange get into the second round from February 2016.

5-5 Enhancement of human resource development and the Management System of the NRA in light of integration with JNES

Due to the merger of JNES in March 2014, NRA developed the Management System which systematically integrated various internal rules applied to daily business in NRA and JNES. NRA developed NRA Management Rule in September 2014. NRA's Management System has been entering into force on April 1, 2015, after trial run from October 1, 2014.

The Management Rule of the NRA stipulates that a PDCA cycle consisting of periodic formulation of an Annual Strategic Plan, implementation of activities, management review, and improvement should be put into practice as the Management System. It also specifies organizations, leadership, and documentation and recording needed as a basis of implementation of the Management System as well as management of resources needed for effectiveness of Management System. In addition, there are provisions related to processes to handle items to be improved, preventive measures, internal audits, etc. in order to allow the whole organization to tackle improvement work aiming at effective and efficient implementation of activities.

5-6 Enhancement of functions of the NRA, including handling of inspections for resumption of nuclear power stations

For power reactors that passed the Conformity Review to be put into operation, it must also pass a Pre-service Inspection NRA conducts. Due to the 2012 amendment of the Reactor Regulation Act, an inspection on quality assurance activities is added to the Pre-service Inspection, so that it has become necessary to make an inspection more

rational. For this reason, in a Pre-service Inspection related to a method of quality control, etc., NRA confirms common matters regarding construction and inspection of target facilities, such as implementing organization for quality control, and plan, implementation, evaluation, improvement, are implemented along with Construction Plan, applying audit methodology. Regarding implementation status of quality control of licensee is a checking item of Operational Safety Inspection and Periodic Safety Management Review, also. To avoid overlap of inspection, in the Pre-service Inspection, NRA checks licensee's quality control focus on the construction and inspection in the extent of Pre-service Inspection.

In Pre-service Inspections of major facilities having safety functions, a focus is on facility structure, functions, performance, etc. The Inspections are put in practice with attendance of inspectors or by a method of checking related records. NRA makes comprehensive review on how much the attendance of the inspectors is needed to achieve effective inspection.

As for Pre-service Inspections on facilities other than major facilities having safety functions, a check is made on items stated in a basic design policy of a Construction Plan and adequacy of conformity confirmation made by licensee with reference to records made by them for each facility as well as on consistency between records made by the licensee and conditions of real facilities in a form of a sampling test.

The Conformity Review includes approval of Operational Safety Programs, so that the NRA checks each licensee's status of conformance to approved Operational Safety Programs in Operational Safety Inspections which take place four times per year. The NRA has made a study to enhance effectiveness of Operational Safety Inspections, based on which following improvements have been fully put in operation since 2015.

- In order to leverage an unannounced inspection and an inspection with interviews to operating staff, a study for implementation of them was made with reference to opinions of Nuclear Safety Inspectors, and implementation manuals for both the inspection were developed.
- To implement an unannounced inspection and an inspection with interviews to operating staff, Operational Safety Inspectors came to be required to enhance their skills of communications with licensees, so that the "Basic Training for Communications" was newly set up in cooperation with the Nuclear Human Resource Development Center. In addition, the "Inspector Communication Training" that has been practiced was reviewed to enrich contents of the Training.
- Based on the implementation manuals for the unannounced inspection and the

inspection with interviews to operating staff, both the types of inspections were put into practice in the third and fourth Operational Safety Inspections in FY2014 in some Commercial Power Reactors. Accordingly, findings in the Inspections were reflected in the implementation manuals for improvement.

- As an index for safety, a new index was selected which reflected an actual status of operational safety activities in licensee with reference to the IAEA TECDOC-1141: Operational safety performance indicators for nuclear power plants, a technical report made up by the IAEA, in addition to the number of non-planned scrams that is an index frequently used.
- A method to select items of Operational Safety Inspection by identifying information to know licensee's operational safety activities from the findings of Operational Safety Inspector's daily plant walk-down was introduced.
- In preparation for a case that a need arises for implementing inspections specialized in a certain field of expertise such as activities to foster safety culture, a support system for Operational Safety Inspectors was studied and a system for conducting expertized inspections was developed.

The following are matters identified as "suggestions" in the 6th Review Meeting for Japan.

5-7 Hosting IAEA OSART and EPREV review missions

TEPCO has been taking various measures aiming at further improvement of safety and reliability of the Kashiwazaki-Kariwa Nuclear Power Station in light of lessons learned from the Fukushima Daiichi NPS accident. As part of this effort, TEPCO invited the IAEA Operational Safety Review Team (OSART) to review operational safety measures in Units 6 and 7 of the Power Station from June 29 to July 13, 2015. Fields of assessment are (1) management, organization and administration, (2) training and qualification, (3) operations, (4) maintenance and technical support (related to mechanics, electrical instrumentation, and civil engineering), (5) operational experience feedback, (6) radiation protection, (7) emergency planning and preparedness, and (8) severe accident management. Consequently, six recommendations, nine suggestions and nine good practices were brought up or identified.

In response, immediately after the review, TEPCO swiftly launched a study on measures necessary to cope with these indications, and it further intends to put in practice all the indications raised in the review. In addition, to review progress of implementation of the measures, TEPCO indicates a willingness to accept a follow up visit in about eighteen months after this mission. Results of the OSART review and the

measures TEPCO has taken are presented in the Annex 5.
Incidentally, EPREV was not hosted during the period covered by this report.

5-8 Continue to develop independent regulatory information on the situation at the Fukushima

The NRA has continuously provided information on situations of the Fukushima Daiichi NPS for international organizations and major nuclear power countries.
Fukushima Daiichi NPS is still in a status in recovering from accident, but as more than five years have passed since the accident, site conditions have come to be stabilized. To this change, the NRA has taken reasonable response such as decrease in frequency of its provision of information to foreign countries. Currently, the NRA provides information on results of environmental radiation monitoring, including the sea as a monitoring target, at a frequency of once a month.

5-9 Consideration of the need to enhance co-operation with regulators of countries introducing the similar technologies

In order to ensure nuclear safety, it is quite important for countries importing the nuclear technology to develop a robust regulatory infrastructure. The basic policy of cooperate with these emerging countries is to "help them develop a robust regulatory infrastructure by themselves," and Japan puts the highest priority on cooperation for development of human resources to be in charge of executing regulation. Japan also positions information exchange and sharing of experiences as important factors for the cooperation, and thus regulatory information exchange meetings have become a pillar of bilateral cooperation in which Japan is involved.
Japan does not conduct cooperation in the form of transfer Japanese regulatory infrastructure to emerging countries like take over those countries' responsibility because such form of cooperation provides less contribution to develop their own regulatory infrastructure.
As stated above, the NRA is acting based on a study on what form of cooperation with each country is suitable, and future regulatory cooperation with the countries importing technologies from Japan is to be pursued in line with this policy.

6 Efforts to Address Challenges Stated in the Summary Report of the 6th Review Meeting

Japan has addressed the challenges indicated in Paragraph 35 of the Summary Report of the 6th Review Meeting as mentioned below.

6-1 Minimize gaps between Contracting Parties' safety improvements

The measures taken based on lessons learned from the Fukushima Daiichi NPS accident are accompanied by a significant change: installation of the NRA whose authority in independent decision making is guaranteed by law; review on regulation where measures against severe accidents and the back-fit system are adopted; rigorous review on conformity to the newly developed regulatory requirements, etc. Since it is considered that there are differences among safety measures taken by Contracting Parties due to different circumstances of each Party, it is judged that proper information exchange among Contracting Parties should contribute to minimization of the gap.

6-2 Achieve harmonized emergency plans and response measures

Japan is surrounded by the sea without connecting to neighboring countries directly over national borders. In fact, Japan's nuclear power station that is the closest to neighboring countries is more than 100 km distant from the nearest country. Therefore, Japan does not share EPZ where emergency measures should be taken with its neighboring countries, so that there are no emergency plans and countermeasures in Japan to be harmonized with theirs.

On the other hand, in order to take proper protective actions, it is important that an accident country provides monitoring data without delay.

For the purpose, Japan develops the system to make monitoring data publicly available on the website.

6-3 Better use of operating and regulatory experience, and international peer review services

In Japan, there is a duty to report operational experiences of domestic nuclear power stations subject to laws. In addition, Japan has also built a scheme where events a licensee consider necessary to be shared are deployed to other licensees despite no legal duty of reporting, which is regarded as a voluntary activity among licensee. As for overseas operation experiences, information collection or information provision is

made by actively using international databases on operational experiences such as IRS, jointly operated by IAEA and OECD/NEA.
As for regulatory experiences, experience sharing is made mainly in the form of bilateral regulatory information exchange.
In terms of international peer review services, the Government of Japan invited IRRS and TEPCO invited OSART, and there is a plan to invite EPREV in the future. The active use of these international peer review services is a future challenge; however, since follow-up mission of the said services are expected to be made within several years, and it is expected to be clear, on the occasion, how much they have been utilized.

6-4 Improve regulators' independence, safety culture, transparency and openness

In the Act for Establishment of the NRA, it is stipulated that the NRA executes independently its official authority so as to ensure its independent decision making. In terms of safety culture of the regulatory body, the NRA enacted the "Statement on Nuclear Safety Culture" in May 2015. The NRA has announced a Code of Conduct on safety culture, and it has declared that it is to take the initiative in taking actions based on the Code of Conduct, make all the parties concerned with nuclear energy have sure awareness on importance of safety culture, and thereby contribute to development of safety culture in Japan.
Transparency and openness are issues being tackled by the NRA since its foundation, while the NRA reported on them in the National Report of Japan for 6th Review Meeting.
The above stated matters are reported in the reporting on Article 8.

6-5 Engage all countries to commit and participate in international cooperation

In the context of promotion to spread nuclear safety, one of the challenges related to participation in international cooperation is to achieve complete participation of the Contracting Parties in review processes of the Convention on Nuclear Safety. In Paragraph 14 of the Summary Report of the 6th Review Meeting, issues to be further enhanced toward future meetings are identified, and Japan is making efforts for this purpose as stated below.
Japan has defined that the obligations of the Contracting Parties are; submission of National Reports; submission of appropriate questions through reviews and response to questions directed to Japan; participation in Review Meetings; and participation in all the meetings of the group to which Japan belongs so as to have useful discussions. Not only

knowledge and experiences of engagement in regulation in Japan but also knowledge and experiences in the Global Nuclear Safety Regime are needed for properly reviewing National Reports. That means that a different expertise from that of ordinary regulatory administrator is needed, so that the NRA is trying to introduce a scheme of developing such as internationalized human resource. Development of internationalized human resource is an approach to further contribution to the international cooperation. On the other hand, from a viewpoint of full participation to Review Meetings, it is important to encourage experts of Japan to join the Review Process. To promote expert's participation, NRA would like to propose to shift the review process to "solution finding approach", more focus on identifying “good practice” which can contribute to significantly enhance nuclear safety. Review process should be a chance to solve the difficulties a Contracting Party faces.

Focusing on “good practice” in the review process can be achieved without amend Review Process Guideline. It can be achieved only by changing attitudes of Contracting Parties, so we are trying to involve the G7 member countries and the major nuclear power countries and call for cooperation to make harmonized efforts.

C Outline of the Report for Each Article

This Chapter reports Japan's implementation status of each Article of the Convention on Nuclear Safety. Section I explains an outline of domestic measures taken for implementation of Japan's obligation of the Convention, and section II states about efforts to enhance nuclear safety.

When Japan concluded the Convention on Nuclear Safety, it took a measure to fulfill obligations stipulated in the Contract by securing performance of the fulfillment with domestic laws. Since the Convention was put into effect in Japan in October 1996, Japan carried out revisions of laws and ordinances related to nuclear regulation, reorganization of the regulation body, etc., which has resulted in the following implementation status of the Convention on Nuclear Safety as of now.
Among all the duties specified in the Convention on Nuclear Safety, those specified between Article 9 and 19, except Article 16, are performed in the form of nuclear regulations of Japan.
Nuclear regulations are stipulated in the Reactor Regulation Act, and regulations applied during the life period of each commercial power reactor are as follows:

I Relationship between Domestic Measures and Conformity to the Convention on Nuclear Safety

1 Commercial Power Reactors

1-1 Reactor Installation Permit

For installation of a commercial power reactor, a Reactor Installation Permit must be obtained from the NRA. In this procedure, review is made on siting conditions for installation of reactor facilities, basic design related to facility safety, technical capability, and financial reserves of operators. In the case of changing matters described in the application documents after obtaining a Reactor Installation Permit, a permit must be obtained on the changed parts from the NRA.

This procedure covers Articles 11, 12, 14, and 17 of the Convention on Nuclear Safety.

1-2 Construction Plan Approval

Licensees who have obtained Reactor Installation Permits must obtain approval from

the NRA on their construction plans before starting work to install or change reactor facilities. This procedure focuses on specific facility design that should conform to basic design on which a Reactor Installation Permit has been obtained as a review target. A review is also made on a quality assurance system applied to the design and the construction. For changing contents of a Permit, including the case of changing a construction plan already permitted or remodeling of an approved facility, a change permit of the construction plan at issue must be obtained.

This procedure covers Articles 13, 14, and 18 of the Convention on Nuclear Safety.

1-3 Pre-service Inspections

This is an inspection conducted by the NRA to confirm that construction of reactor facilities has been carried out as specified in an approved construction plan, and performance of the facilities conforms to the technical standards specified in the NRA Ordinance. Without passing this inspection, the licensees cannot use the facilities.

A Pre-service Inspection is made at each step of construction when inspection becomes possible at the step. However, without passing all the inspection items, the facilities at issue cannot be used, so that this Inspection means the first approval action toward use of the facilities and it covers the Article 19 paragraph 1 of the Convention on Nuclear Safety.

1-4 Fuel Assembly Inspections

Manufacturers of fuel assemblies to be used in reactor facilities must beforehand obtain an approval on design of the fuel assemblies from the NRA and then must be subject to a Fuel Assembly Inspection. The NRA is to confirm that fuel was manufactured as specified in the approval through a Fuel Assembly Inspection. This is a procedure needed each time design of fuel assemblies is changed, and it is an act of approval that enables use of the fuel assemblies in reactors. Therefore, like the Pre-service Inspection, it is one of the procedures to cover the Article 19 paragraph 1 of the Convention on Nuclear Safety.

1-5 Welding Inspections of Contractors and Welding Safety Management Reviews

Licensees must inspect weld parts on important ones of reactor facilities. The NRA reviews and assesses methods, schemes, etc. of welding inspections licensees are to make.

This procedure is also one of procedures that cover the Article 19 paragraph 1 of the Convention.

1-6 Operational Safety Program Approval

Licensees must formulate Operational Safety Programs and obtain approval from the NRA before starting use of their reactor facilities. The Operational Safety Programs are a document that is positioned at the highest level of documents related to reactor facility safety. Licensees are obliged to comply with their Operational Safety Programs, and they must have their employees in charge of nuclear power stations comply with the Programs.

Requirements of Operational Safety Programs cover the Articles 10 and 11 paragraph 2, and further Articles 12, 13, 15, and 19 paragraphs 2 to 8 of the Convention.

1-7 Operational Safety Inspections

This is an inspection made by the NRA to check a status of conformity to Operational Safety Programs. A periodic Operational Safety Inspection is implemented four times per year. It is also implemented in a manner of accompanying actions important for securing safety such as operation to start up or shut down a power reactor and operation related to replacement of fuel.

This procedure covers the Article 19 paragraph 3 of the Convention on Nuclear Safety.

1-8 Periodic Facility Inspections, Periodic Licensee's Inspections and Periodic Safety Management Reviews

These are inspections periodically implemented on reactor facilities after they have passed Pre-service Inspections. Licensees are obliged to implement Periodic Licensee's Inspections, and the NRA reviews and assesses methods, schemes, etc. of the Periodic Licensee's Inspections. In addition, inspectors from the NRA attend especially important Periodic Licensee's Inspections.

This procedure covers the Article 19 paragraph 3 of the Convention on Nuclear Safety.

1-9 Evaluations to Improve Safety

This is a system instituted by the Reactor Regulation Act revised in 2012 and put into effect in December 2013. Licensees of power reactor operation must evaluate safety of power reactor facilities at issue in a period within six months from the date when each Periodic Facility Inspection is completed, report results of the evaluation, and make them open to the public. Details are mentioned in the reporting of Article 6.

This is one of activities corresponding to Article 14 of the Convention on Nuclear Safety.

1-10 Technical Evaluation of Aging Facilities and Aging Management System

Licensees are obliged to take measure for safety of power reactor facilities. And as part of it, they must make a Technical Evaluation of Aging Facilities by the day when 30 years have passed after the date when operation of the reactor facilities started, and based on its results, they must formulate a long-term maintenance policy. After that, they are to conduct a Technical Evaluation of Aging Facilities in every 10 years and to revise the long-term maintenance policy as a need arises.

This procedure covers the Article 14 of the Convention on Nuclear Safety.

1-11 Approval of Extension of the Limit of Operational Periods

This is a procedure instituted in the 2012 revision of the Reactor Regulation Act. The operational periods of power reactors are limited to 40 years calculated from the date of passing a Pre-service Inspection on construction for installation of each power reactor, but an operational period of each reactor can be extended, one time only, for another 20 years or less if approval is obtained from the NRA. When a licensee files for an extension of operation, the NRA can approve the extension only if it finds conformance to standards it specifies for securing safety during a period for the expected extension in light of conditions of degradation of the reactor at issue and other facilities that has occurred due to long-tern operation. Application must have documents attached, where the following items are described.

(1) Results of inspections made to grasp conditions of degradation that has occurred on a reactor at issue and other facilities.
(2) Results of technical evaluations on conditions of degradation that will occur on a reactor at issue and other facilities during a period for the expected extension.
(3) A policy of maintenance management of a reactor at issue and other facilities during a period for the expected extension.

In order to obtain approval of an extension of the limit on an operational period, it is required to conform to the technical standard rule, even if degradation due to operation of a reactor at issue and other facilities during a period of the expected extension is taken into account.

1-12 Suspension of Facility Use

The NRA can order licensees of power reactor operation measures necessary for

safety such as suspension of use, remodeling, repair, and transfer, and designate operation methods of facilities, when it finds that locations, structure, and equipment of power reactor facilities do not conform to the installation permit standard rule or when it judges that measures related to safety and operation of power reactor facilities, transportation, storage, and disposal of nuclear fuel or items contaminated by nuclear fuel material violate the rule of commercial power reactors.

The measures, in this regulation, taken when there is no conformance to the NRA Ordinance on Standards for the Location, etc., and the NRA Ordinance on Technical Standards request back-fitting of existing power reactor facilities. They conform to Articles 17 and 18 and also cover Article 6 and the Vienna Declaration.

1-13 Approval of Decommissioning Plan

For licensees to decommission reactor facilities, they must obtain permission from the NRA. Licensees are to obtain a change permit of their Operational Safety Programs for decommissioning measures till the date of approval of their decommissioning plan and then implement the decommissioning measures.

What should be carried out as decommissioning measures is dismantlement of a power reactor, transfer of possessed nuclear fuel material, removal of contamination caused by nuclear fuel material, disposal of nuclear fuel material or items contaminated by nuclear fuel material, and delivery of radiation control records to a designated institution.

1-14 Confirmation of Completion of Decommissioning Measures

This is the last approval action to licensees where the NRA confirms completion of decommissioning measures for sites where decommissioning measures were completed. With this confirmation, related Reactor Installation Permits lose their effects.

1-15 Other Regulations

In addition to above stated regulations, the Reactor Regulation Act stipulates procedures related to revocation of permits, merger and breakup of corporate bodies that are licensees of power reactor, succession of licensees of power reactor, etc.

2 Specified Nuclear Facility

Licensees must immediately take emergency measures when it is thought that a

disaster might occur or it has occurred due to nuclear fuel material, items contaminated by nuclear fuel material, or a reactor in consequence of an earthquake, a fire, or other disasters. With these measures taken, when the NRA judges that it is especially necessary to implement management in a suitable manner according to conditions of facilities, it can designate the facilities at issue as the "Specified Nuclear Facilities" that mean facilities requiring special measures for protection of Specified Nuclear Fuel Material. After this designation, the NRA is to indicate items licensees should take measures against and a time limit for submission of plans (hereinafter called the "Implementation Plans") to implement measures for safety or protection of Specified Nuclear Fuel Material and then require them to submit the Implementation Plans. The licensees must submit their Implementation Plans by a time limit and obtain approval from the NRA.

In Specified Nuclear Facilities, it is allowed to apply only part of the Reactor Regulation Act, only if it is judged that measures such as safety measures subject to an Implementation Plan can be properly implemented there. This enables taking measures more fitting into an actual status of facilities, since provisions of the Reactor Regulation Act are stipulated with in mind safety and so on of normal reactor facilities and it is not proper to require damaged facilities to take the same measures as normal facilities.

Incidentally, it is the Fukushima Daiichi NPS that is designated, so far, as Specified Nuclear Facilities.

As stated in this section, through enforcement of regulation based on the Reactor Regulation Act, Japan is implementing duties stipulated in Article 10 to 15 and Article 17 to 19 of the Convention on Nuclear Safety. Furthermore, the Reactor Regulation Act includes miscellaneous regulations, in addition to those related to a regulation system, where there are provisions about responsibilities and duties of licensees that cover the Article 9 of the Convention on Nuclear Safety. Other provisions are explained below.

The NRA has its ground of institution in provisions of the Atomic Energy Basic Act, and its concrete capacity and power, conditions on enforcement of them, etc. are stipulated in the Act for Establishment of the NRA. The NRA is a committee established subject to Article 3 of the National Government Organization Act that governs administrative organizations of the Japanese Government. Staff of the NRA, as government officials, are subject to control of the National Civil Service Law. These issues will be reported in Article 8.

Since Article 7 of the Convention requests establishment of related laws and rules, our

report is made to present a hierarchical law system Japan has for nuclear regulation and an overview of Japanese laws and rules to regulate nuclear power stations.
About Article 6, our report is made on measures taken to secure safety of existing facilities, following provisions of the guideline about National Reports (INFCIRC/572/Rev. 5).
Response to nuclear emergency is stipulated at each stage, such as preparation for and restoration from emergency, in terms of duties and responsibilities of the central government, municipalities, and licensees in the Act on Special Measures Concerning Nuclear Emergency Preparedness (the Nuclear Emergency Act). Along with the Basic Act on Disaster Control Measures, this covers the Article 16 of the Convention on Nuclear Safety.
With the above stated matters totally considered, it is judged that measures Japan has taken conform to duties specified in the Convention on Nuclear Safety. A result of individual conformity assessment on each Article is presented at the start of a report related to the Article.

II Activities Contributing to Enhancement of Nuclear Safety

Through expansion of domestic measures and international cooperation, it is one of important objects of the Convention on Nuclear Safety to globally achieve and maintain nuclear safety at a higher level and conformity to the Convention contributes to securement of the object. Below stated are activities that are considered to contribute to nuclear safety improvement among activities Japan put into practice during this reported period.

1 Implementation of the Back-fit System (Article 6, Article 17, and Article 18)

It contributes to safety improvement in utilization of nuclear energy to make not only new but also existent nuclear facilities conform to regulation standards that have been revised with the latest technical knowledge taken in. Japan has strengthened legal force by institutionalizing back-fitting to include it in laws. Activities on back-fitting Japan has been promoting are reported in a following way: Article 6 in terms of related institutions from a viewpoint of operation of facilities whose safety was confirmed; Article 17 from a viewpoint of site conditions; Article 18 from a viewpoint of design; and Chapter B in terms of activities that have been implemented in this reported period.

2 Measures for Severe Accidents (Article 19)

Although prevention of severe accidents is important, it is an important element of safety improvement in utilization of nuclear energy to make preparation for measures for restoration to the normal status on the assumption that a severe accident should occur.

In the Fukushima Daiichi NPS accident, it was obliged to adopt procedures different from ordinary ones such as injection of water into reactor pressure vessels by use of fire trucks; therefore, but training for and learning of this kind of flexible response contribute to securement of safety. In Japan, severe accident measures are required to be adopted in design by the new regulatory requirements, and furthermore, appropriate operation of severe accident countermeasures, including maintaining appropriate scheme and training, are included in Operational Safety Programs.

With reference to past examples in the world, it is apparent that severe accidents never happen frequently. But it is thought that significant efforts are required to maintain activities, at a high level for a long time, in preparation for such a rare event. It is an important challenge to take measures for maintaining awareness and technical capability at a high level, so that what is prepared for severe accidents can be swiftly deployed at any time if a need arises.

ARTICLE 6 EXISTING NUCLEAR INSTALLATIONS

Each Contracting Party shall take the appropriate steps to ensure that the safety of nuclear installations existing at the time the Convention enters into force for that Contracting Party is reviewed as soon as possible. When necessary in the context of this Convention, the Contracting Party shall ensure that all reasonably practicable improvements are made as a matter of urgency to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shut-down may take into account the whole energy context and possible alternatives as well as the social, environmental and economic impact.

Outline of the Implementation of Article 6

There are 48 commercial power reactors in Japan, five of which were recognized as conforming to the new regulatory requirements which the NRA implemented and obtained amendments on a Reactor Installation Permit.

As for TEPCO's Fukushima Daiichi NPS, it was designated as the Specified Nuclear Facilities by the NRA and, accordingly, it has been under special control.

Nuclear facilities in Japan are required to conform to the regulatory standards stipulated in the NRA Ordinance, according to provisions of the Reactor Regulation Act. When the regulatory standards are amended, even existing reactor facilities will be obliged to conform to amended regulatory standards, and if nonconformity is found, the NRA can order suspension for use of the facilities. Therefore, there is no continuing operation of nuclear facilities in Japan that are in a state without safety secured, so that conformity to the provision of Article 6 of the Convention is achieved.

1 Reactor Facilities in Japan

As of the end of March 2016, there were a total of 48 power reactors (24 BWR and 24 PWR) in Japan. Six reactors were permanently shut down to take decommissioning measures, and the decommissioning of another four reactors is currently underway.
The Annex provides a list of reactors for nuclear installation in Japan.

2 Accidents or Failure that Occurred during the Reported Period

During the three-year period FY2013 -FY2015, 15 incidents were reported to the NRA by licensees in accordance with the Reactor Regulation Act. Although the number of reported incidents has decreased compare to the past, this is because almost all the commercial power reactors in Japan have suspended. 12 among above mentioned 15 incidents are occurred in TEPCO's Fukushima Daiichi NPS. The list of accidents or failure that occurred during the reporting period is shown in the Annex.

3 Efforts to Secure Safety

3-1 Conformity Reviews

The NRA Ordinance so called the new regulatory requirements stipulates that commercial power reactors should conform to them which is put into effect in July 2013 An outline of the new regulatory requirements is presented in the National Report of Japan for 6th Review Meeting.
The conformity review is a regulatory procedure needed for operation of existing power reactors in Japan, which consists of review procedures for amendment on Reactor Installation Permit, on a construction plan, and on Operational Safety Programs. The NRA checks conformity to the regulatory requirements through these procedures.
Regulatory requirements measures against severe accidents were added, and regulatory requirements against earthquakes, tsunamis were reinforced base on the lessons learned from the accident at TEPCO's Fukushima Daiichi NPS. Accordingly, existing reactors need to take back-fitting to them. In case of occurrence on accidents or natural disasters that exceed estimation in the regulatory requirements, it is required to take measures for prevention of core damage, containment vessel failure, and dispersion of radioactive material. The review of amendment on Reactor Installation Permit focuses on whether the reactor location, structure, and facilities of the power

reactor as well as technical capability of the licensee of power reactor meet these requirements.

The review on Construction Plan focus on whether detailed design of power reactor facilities, quality control methods related to design and construction fit with the Reactor Installation Permit and conform to the regulatory requirements.

The review on Operational Safety Programs focus on whether measures needed for safety of power reactor facilities specified in the Operational Safety Programs are sufficient for prevention of disasters caused by nuclear fuel material, items contaminated by nuclear fuel material, or the power reactor.

After these reviews on the regulatory requirement, the NRA conducts a Pre-service Inspection on a power reactor that has obtained Permission of amendment on Reactor Installation Permit, Construction Plan Approval, and Approval of amendment on Operational Safety Program.

In a Pre-service Inspection, the NRA's Nuclear Facility Inspectors check conformity to an approved Construction Plan and technical standards. Licensees of power reactor shall not use the facilities before passing the Pre-service Inspection.

The Operational Safety Inspection is designed to check licensee's compliance to Operational Safety Programs which measures necessary for safety concerning a power reactor are stipulated. An Operational Safety Inspection is periodically carried out four times a year with focus on whether licensees carries out a series of planning processes, implementation, evaluation, and improvement of safety activities properly.

In addition to Operation Safety Inspection, there are also inspections to check compliance on important measurements securing safety such as in startup and shutdown of reactors, refueling, training related to the case of occurrence of a severe accident or Loss of Large Area.

The Periodic Facility Inspection is the regulatory inspection periodically conducted by NRA. The licensees who own specified important nuclear facilities are obliged to conduct Periodic Licensees' Inspection to confirm conformity to technical standards, and NRA's inspector checks these licensees' inspection on site or by record.

After the new regulatory requirements enter into force, nuclear power plants cannot resume their operation without completing these reviews and inspections.

3-2 Assessment to Enhance Safety

The Reactor Regulation Act revised in 2012 newly introduced a safety assessment system for enhancement of nuclear safety. In this system, licensees of power reactor are

requested to make an assessment by themselves in a period within six months of the date when a Periodic Facility Inspection on safety of the power reactor facilities at issue is completed, and after the assessment, they are requested to submit reports of the assessment to the NRA without delay and make them open to the public.

3-3 Specified Nuclear Facilities

The NRA designated TEPCO's Fukushima Daiichi NPS as the Specified Nuclear Facilities in accordance with the Reactor Regulation Act and requested TEPCO to submit an implementation plan with measures to take. The implementation plan was submitted on December 7, 2012, and accordingly, the NRA approved it on August 14, 2013. Afterwards, amendments were made in the implementation plan in accordance with working progress in Fukushima Daiichi NPS, 112 applications for amendments are made as of the end of 2015. The NRA has been progressively reviewing them.

4 Nuclear installation to be decommissioned

4-1 Tokai Nuclear Power Station, Japan Atomic Power Company

Electric generating power:	166,000kW
Reactor type:	Graphite-moderated carbon dioxide gas-cooled reactor (GCR)
Fuel:	Natural uranium
Commissioned:	July 25, 1966
Operations terminated:	March 31, 1998
Operation period:	31 years, 8 months
Status:	Decommissioning measures underway (being dismantled outside the reactor area)

Overview:

Tokai NPS is natural uranium, graphite-moderated carbon dioxide gas-cooled reactor facility that began trial operations on May 4, 1965 and became the first commercial nuclear power station to begin operating in Japan on July 25, 1966; it ceased commercial operation on March 31, 1998.

Subsequently, the Japan Atomic Power Company submitted notification of its dismantling on October 4, 2001, and decommissioning commenced on December 4 of that year.

The decommissioning plan was approved on June 30, 2006, following the revision of the Reactor Regulation Act.

All of the spent fuel had been removed by June 21, 2001, before notification of the decommissioning.

The decommissioning began with the serial dismantlement of the auxiliary equipment. The dismantlement of the reactor area has been deferred until radioactivity levels are reduced and the immediate focus has been on safe storage until reactor dismantlement begins.

At present, non-operational facilities and equipment which have comparatively low levels of radioactivity or are uncontaminated are being dismantled in the area outside the reactor area are being dismantled.

4-2 Fugen Nuclear Power Plant Advanced Thermal Reactor, Japan Atomic Energy Agency

Electric generating power:	165,000kW
Reactor type:	Heavy-water-moderated light-water-cooled boiling water reactor (pressure tube reactor)
Fuel:	Natural or enriched uranium, plutonium mixed oxide
Commissioned:	July 29, 1978
Operations terminated:	March 29, 2003
Operation period:	24 years, 8 months
Status:	Decommissioning measures underway (spent fuel currently being removed)

Overview:

The Advanced Thermal Reactor facility (Fugen) reached its first critical state on March 20, 1978 and operated for about 25 years before ending operations on March 29, 2003. Removal of the whole fuel assemblies from the reactor was completed on August 13, 2003.

On February 20, 2004, MET I approved measures to ensure that the fuel could not be reloaded and to shut down the reactor permanently.

Subsequently, J AEA received approval for its decommissioning plan on February 12, 2008.

It called for dismantling the facilities safely and efficiently, taking into account the need for ongoing management and equipment maintenance even after operations ends.

According to the decommissioning plan, it is planned to continue dismantling of facilities in a safe and reasonable manner while taking into consideration conditions of

specific equipment that need continued control of maintenance after completing their operation.

As for spent fuel stored in the spent fuel storage pools, JAEA initially planned to dispose of all the amount of them at the reprocessing plant of the Japan Atomic Energy Agency's Tokai Research and Development Center, Tokai Reprocessing Technology Development Center. Although a new policy for abolish this reprocessing plant was announced in 2014, a study on a possibility of committing the work to overseas parties is going on.

4-3 Hamaoka Nuclear Power Station, Chubu Electric Power Company (Units 1 & 2)

Electric generating power:	540,000kW (Unit 1); 840,000kW (Unit 2)
Reactor type:	Light-water-moderated, light-water-cooled reactor, boiling water reactor (BWR)
Fuel:	Enriched uranium
Commissioned:	March 17, 1976 (Unit 1); November 29, 1978 (Unit 2)
Operations terminated:	January 30, 2009
Operation period:	32 years, 10 months (Unit 1); 30 years, 2 months (Unit 2)
Status:	Decommissioning measures underway (Dismantling facilities in the peripheral of the reactor area underway)

Overview:

Both Units 1 and 2 at Hamaoka NPS are enriched uranium, light-water-cooled and moderated reactors (BWR); Unit 1 reached its first critical state on June 20, 1974 and operated for about 27 years until November 7, 2001, when the reactor was shut down due to the rupture of a pipe in the residual heat removal system.

Subsequently, the Chubu Electric Power Company decided halt reactor operations after January 30, 2009, and began decommissioning following approval of its decommissioning plan on November 18 that year.

Unit 2 reached its first critical state on March 28, 1978 and operated for about 26 years, until it was shut down on February 22, 2004 to conduct the 20th periodic inspection.

Subsequently, the Chubu Electric Power Company decided to end reactor operations after January 30, 2009 (the same date as Unit 1), and commenced decommissioning measures following approval of its decommissioning plan on November 18 that year.

In response to amendment on decommissioning plan permit granted on February 3, 2016, each unit has shifted to a period of dismantlement on facilities in the peripheral reactor area. Investigation and study on status of contamination and systematic decontamination are continued and work for dismantling and removal are ongoing.

4-4 Fukushima Daiichi Nuclear Power Station, Tokyo Electric Power Company (Units 1-4)

Electric generating power:	460,000kW (Unit 1); 784,000kW (Units 2-4)
Reactor type:	Boiling Water Reactor (BWR)
Fuel:	Enriched uranium
Commissioned:	March 26, 1971 (Unit 1); July 18, 1974 (Unit 2); March 27, 1976 (Unit 3); October 12, 1978 (Unit 4)
Operations terminated:	March 11, 2011
Operation period:	40 years (Unit 1); 37 years, 4 months (Unit 2); 35 years (Unit 3); 33 years, 7 months (Unit 4)
Status:	Decommissioned as a commercial source of power under the Electricity Business Act (April 19, 2012)

Overview:

In the wake of the March 11, 2011 accident and having concluded that it was impossible to further use Units 1-4 of the Fukushima Daiichi Nuclear Power Station as electric facilities for business purposes, TEPCO submitted a plan, on March 30, 2012, for their decommissioning as a commercial source of power on April 19 that year, pursuant to the provisions of the Electricity Business Act.

After the accident, emergency measures pursuant to the provisions of the Reactor Regulation Act were taken at the Fukushima Daiichi plant to deal with this dangerous situation.

The Nuclear and Industrial Safety Agency (as it was known at the time) published The Concept of Securing Mid-Term Safety, which set out basic targets to be achieved before starting work on specific decommissioning tasks. It instructed TEPCO to submit a facility operation plan and then evaluated the validity of this emergency plan.

Because the safety of the Fukushima Daiichi power station could not be guaranteed in the long-term by such emergency measures, the NRA On November 7, 2012, designated it as a Specified Nuclear Power Facility requiring special management. It further gave TEPCO a list entitled Matters for which Measures Should be Taken and told the company to submit an implementation plan to ensure operational safety and the protection of specified nuclear fuel materials.
The NRA established the Supervision and Evaluation Committee for Specified Nuclear Facilities, and reviewed TEPCO's implementation plan to ensure to ensure its compliance with the guidelines.

4-5 Nuclear installations decided to be decommissioned

Operators decided to decommission the following power reactors. The following status of power reactors are in permanent shut down status.

NPS	Reactor Type	Output (MWe)	Commissioned	Shutdown
Tsuruga Nuclear Power Station unit 1 (Japan Atomic Power Company)	BWR	357 MW	1970/03/14	2015/04/27
Mihama Power Station unit 1 (Kansai Electric Power Co., Inc.)	PWR	340 MW	1970/11/28	2015/04/27
Mihama Power Station unit 2 (Kansai Electric Power Co., Inc.)	PWR	500 MW	1972/07/25	2015/04/27
Genkai NPS unit 1 (Kyushu Electric Power Co., Inc.)	PWR	559 MW	1975/10/15	2015/04/27
Shimane Nuclear Power Station unit 1 (Chugoku Electric Power Co., Inc.)	BWR	460 MW	1974/03/29	2015/04/30
Ikata Power Station unit 1 (Shikoku Electric Power Co., Inc.)	PWR	566 MW	1977/09/30	2016/05/10

5 Operation of 'Safe' Reactor Facilities

The Reactor Regulation Act stipulates that "In the event that the location, structure, or equipment of a nuclear power reactor facility does not comply with the standards set forth in the Ordinance of the NRA, the NRA can suspend the use of the reactor facility in question, or its modification, repair, or relocation, or may designate a specific method of operating the reactor in question, or may order any other measure required to ensure operational safety."

This means that reactor facilities that have not been confirmed to be safe will not be operated unless such necessary steps are taken, and that no reactor will be allowed to operate for power generation without its safety having first been ensured.
When regulatory requirements are revised, existing nuclear installations are obliged to meet revised regulatory requirements.

ARTICLE 7 LEGISLATIVE AND REGULATORY FRAMEWORK

1	Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.
2	The legislative and regulatory framework shall provide for: (i) the establishment of applicable national safety requirements and regulations; (ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a license; (iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licenses; (iv) the enforcement of applicable regulations and of the terms of licenses, including suspension, modification or revocation.

Outline of the Implementation of Article 7

The Reactor Regulation Act stipulates regulations on use of nuclear energy in Japan. The NRA Ordinance detailed regulations stipulated in the Reactor Regulation Act and defines regulation requirements. To install a nuclear power plant, a Reactor Installation Permit shall be obtained subject to the Reactor Regulation Act. Construction Plan Approval, a Pre-service Inspection, Operational Safety Programs Approval are procedures to check compliance to regulations and approval conditions.

The Reactor Regulation Act includes provisions of revoke of permits and suspension of facility use as exercise of the NRA's authority; it also provides implementation methods of regulations and approval conditions within a legal framework.

Therefore, Japan has a legal framework to regulate conditions for safety which defines necessary regulatory requirements. It means that Japan conforms to Article 7 of the Convention.

Article 7 (1) Establishment of a Legislative and Regulatory Framework

1 Outline of Major Legislation Relating to Nuclear Safety

1-1 The Atomic Energy Basic Act

Promulgated in 1955, the Atomic Energy Basic Act is the legal basis of nuclear energy use in Japan.

The objective of the Act is to secure current and future energy resources, promoting advanced learning and industrial development thus ensuring that nuclear energy will contribute to improved standards of living and the overall welfare of mankind.

The Act's basic principles ensure that the research, development and utilization of nuclear energy shall be strictly limited to peaceful purposes, developed safely and contribute to international cooperation.

The objects of securement for safety are protection of lives, health, and property of the people, conservation of the environment, and contribution to security of Japan.

In reflection of lessons learned from the Fukushima Daiichi NPS accident, the Reactor Regulation Act was revised in 2012 to stipulate the foundation of the NRA and the Nuclear Emergency Preparedness Commission. It also provides the grounds for the establishment of the NRA as a government supervisory body for enforcement and democratic control of nuclear energy polices for utilization of nuclear energy.

1-2 the Act for Establishment of the Nuclear Regulation Authority

The Act for Establishment of the NRA was enacted on September 19, 2012, stipulates foundation of the NRA as the nuclear regulation body of Japan, its powers and responsibilities.

The object of the Act is to emphasize the importance for exercise its powers integrated in a neutral and fair manner independently.

This Act provides the organizational structure of the NRA, the appointment and dismissal of its Chairman and Commissioners, the duty of reporting to the national Diet and disclosure of information, and other competence and responsibilities needed for NRA to carry out its mission. A report on the competence and functions this Act guarantees is to be provided in the reporting of Article 8.

1-3 The Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (Reactor Regulation Act) and Relevant Ordinances

Promulgated in 1957, the Reactor Regulation Act is a law dealing with all regulations concerning the use of nuclear energy.

This Act, in accordance with the spirit of the Atomic Energy Basic Act, was enacted to provide necessary regulations on refining, fabricating and enrichment, interim storage, reprocessing and waste disposal activities, as well as on the installation and operation of reactors. The Act provides necessary regulations on the uses of internationally controlled materials. It executes treaties and other international agreements ensuring the use of nuclear energy – source materials, nuclear fuel and reactors are limited to peaceful ones. At the same time, it promotes public safety and the protection of nuclear fuel materials in the event of a serious nuclear accident resulting in abnormal radioactive levels.

The Reactor Regulation Act governing the construction and operation of reactors establishes safety regulations and standards for granting permits and approval, including Reactor Installation Permits, Approval of Construction Plan, Pre-service Inspections, Periodic Facility Inspections, Approvals for Operational Safety Programs and Operational Safety Inspections, and reactor decommissioning. The regulations establish administrative procedures such as suspension of operations and the revocation of permits, as well as criminal penalties, such as imprisonment or a fine, which can be imposed if an operator does not comply with the provisions of this Act.

It stipulates a system for employee feedback system (whistle blowers) whereby they can report any violation of the Reactor Regulation Act to the NRA without any fear of penalty.

While Installation Permits for commercial power reactors are regulated on the basis of the Reactor Regulation Act, certain procedures from design and construction through to operation – namely Approval for Design and Construction Methods, Pre-service Inspections, welding methods and their inspection, and Periodic Facility Inspections – were also subject to equivalent regulation under the Electricity Business Act.

Of the NRA Ordinances established in response to the Reactor Regulation Act, those covering the regulation of reactor facilities are as follows.

- NRA Ordinance Concerning the Installation and Operation, of Commercial Power Reactors (NRA Ordinance on Commercial Reactors)
  - Rules prescribing the Installation and operation of commercial power reactors

- NRA Ordinance Prescribing Standards for the Location, Structure, and Equipment of Commercial Power Reactors and their Auxiliary Facilities (NRA Ordinance on Standards for the Location, etc.)
  - Standards relating to the location, structure, and equipment of reactor facilities, which form one of the criteria for obtaining a power reactor construction permit.
- NRA Ordinance Prescribing Technical Standards for Commercial Power Reactors and their Auxiliary Facilities (NRA Ordinance on Technical Standards)
  - Technical standards relating to construction plan approvals and the maintenance of power reactor facilities.
- NRA Ordinance on Technical Standards for Quality Control Methods Concerning the Design and Construction of Commercial Power Reactors for Licensees of Power Reactor Operation and Systems for Their Inspection (NRA Ordinance on Quality Control Methods)
  - Technical standards prescribing quality control methods relating to design and construction for licensees, which are one of the criteria for approval of a construction plan, and systems for their inspection.
- NRA Ordinance Prescribing Technical Standards for Nuclear Fuel Material Being Used as a Fuel in Commercial Power Reactors
  - These are technical standards relating to the inspection of fuel assemblies.

As well as BWR and PWR commercial power reactors, Japan has the Monju prototype fast breeder reactor. However, Monju is considered in law to be a reactor for power generation at the research and development stage, so the following NRA Ordinances have been established, separate from those governing commercial power reactors.
These ordinances take into account the attributes of power reactors at the research and development stage, but still establish the same regulations as those for commercial power reactors.

- NRA Ordinance on the Installation and Operation of Reactors for the Purpose of Power Generation at the Research and Development Stage
- NRA Ordinance Prescribing Standards for the Location, Structure, and Equipment of Reactors for the Purpose of Power Generation at the Research and Development Stage and their Auxiliary Facilities
- NRA Ordinance Prescribing Technical Standards for Reactors for the Purpose of Power Generation at the Research and Development Stage and their Auxiliary

Facilities

- NRA Ordinance on Technical Standards for Quality Control Methods Concerning the Design and Construction of Power Reactors for Licensees of Power Reactor Operation at the Research and Development Stage and Systems for Their Inspection
- NRA Ordinance Prescribing Technical Standards for Nuclear Fuel Material Being Used as a Fuel for the Purpose of Power Generation at the Research and Development Stage

In addition to the aforementioned ordinances, the Reactor Regulation Act stipulates that it may be only partially applied if proper implementation of measures to ensure operational safety is ensured. Accordingly, the following ordinances have been enacted that stipulate the steps to be taken to ensure safety at the Fukushima Daiichi Nuclear Power Station, as the situation there differs from that at ordinary reactor facilities.

- NRA Ordinance on the Operational Safety of Reactor Facilities at the Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Station and the Physical Protection of Specified Nuclear Fuel Material

1-4 The Act on Special Measures Concerning Nuclear Emergency Preparedness (Nuclear Emergency Act)

Because of the specific nature of nuclear disasters, the Nuclear Emergency Act was promulgated in 1999, with the objective of strengthening measures against nuclear disasters. Combined with the Reactor Regulation Act, the Basic Act on Disaster Control Measures, and other related laws, they were designed to protect the lives, bodies, and property of citizens by prescribing responsibilities of licensees, the Declaration of a Nuclear Emergency Situation, the establishment of a Nuclear Emergency Response Headquarters, and the implementation of emergency response measures, and other special measures relating to nuclear disasters.

Under this law, licensees must take all possible steps to prevent a nuclear disaster, preventing the spread of the effects of a crisis and repairing any damage caused by such an incident.

It stipulates that the government must implement emergency response measures, take steps to precautionary protective measures and measures following the nuclear emergency to prevent any nuclear disaster

Following the TEPCO Fukushima accident the Nuclear Emergency Act was revised on September 19, 2012, to enhance precautionary protective measures and strengthen the

Nuclear Emergency Response Headquarters during nuclear emergency
Measures relating to nuclear emergency preparedness are detailed in Article 16.

2 International Conventions

Japan is a contracting party of the following conventions relating to nuclear safety.

- Convention on Nuclear Safety
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
- Convention on Early Notification of a Nuclear Accident
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency

Article 7 (2) Safety Requirements and Safety Regulations

1 Safety Requirements

In light of lessons learned from the accident of TEPCO's Fukushima Daiichi NPS, NRA put into effect the new regulatory requirements in July 2013.
The new regulatory requirements have required multiple (multi-layer) countermeasures effective for achieving objectives, and adopted, as a basis, the concepts of defense-in-depth that independence effectiveness of different levels of defense (If one level of protection or barrier were to fail, the subsequent level or barrier would be available.)when considering countermeasures at each layer. Accordingly, they have intensified estimation of, and countermeasures against, natural phenomena, etc. that would bring about common-cause failure and also reinforced countermeasures against events other than natural phenomena, such as a fire that would trigger common-cause failure. Moreover, they request prevention of core damage and containment vessel breakage in case of a severe accident as well as measures for suppression of radioactive material dispersion and against intentional airplane crashes.
The basic policies for measures against severe accidents and acts of terror are as follows:

- Protective measures through multiple stages such as "prevention of core damage ", "maintenance of the containment function", "controlled discharge through vents", and "suppression of dispersion of radioactive material."
- Further enhancement of reliability in combination of portable facilities with

permanent ones, although the basis of response is use of portable facilities.

- Reinforcement of preventive and protective measures in spent fuel storage pools.
- Enhancement of resistance properties of Emergency Response Center, reliability and durability of communications, and reliability and sustaining power of measurement systems including those in spent fuel storage pools (reinforcement of command communications and measurement systems).
- Development of procedures, securement of personnel, implementation of training are required since it is important to exercise necessary functions in integration of hardware (facilities) and software (on-site work).
- As countermeasures against intentionally caused airplane crashes, distributed storage and connection of portable facilities are requested. A specialized safety facility is introduced as a backup measure for reliability enhancement.

2 Regulation System

2-1 Permitting Approval Systems

When constructing commercial power reactors, a permit must be obtained from the NRA, pursuant to the provisions of the Reactor Regulation Act.

The Reactor Regulation Act sets forth the reasons for disqualification from obtaining a permit, stipulating that anyone who has had a Reactor Installation Permit revoked within the last two years may not obtain a new permit.

If a licensee wishes to change an already approved he must seek permission for any amendment or, if the change is a minor one prescribed in law, must submit notification of the change.

No expiry date is set for Reactor Installation Permit in Japan so there are no procedures for renewing a permit. A 40-year operation limit is stipulated though this may be extended one time only for a maximum of 20 additional years.

The safety reviews for obtaining a Reactor Installation Permit are carried out by the NRA, the regulatory authority.

Article 17 provides an explanation concerning Reactor Installation Permit.

In granting Reactor Installation Permits, the NRA must seek the opinion of the Atomic Energy Commission of Japan, in order to confirm that there is no risk that the facility will be used for anything other than peaceful purposes.

Anyone who constructs a reactor without obtaining a Reactor Installation Permit will be subject to a penalty of imprisonment with work for not more than three years, or a fine of not more than three million yen, or both, pursuant to the provisions of the

Reactor Regulation Act.
Holders of a Reactor Installation Permit must obtain NRA approval for their construction plan before commencing construction, or notify the NRA of the plan.
NRA approval must be sought for the design of the fuel assembly to be loaded into the reactor.

2-2 Inspection and Assessment Systems

In constructing a reactor facility, the licensee must undergo a Pre-service Inspection by the NRA and may not use the reactor facility in question if it does not pass this inspection.
The fuel assembly to be loaded into the reactor must undergo a Fuel Assembly Inspection by the NRA and may not be used if it does not pass this inspection.
As well as conducting inspections of welding parts, particularly in areas which must withstand high pressures and the containment vessel itself, licensees must undergo a review by the NRA (Welding Safety Management Review). This will focus on the systems involved in conducting the inspection, the inspection method, process controls, and other matters stipulated in the NRA Ordinance.
After commencing operations, licensees must undertake Periodic Licensee's Inspections, as well as undergoing Periodic Facility Inspections by the NRA, focusing on designated key safety components.
Systems involved in conducting inspections, inspection methods, process controls and other matters stipulated in NRA Ordinances must undergo a Periodic Safety Management Review by the NRA.
Operational Safety Inspectors from the NRA will also periodically conduct inspections to confirm compliance with Operational Safety Programs of operational facilities pursuant to the provisions of the Reactor Regulation Act.
Other inspections will examine compliance with regulations concerning the physical protection of nuclear material, pursuant to the provisions of the Reactor Regulation Act.
If reactor facilities or fuel assemblies that have not passed the Pre-service Inspection or Fuel Assembly Inspection are used, or if a licensee is obstructionist they may be subject to imprisonment with labor for not more than one year, a fine of not more than one million yen, or both, pursuant to the provisions of the Reactor Regulation Act. These include a refusal or obstruction or evasion of a Pre-service Safety Management Review, a Welding Safety Management Review, a Periodic Facility Inspection, or a Periodic

Safety Management Review. Additionally, if a licensee has refused, obstructed, or evaded granting entry to the site, an inspection, or submitting samples for an Operational Safety Inspection or nuclear material physical protection inspection, or fails to respond to questions, or makes false statements in response to questions.

3 Law Enforcement Measures

The Reactor Regulation Act stipulates law-enforcement measures for the NRA execution

The NRA can revoke a Reactor Installation Permit if a licensee does not start operation of the power reactor without reasonable excuse within five years of the date of obtaining the Permit or if it discontinues operation for more than a year.

The NRA can also revoke a Reactor Installation Permit or order a licensee to shut down the power reactor at for a period of one year or less if it has come to fall into a disqualification state for the permit or if it violates a provision of the Reactor Regulation Act or an order issued based on the Act.

In addition, the NRA can order licensees to take measures necessary for safety such as a halt, remodeling, repair or transfer of power reactor facilities or designate a method of operation if it finds that the power reactor facilities do not conform to the installation permit standard rule or the technical standard rule, or that measures being taken related to safety, operation. The NRA can order licensees to dismiss Chief Reactor Engineers if they violate provisions of the Reactor Regulation Act.

As for measures against dangerous situations, the NRA can order licensee to take measure against disaster prevention in the case of occurrence on disaster caused by a reactor. .

There are penalty provisions in the Reactor Regulation Act. For example, if anyone who installed a power reactor without a Reactor Installation Permit or an order relating to shutdown of a power reactor which is issued by the NRA is not complied shall be sentenced to imprisonment with work for not more than three years or a fine of not more than three million yen. However, these punishment provisions are not executed directly by the NRA, but the judiciary authorities shall enforce them after receiving an accusation from the NRA.

ARTICLE 8 REGULATORY BODY

1	Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities.
2	Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.

Outline of the Implementation of Article 8

The NRA is a regulatory body entrusted with enforcement of legal framework, and the Act for Establishment of the NRA guarantees its independence to execute of official power. The NRA has the authority to establish the NRA Ordinance to execute laws, it has the authority to grant permission and approval, implement of inspections, and issue necessary orders. The NRA is financed by the national budget and its staffs are central government officials.

The Chairman and Commissioners of the NRA are appointed by the Prime Minister with the consent of the national Diet, and the NRA Chairman appoints the staff of the Secretariat of the NRA.

Therefore, the NRA has authority, financial resources, and human resources needed to pursue its mission, and secure effective separation from implementation organizations as defined by law, which means that it conforms to provisions of Article 8 of the Convention.

Article 8 (1) Establishment of a Regulatory Body

1 Nuclear Regulation Authority

1-1 Organization, Authority, and Duties

The NRA regulates nuclear-related activities in Japan, while the Secretariat of the NRA deals with related administrative matters.

The NRA is established as an external bureau of the Ministry of the Environment. The Chairman and Commissioners of the NRA are appointed by the Prime Minister, with the consent of the Diet, based on the provisions of the Act for Establishment of the NRA. It will exercise independent authority from a fair and neutral standpoint.

The NRA will provide the Diet with a detailed report, via the Prime Minister, concerning its activities. The appointment or dismissal of the Secretariat of the NRA's members rests with the NRA Chairman.

The NRA has the authority to establish the NRA Ordinance to implement laws and Cabinet Orders relating to the affairs under its jurisdiction. The term of office of the Chairman and Commissioners is five year but they may be reappointed at the end of this initial term.

The duty of the NRA is to ensure safety in the use of nuclear energy, so it has the right to review planned nuclear installations to confirm their location, structure, and equipment do not pose a disaster threat, and that being the case to give the permission for their construction.

Moreover, as well as formulating the NRA Ordinance that includes regulations concerning nuclear-related activities such as emergency, operational safety measures and programs, and the physical protection of specified nuclear fuel material, the NRA handles other issues such as the approval of the design and construction of facilities, inspections, approval of Operational Safety Programs, and the approval of plans for nuclear reactor decommissioning measures. It also collects reports from licensees and conducts on-site inspections, if necessary.

It has the authority to revoke Reactor Installation Permits or suspend the use of such facilities; to order safety measures, the dismissal of Chief Reactor Engineers and measures covering decommissioning and disaster prevention.

In March 2014, following a notion that more enhancement of expertise is indispensable for reinforcement of the NRA's functions, Japan Nuclear Energy Safety Organization (JNES) was integrated into the Secretariat of the NRA.

As a result of the integration, the number of staff members of the NRA reached about

1,000 as of the end of March 2014, including Nuclear Safety Inspectors and Nuclear Emergency Preparedness Officers stationed at nuclear sites.

The Act for Establishment of the NRA specifies that the Reactor Safety Examination Committee (for investigation and review of nuclear safety), the Nuclear Fuel Safety Examination Committee (for investigation and review of nuclear fuel material safety), and the Radiation Council (for review of technical standards related to radiation damage prevention) shall be established under the NRA.

The Secretariat of the NRA consists of the three Departments of the Regulatory Standard and Research Department in charge of preparation of standards and policies and research on nuclear systems, severe accidents, nuclear fuel and nuclear waste, safety research related to earthquakes and tsunamis, the Radiation Protection Department in charge of setup of the systems of nuclear emergency preparedness and response, initial emergency response, physical protection of nuclear material, radiation monitoring, regulation for radiation isotopes, and safeguards based on international commitments, and the Nuclear Regulation Department consisting of the Nuclear Regulation Policy Planning Division and other seven Divisions for BWRs; PWRs; inspections of nuclear reactors; research reactors, and decommissioning; nuclear fuel facilities; radioactive waste storage, transport and disposition; and implementation of regulations on earthquakes and tsunamis, in addition to the General Affairs Division, the Personnel Division, the Counsellor of Budget and Accounting.

Moreover, as shown in Table 8-1, there are NRA Regional Offices at 22 nuclear sites, with safety inspectors and nuclear emergency preparedness officers permanently stationed there.

Table 8-1 NRA Nuclear Regulation Offices

Office Name	Target Facilities
Tomari Nuclear Regulation Office	Power plant (PWR)
Higashidori Nuclear Regulation Office	Power plant (BWR); research reactor; SF interim storage
Rokkasho Nuclear Regulation Office	Uranium enrichment; reprocessing; disposal facility
Onagawa Nuclear Regulation Office	Power plant (BWR)
Fukushima Daiichi Nuclear Regulation Office	Power plant (BWR)
Fukushima Daini Nuclear Regulation Office	Power plant (BWR)
Kashiwazaki-Kariwa Nuclear Regulation Office	Power plant (BWR)
Tokai and Oarai Nuclear Regulation Office	Power plant (BWR, GCR); research reactor, fuel fabrication, reprocessing, and usage facilities; disposal facility
Kawasaki Nuclear Regulation Office	Research reactor; usage facilities
Yokosuka Nuclear Regulation Office	fuel fabrication; research reactor
Shika Nuclear Regulation Office	Power plant (BWR)
Hamaoka Nuclear Regulation Office	Power plant (BWR)
Tsuruga Nuclear Regulation Office	Power plant (PWR, BWR, FBR, ATR)
Mihama Nuclear Regulation Office	Power plant (PWR)
Ohi Nuclear Regulation Office	Power plant (PWR)
Takahama Nuclear Regulation Office	Power plant (PWR)
Kumatori Nuclear Regulation Office	fuel fabrication; research reactor; usage facilities
Kamisaibara Nuclear Regulation Office	Uranium enrichment
Shimane Nuclear Regulation Office	Power plant (BWR)
Ikata Nuclear Regulation Office	Power plant (PWR)
Genkai Nuclear Regulation Office	Power plant (PWR)
Sendai Nuclear Regulation Office	Power plant (PWR)

1-2 Resource for Regulation

(1) Funding

As a regulatory body the government funds the NRA which compiles a proposed annual budget and submits it to the appropriate financial authorities.

This procedure is carried out in the same manner as all government departments.

The NRA budget in FY2016 is 57.7 billion yen.

(2) Human resources

The NRA is composed of the Chairman and four Commissioners who are appointed by

the Prime Minister, and the Secretariat of the NRA was established with staff accepted mainly from the NISA, the Nuclear Safety Commission, and the Atomic Energy Commission of Japan in September 2012. In order to integrate functions of safeguards and radiation protection in April 2013, the NRA accepted staff from MEXT. The NRA has integrated JNES a technical support organization, in March 2014, it accepted staff from the Organization. Furthermore, it has employed new graduates and mid-career with experiences in the industry and other R&D institutes, so that the NRA has come to command human resources with various expertise.

In order to make scientific and technical judgments without relying on knowledge and experiences of electricity utilities, the NRA needs to maintain a certain level of the amount and quality of human resources and continually enhance their technical ability. With this in mind, the NRA formulated the basic policy for development of human resources in June 2014 so as to make clear the fundamental principles and the outline policy of human resource development. In this basic policy, the following points are identified as duties of the NRA: (1) properly distribute resources needed for learning, training, (2) connect future challenges and strategies of the organization with human resource development, and (3) encourage staff to promote their voluntary learning.

1-3 Ensuring Transparency and openness

(1) Ensuring Transparency

The *Policy on Ensuring the Operational Transparency of the NRA* stipulates that the basic policy of the organization is (1) to be able to release information not subject to disclosure under the Act on Access to Information Held by Administrative Organs; (2) to adhere to the process of disclosure and discussion; and (3) to adhere to the principle of administration based on written documents. Accordingly, to ensure full transparency it has been decided that details of the agenda, minutes and distributed materials at NRA Commission and committee meetings and information from its study teams, shall be published, as a general rule.

Following meetings concerning regulations attended by at least three Commissioners or interviews between NRA Commissioners or Secretariat staff and those subject to regulation, it was decided that outlines of these proceedings will be published, together with the names of those present and reference materials used. Overviews of particularly important information will be reported at the NRA Commission Meetings.

Based on such guidelines as the *Policy on Ensuring the Operational Transparency of the NRA* and *Operational Guidelines for NRA Commission Meetings*, the proceedings of NRA

Commission Meetings and its study teams will generally be made available to the public.

For this purpose, an official page has been set up on online video-sharing websites such as YouTube, with the NRA Commission Meetings and study teams meetings being broadcast live whenever possible; in addition, recordings and edited highlights of these meetings will also be made available.

Reference materials used in the NRA Commission Meetings and its study teams are published on the NRA's website at the start of each meeting, increasing the ease and accessibility of interested parties.

As a rule, minutes of NRA Commission Meetings are posted on the website the following day while those of study team meetings are generally published within a week.

The NRA Chairman conducts weekly press conference. The Deputy Secretary-General of the NRA Secretariat, in his capacity as spokesman, also conducts press conference twice a week. If necessary, extraordinary press conferences are held.

These press conferences are made available as live broadcasts and recordings, in the same way as the NRA Commission Meetings and study team meetings, while the minutes of the press conferences are made available on the NRA's website on the same day of the Chairman's press conferences, and the following day of the spokesman's press conferences as far as possible.

(2) Ensuring openness

One of the guiding principles in NRA's Core Values and Principles is "We shall be open to all opinions and advice from Japan and the international community and avoid both self-isolation and self-righteousness."

Based on these principles, the NRA has utilized the expertise of external experts, including those serving on study teams, and has actively held discussions with other experts and relevant licensees.

To seek the opinions of a wide range of both domestic and foreign experts concerning its activities, the NRA held a meeting in November 2012 with members of the accident investigation committees established by the Diet and the government and NPO specialists; in December international advisors participated in an exchange of opinions.

In other activities, the NRA has published information and conducted interviews with relevant experts and licensees to ensure transparency, closer communications and stronger relationships to facilitate a swift response to any emergency, encouraging a wider understanding of regulations and gathering a wider knowledge from both

domestic and overseas sources.

The NRA canvassed widespread public views to help formulate new regulatory requirements and countermeasures in the event of nuclear disasters and published those findings.

Even before inviting public comment on the draft text of provisions, the NRA sought public comment on the draft framework stage, further encouraging widespread public participation.

The NRA established a website and call centers enabling the public to express their opinions or questions via the internet or telephone whenever they wish.

1-4 Technical Support

(1) Technical support organizations

As Technical Support Organizations, NRA has joint jurisdiction over JAEA and NIRS with the MEXT.

JAEA is a body that, in accordance with the basic policy prescribed in the Atomic Energy Basic Act, conducts basic and applied research into nuclear energy; the development of fast breeder reactors and the nuclear fuel material required for this, in order to establish the nuclear fuel cycle. It also seeks the comprehensive, systematic, efficient development of reprocessing of nuclear fuel material techniques and the disposal of high-level radioactive waste. This information is disseminated to help promote nuclear energy research which in turn should help improve the standard of living and welfare of mankind.

Activities carried out by JAEA in the fields of ensuring the safety in nuclear energy research, its development, and use fall under the joint jurisdiction of MEXT and the NRA.

NIRS encouraged search and development focused on the radiation effects on the human body, thereby improving the scientific and technological level of medicine; the prevention of human radiation injuries, diagnosis and treatment, and the medical use of radiation.

Activities by NIRS in the fields of radiation effects on the human body, the prevention of radiation injury in humans, and diagnosis and treatment also fall under the joint jurisdiction of MEXT and the NRA.

(2) Input from external experts

The NRA provides opportunities to hear opinions from external experts working in

Japan and abroad. There are various study teams where experts discuss individual regulatory challenges, including formulation of new regulatory standards, measures against nuclear disasters, etc. For assessment of conformity to the new regulatory standards, an examination meeting is held to hear opinions from external experts.

(3) Safety study

For the NRA to adequately implement its activities, it is necessary to pursue safety study to continue improving nuclear safety and to accumulate scientific/technical knowledge. The NRA decided to review research fields to tackle after FY2015 in light of past progress of safety study. On April 22, 2015, the NRA formulated "Safety Study in the NRA – 2015 version," based on which the safety research project has been implemented covering the nine research fields (nuclear installation; Specified Nuclear Facilities; internal/external events that trigger common-cause failure; the nuclear fuel cycle; the back end; nuclear disaster countermeasures and radiation protection; safeguards and physical protection of nuclear material; radiation regulation/ control; and cross-sectional challenges).

The NRA states in "The Mid-Term Goal for the First Term of the NRA" that it should especially put emphasis on the following items:

- Regulatory issues in the decommissioning process of TEPCO's Fukushima Daiichi NPS,
- Countermeasures against natural phenomena that cause common-cause failure leading to severe accidents,
- Expansion of scientific/technical knowledge related to severe accident measures, and
- Development of technical bases that support the above stated issues.

As for evaluation of the safety study, the NRA performs evaluation at each phase from prior evaluation in the research planning phase to follow-up evaluation after the research based on "The Implementation of Evaluation Related to the Safety Research in the NRA."

In addition, from a viewpoint of practical use for nuclear regulation, it is important to make results of the safety research scientifically and technologically reliable while securing traceability. It is also important to reflect results of safety study in efforts to address imminent challenges immediately. For this reason, the NRA promptly discloses results of the safe study as NRA technical report.

Collaborative research is pursued in international agencies, because nuclear safety is a common issue global. Participation in such international collaborative research plays

an important role in grasping needs for future nuclear regulation and obtaining the latest knowledge. Therefore, the NRA is actively joining international agencies such as OECD/NEA and IAEA and international collaborative research where frameworks of bilateral/multilateral cooperation are adopted.

1-5 Management system

In order to carry out duties stipulated in the Act for Establishment of the NRA, the NRA Management Rules was established in September 2014 for the purpose of maintaining and improving work quality of the NRA and building, implementing, evaluating, and enhancing an integrated management system that enables development of robust and sound safety culture supported by effective leadership with reference to ISO 9001 (JIS Q 9001), a standard specified by the IAEA. Full operation of this management system started in April 2015.

The NRA Management Rules stipulates that a PDCA cycle should be implemented as a management system in a unified manner where the cycle consists of periodical formulation of a fiscal-year emphasis plan, implementation of activities, management review, and improvement. It also stipulates organizational structure, leadership, and documentation and recording needed as a basis for implementation of the Management system as well as management of resources needed for securement, development, and effective use of high-quality human resources. In addition, the Rule also includes provisions about processes to handle items where improvement is needed, preventive measure, internal audits, aiming at promotion of efforts by the whole organization toward improvement of activities for effective implementation of them.

Article 8 (2) Status of the Regulation Body

The NRA carry out its regulation activities in a far, neutral and independent manner base on the approach to separate the regulation from the promotion of nuclear energy use. The Chairman and Commissioners of the NRA are appointed by the Prime Minister with the consent of the Diet, and the NRA Chairman appoints the staff of the Secretariat of the NRA, so other authorities on the promotion side of nuclear energy have no involvement in the appointment and dismissal of staff.

From a fiscal perspective, the activities of the NRA are funded by the national budget, with budget proposals being submitted to the Ministry of Finance by the NRA.

The budget proposals undergo appraisal by the financial authorities, according to the

fiscal situation of the government as a whole, but the authorities tasked with promoting nuclear energy are not involved from a financial perspective either.

The NRA has clear authority and competence over safety regulation, in accordance with the provisions of the Reactor Regulation Act, and it engages in independent decision-making concerning regulatory activities focused on reactor facilities, such as permits, approvals, and inspections, including nuclear reactor construction permits, without any involvement by the authorities tasked with promoting nuclear energy.

Moreover, with the objective of ensuring the independence and neutrality of regulation, Article 6, paragraph (2) of the Supplementary Provisions of the Act for Establishment of the NRA stipulates that, following a five-year period of transitional measures after the entry into force of the Act, staff members of the Secretariat of the NRA shall not be permitted to be redeployed to administrative bodies with jurisdiction over administrative matters relating to the use of nuclear energy (the so-called "no-return rule").

In 2015, in order to clarify the "no-return rule", the NRA designated offices in ministry and agency where the Secretariat of the NRA's members should not be transferred.

ARTICLE 9 RESPONSIBILITY OF THE LICENSE HOLDER

Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant license and shall take the appropriate steps to ensure that each such license holder meets its responsibility.

Outline of the Implementation of Article 9

In Japan, nuclear energy use should be aimed to ensuring safety and be performed independently under democratic management in accordance with the Atomic Energy Basic Act, and it is basic policy that licensees has primary responsibility for ensuring safety. For implementing this principle, the Reactor Regulation Act aims to enforce nuclear-related activities and regulations and stipulates primary responsibility of licensees to ensure safety.

The Reactor Regulation Act includes a system of penalties to be imposed on licensees if they violate the law or any orders based thereon.

Therefore, the provisions of the Act clearly state that those who have been granted permits shall have total responsibility about safety and be requested to perform it, which conforms to Article 9 of the Convention.

1 The Primary Responsibility to Ensure Safety

The Atomic Energy Basic Act establishes the most basic issues concerning the use of nuclear energy in Japan. This Act stipulates that "The research, development and utilization of nuclear energy shall be limited to peaceful purposes, aimed at ensuring safety and performed independently under democratic management. The results therefrom shall be made public to contribute to international cooperation."

Based on this provision, licensees bear the primary responsibility to ensure the safe and peaceful use of nuclear energy.

Furthermore, the Atomic Energy Basic Act establishes that "Those wishing to build a nuclear reactor must comply with the regulations imposed by the government, as prescribed separately by law."

In other words, those seeking or holding a license bear responsibility to comply with regulations imposed by the government as set forth in the Reactor Regulation Act.

The Reactor Regulation Act explicitly states the legal responsibilities of licensees that they "shall be responsible for installing equipment or apparatus contributing to the improvement of the safety of nuclear facilities, enhancing education on operational safety, or taking any other necessary measures for preventing disasters resulting from nuclear source material, nuclear fuel material, and reactors, while taking into account the latest knowledge on safety at nuclear facilities."

2. Measures to Ensure That Licensees Meet Their Responsibilities

In the Reactor Regulation Act, measures for operation and maintenance of reactor facility, shipment, storage and disposal are stipulated as the measures licensees should take to ensure operational safety.

These measures are detailed in the NRA Ordinance pursuant to the Reactor Regulation Act.

In addition to establishing Operation Safety Programs and obtaining NRA approval, licensees must also undergo NRA compliance inspections.

Licensees must stipulate in their Operational Safety Programs that they will disclose noncompliance information in the event that such noncompliance results in the non-fulfillment of basic operational targets. Measures have thus been put in place to ensure

that licensees do not conceal noncompliance.

Licensees are liable to penalty if they fail fulfill the legal responsibility for operational safety.

In case nuclear installations fails to meet legal technical standards or its operations contravene regulatory requirements, the NRA may require the licensee to adopt alternative operating methods or order it to take any other necessary measures pursuant to the provisions of the Act. If the licensee violates this order, the NRA may revoke its permission or order it to suspend operations for a specified period not exceeding one year.

If an operator establishes a power reactor without permission, it shall be sentenced to imprisonment with work and/or a fine, pursuant to the provisions of the Act.

The same shall apply if licensee fails to obtain Approval of Operational Safety Programs or amends it without obtaining approval, or if a licensee and/or its employee(s) fails to comply with those Operational Safety Programs.

ARTICLE 10 PRIORITY TO SAFETY

Each Contracting Party shall take the appropriate steps to ensure that all organizations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety.

Outline of the Implementation of Article 10

The NRA Ordinance on Commercial Reactors prescribes that Operational Safety Programs established by licensees shall stipulate provisions fostering safety culture and disclosing noncompliance, thereby focusing on the operational safety of reactor facilities.

Quality assurance plans have been established in Operational Safety Programs and incorporated into a quality management system to prioritize overall safety.

The NRA has been engaged in its activities along with NRA's Core Values and Principles. Furthermore, it has formulated the Statement on Nuclear Safety Culture, and setting priority to safety, it has been engaged in its activities.

Therefore, in Japan, the regulatory body and licensees and their related organizations are taking measures to set reasonable priority to safety, which means conformity to Article 10 of the Convention.

1 Regulatory Requirements Prioritizing Safety

The Reactor Regulation Act clearly states that licensees are responsible for installing appropriate safety equipment and apparatus, enhancing operational safety education, and other appropriate measures, while incorporating the latest nuclear safety knowledge.

It further stipulates that licensees must ensure safety in the maintenance and operation of nuclear installation, in the storage of waste and in other related activities.

In the event that a licensee contravenes these rules, the NRA may order to take other necessary safety measures and, if the licensee violates this order, may revoke its Reactor Installation Permit or order the licensee to suspend operation of the facility for a specific period not exceeding one year.

Moreover, licensees must establish and obtain NRA approval for Operational Safety Programs before commencing reactor operations, in accordance with the Reactor Regulation Act.

Such Operational Safety Programs are required to establish a system fostering safety culture and a plan for quality assurance incorporating safety-first into the quality management system.

Licensees and their employees must comply with Operational Safety Programs, as stipulated by the Reactor Regulation Act. If the programs are violated, the NRA may revoke its Reactor Installment Permit or order the licensee to suspend operations for a period not exceeding one year.

2 Measures to Prioritize Safety Taken by Licensees

In Operational Safety Programs, licensees must establish provisions to foster a safety culture wherein safety is the first priority of the nuclear energy business.

Further licensees must establish the policy for fostering safety culture, develop annual plan, and implement the activities for fostering safety culture, in order to realize prioritize safety in their business operations.

They must evaluate the implementation of the plan, report the results to the company president, and seek improvements in subsequent fiscal years.

Operational Safety Programs must comply with relevant legislation and the Operational Safety Programs themselves at the same time as activities to improve compliance awareness are followed.

The quality assurance plan must assign the highest priority to nuclear safety under the direct responsibility of senior management. Duties must be clearly specified, and structured in such a way to ensure that these requirements are met.

3 Efforts by the Regulatory Authority to Prioritize Safety

At its 22nd Commission Meeting in FY2012 on January 9, 2013, the NRA discussed its core values and principles, and decided that the organization's mission was to "protect the general public and the environment through rigorous and reliable regulation of nuclear activities." It established five guiding principles focusing on independence, effectiveness, transparency, expertise, and readiness, in order to achieve this mission (Table 10-1).

Table 10-1 The NRA's Core Values and Principles

The Nuclear Regulation Authority was established to absorb and learn the lessons of the Fukushima Daiichi nuclear accident of March 11, 2011. Such nuclear accidents should never be allowed to happen again. Restoring public trust, both within Japan and overseas, in the nation's nuclear regulatory organization is of utmost importance, and the nuclear safety system and management must be rebuilt on a solid basis, placing the highest priority on public safety and a genuine safety culture.
Everyone involved in nuclear activities must have a high degree of responsibility and ethical values, and seek to achieve the highest levels of global safety.
We hereby solemnly pledge our full commitment and unwavering efforts in regard to the foregoing.

Mission

Our fundamental mission is to protect the general public and the environment through rigorous and reliable regulation of nuclear activities.

Guiding Principles for Activities

We in the NRA and its supporting Secretariat shall perform our duties diligently, acting in accordance with the following principles.

(1) Independent Decision Making
We shall make decisions independently, based on the scientific and technological information, free from any outside pressure or bias.

(2) Effective Actions
We shall discard the previous formalistic handling of regulatory work and stress the importance of a field-oriented approach in achieving genuinely effective regulations.

(3) Open and Transparent Organization
We shall ensure transparency and appropriate information disclosure on regulations, including the decision-making process.

We shall be open to all opinions and advice from Japan and the international community and avoid both self-isolation and self-righteousness.

(4) Improvement and Commitment

We shall be assiduous in learning and absorbing the latest regulatory know-how and best practices, enhancing individual capacity, and performing our duties, mindful of high ethical standards, a sense of mission, and rightful pride.

(5) Emergency Response

We shall be ready to swiftly respond to all emergency situations while ensuring that in 'normal' times a fully effective response system is always in place.

On May 27, 2015, the NRA formulated "Statement on Nuclear Safety Culture," as a subordinate document related to NRA's Core Values and Principles, which concretely and clearly explains activity principles from a viewpoint of nuclear safety culture. The NRA has pronounced that it will enhance awareness of importance for nuclear safety and contribute to development of safety culture in Japan by taking initiative in accordance with "Statement on Nuclear Safety Culture"

Table 10-2 Statement on Nuclear Safety Culture

Safety shall be given the overriding priority in the utilization of nuclear energy. Safety culture is recognized as continued practices with an awareness of this principle. It is the duty of everyone involved in nuclear energy to foster safety culture.

Recognizing its importance, the NRA has developed the code of conduct on safety culture taking due account of the lessons learned from the accident at the Fukushima Dai-ichi Nuclear Power Station of Tokyo Electric Power Company. The NRA will take the initiative in acting based on it.

Thereby, the NRA will strive for raising awareness of the importance of safety culture among everyone involved in nuclear energy and hence contributing to fostering safety culture in Japan.

Code of conduct

1. Priority to safety

   In lucid recognition that absolute safety is not achievable and the possibility of a serious accident remains, the overriding priority shall be placed on safety for "protecting people and the environment".

2. Decision making taking into account the risks

   Decision shall be made in an independent and objective manner taking due account of the risks. Anyone who makes a decision is responsible for explaining logically the rationale of the decision while clarifying its own roles, responsibilities, and authority.

3. Fostering, sustaining and strengthening safety culture

   Managers shall take the initiative in fostering the attitudes and actions that place the overriding priority to safety in their respective organizations. For sustaining and further

strengthening safety culture, they shall also be vigilant to any early warning signs of decline in safety culture and shape and enhance the working environment so that the staff can maintain high morale.

4. Maintaining high level of expertise and organizational learning
   Recognizing the importance of scientific and technical expertise for safety, each organization shall collect and analyze the latest information in Japan and overseas on regulatory activities, operating experience, and failures to feedback the findings in its activities. Managers shall shape and enhance the working environment to promote such organizational learning.
5. Effective communication
   Open and frank discussion in the workplace shall be the basis in the pursuit of safety. Managers shall create such working environment and promote active discussion in their respective organizations.
   Adequate communication shall be pursued both inside/outside the organization and with stakeholders for enhancing transparency and building trust by taking the initiative in information disclosure and exchange of a wide range of opinions.
6. Questioning attitude
   All the personnel shall always have one's own "questioning attitude" without complacency whether there are any weaknesses that may affect safety, as well as whether there is any room for further improvement, and thereby identify safety issues.
7. Rigorous and prudent decisions and agile actions
   In response to any challenges to ensuring safety, all the staff shall make conservative decisions for safety taking into account even the worst-case scenario, and take necessary actions with agility.
8. Harmonization with nuclear security
   It is necessary to recognize that nuclear safety and security activities do not exist independently, namely complement each other and interfere with each other. All the personnel involved in nuclear safety and security activities shall respect each other's way of thinking and make efforts for harmonizing both activities. Senior managers shall take responsibility to select the most appropriate solution.

ARTICLE 11 FINANCIAL AND HUMAN RESOURCES

1	Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.
2	Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life.

Outline of the Implementation of Article 11

In addition to basic financial reviews in the examination stage of Reactor Installation Permits, a mechanism is always included for financial reserves to cover the cost of possible decommissioning as well as the cost of processing and disposal of all spent fuel and radioactive waste.

The recruitment of competent personnel is a regulatory requirement, and enough personnel who have sufficient competent

Therefore, the regulations are ensuring financial and human resources which means it conforms to Article 11 of the Convention.

Article 11 (1) Financial Resources

1 Regulatory Requirements

The Reactor Regulation Act requires anyone who installs nuclear facilities to have adequate financial resources, as one of criteria for permission.
In addition to a request for a Reactor Installation Permit, operators must provide appropriate financial evidence of outlining funding which is necessary for installation, such as details for acquiring the necessary fuel materials and latest assets and balance sheets. The NRA will check and confirm that any applicant has the appropriate financial resources.

2 Steps to be taken by Licensees regarding decommissioning and disposal of high-level radioactive waste

Licensees are obliged to estimate the total estimated amounts (costs needed for dismantling and those for waste processing and disposal) in each fiscal year. It is required for decommissioning of each nuclear station through the "Reserve Account for Dismantling" in accordance with the Electricity Business Act and to reserve a fund to cover decommissioning work with consent of the Minister of Economy, Trade and Industry.
While the plant is in operation, to fund the costs of any reprocessing of spent fuel, licensees must build up a financial reserve in a deposit management entity designated by the Minister of Economy, Trade and Industry, pursuant to the "Spent Nuclear Fuel Reprocessing Fund Act."
The fund amount shall be determined by such factors as the amount of spent fuel generated, the capacity and operational status of reprocessing facilities, and the cost of reprocessing. The Act states that the Minister of Economy, Trade and Industry shall notify each licensee of the amount of needed reserves according to set criteria and any necessary changes in accordance with the criteria set forth in an ordinance of the METI and licensees will be further informed should changes needed to be made in the reserves depending on status of spent fuel generation.
With regard to the final disposal of high-level radioactive waste and radioactive waste with low heat production and a long half-life (TRU waste) generated by reprocessing, the Specific Radioactive Waste Final Disposal Act stipulates that needed financial reserves shall be calculated by multiplying the final disposal cost per unit of high-level

radioactive waste by the quantity of generated waste; and that the final cost of disposal per unit shall be prescribed in an ordinance of the METI, based on these factors.
Funds designated for the final disposal of high-level radioactive waste generated through spent fuel reprocessing shall be deposited with a Deposit Management Entity designated by the Minister of Economy, Trade and Industry.
The legislation limits the ability to utilize these reserves which may not be used for anything other than their designated purpose. Furthermore, the Minister of Economy, Trade and Industry may conduct on-site inspections of electric utilities and Deposit Management Entities.

Article 11 (2) Human Resources

1 Regulatory Requirements

In granting Reactor Installation Permits the NRA must ensure that the applicant possesses the technical and personnel ability to build such a facility, operate it safety and efficiently and prevent severe accidents.
Before commencing reactor operations, licensees must both outline Operational Safety Programs and obtain NRA approval.
There are regulatory requirements to ensure operational safety that only fully qualified staff and technicians meeting NRA criteria and having undergone NRA checks are engaged in the reactor operation. Checks must be carried out before the reactor is started, while it is operational, and after it is shutdown.
The NRA Ordinance on Commercial Reactors outlines Operational Safety Programs, including the content of operational safety education and its implementation for personnel operating and managing reactor facilities.
A quality assurance plan in the Operational Safety Programs outlines requirements on staff competence for operational safety and any supplemental education or training to be implemented should staff be deficient in such competency.
The NRA conducts inspections four times a year, focused compliance with Operational Safety Programs, as well as checking that competence management and education and training are carried out appropriately.
From among qualified applications, including the provisions of the NRA Ordinance, licensees must appoint a Chief Reactor Engineers to supervise the operational safety of reactor operations.

When implementing decommissioning measures, licensees must establish appropriate Operational Safety Programs and obtain NRA approval.
Human resource provisions covering Operational Safety Programs follow the same system as those for reactor operations, including operational safety education in such fields as decommissioning and providing for competence management and similar matters in the quality assurance plan as well.

2 Check by licensees on technical ability

To secure safety of nuclear power plant, securing high awareness of nuclear safety and excellent knowledge and technical ability held by on-site personnel involved in operation and maintenance are important. Licensees are making effort on the education and training of personnel involved in operation and maintenance in specialized facilities inside and outside their companies on a long-term basis following their plans. For operation training, the licensees have operation training facilities (simulators) to implement emergency response training and training on reproduced failure and troubles. There are specialized facilities for different reactor types outside their companies: the BWR Training Center (BTC)[7] for BWR and the Nuclear Power Training Center (NTC)[8] targeting PWR, both of which are used for basic education and simulator training of operation staff of nuclear facilities of the licensees. In training in these Training Centers, curriculums designed according to ability of operation staff are available. The licensees periodically dispatch operation staff to the operation training facilities for re-training of them.
Persons responsible for operation are required to have not only knowledge and technical ability directly needed for operation of reactor facilities but also leadership and capability of crisis management. Accordingly, training for this purpose is provided for them. Persons responsible for operation are also required to have a level of performance that conforms to the following standards set up by the NRA.

- Have five year or more work experiences related to reactor operation.
- Have six month or more work experiences in operation of the same type of reactors within the last one year.
- Hold state at a management or supervisory level in a nuclear power station.
- Have knowledge and technical ability concerning reactors.

[7] http://www.btc.co.jp/e_training.html
[8] http://www.jntc.co.jp/en/index.html

In response to designation by licensees in April 2009, JANTI[9] has come to be engaged in competence determination of persons responsible for operation that is subject to the code related to assessment of persons responsible for nuclear power station operation (JEAC4804) and the acceptance rule of the licensees. The determination is made based on operation skill tests using a simulator, training sessions, and an oral examination. When conformance to standards is confirmed with a person, a certification is granted. This certification is valid for three years.

For maintenance staff, trainings through daily practical business or on-the-job training (OJT) applies and each licensee sets up a maintenance training center, thus providing its employees and employees of maintenance-related companies with education on Operational Safety Programs and radiation protection as well as training on practical maintenance work using actual models of equipment and facilities unique to the nuclear energy industry. There are also various types of training courses on equipment produced by manufacturers, and engineers are dispatched to these manufacturers for training.

[9] The Japan Nuclear Technology Institute. JANTI was reformed to JANSI in November 2012.

ARTICLE 12 HUMAN FACTORS

Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.

Outline of the Implementation of Article 12

Licensees must deal with both human and organizational factors in anticipating problems and managing any noncompliance with rules and regulations.

In the Operational Safety Program and its quality assurance plan, licensees set force guidelines dealing with noncompliance. These include programs for the analysis, prevention, detection, and correction of human error, and for self-appraisal of management and organizational problems.

Incidents of noncompliance due to human or organizational error are shared within the licensee organization, as well as with other licensees to ensure a strong and effective system.

All designs must incorporate appropriate measures to prevent mis-operations by operators.

Therefore, it is confirmed that human factors are included in the regulatory requirements, and facility design and safety activities subject to them are put into practice, which means conformity to Article 12 of the Convention.

1 Regulatory Requirements

In the rule on the standards about locations, structure and equipment of the commercial power reactors and auxiliary facilities (the Reactor Installation Permit standards), it is required in designing nuclear reactors to take necessary measures to prevent operational error. In the rule on technical standards of commercial power reactors and auxiliary facilities, it is required in design of control rooms to install systems in such a way as to ensure their safe operation and prevent any operational error.

It is required to set a quality assurance plan in Operational Safety Programs at a stage of operation, so that nonconformance due to human error is a target of nonconformance control in quality assurance activities.

Licensees are required to undertake close analysis and evaluation of human error, and take measures to prevent future human error situations.

The NRA evaluates these licensee measures during Operational Safety Inspections.

Guidelines are described in the *Guidelines for Evaluation by Regulatory Authorities of Autonomous Initiatives by Business Operators for Rectifying Noncompliance Concerning Direct Factors in Human Error* (February 2008). The Guidelines state that clarity is essential in analyzing the direct cause of any problem and whether human error was responsible. The mechanism for sharing information with other licensees' about noncompliance due to human error must also be clear, as well as the system for enabling all licensees to effectively utilize such information.

Noncompliance events are classified according to their impact on overall safety with categories including accident/failure, deviation from operational conditions, violation of Operational Safety Programs, and autonomous analysis of direct causes. Key points to be checked in specific examples include:

- that the condition of systems, equipment, and components and any changes therein; and the behavior of individuals, relationships between individuals, and communications, are described logically, together with any associated problems.
- that factors surrounding any human error are summarized objectively in a way easily understood by third parties; that safety factors are identified and described in specific detail; and that proposed corrective safety measures are described in specific terms and then applied if necessary.

Accumulating, analyzing and utilizing data from human error noncompliance are checked during Operational Safety Inspections taking into account the frequency and

timing of data analysis carried out by each licensee:

- that data concerning direct causes of noncompliance resulting from human error are collected and accumulated;
- that this accumulated data is analyzed;
- that, should the collected data indicate such actions are necessary, preventive measures are formulated, evaluated, and implemented and the outcomes checked; and
- that information about noncompliance resulting from human error is shared with other licensees and utilized as appropriate.

The overall objective is not to assign individual responsibility but to construct a more efficient operational management structure to try to eliminate human error or, if it occurs, to reduce the severity of the impact. Based on this objective, the NRA conducts the aforementioned checks, while encouraging licensees to implement the PDCA cycle (Plan ⇒ Do ⇒ Check ⇒ Act ---make improvements and formulate another plan), share the information with their workers and other licensees and implement continuous improvement initiatives.

2 Prevention of human error

In NPSs in Japan, measures to prevent human error are taken not only with hardware but also in operation management. As measures to prevent human error based on hardware, man-machine interfaces on the control panel have been improved for prevention of mis-operations, and an interlock system has been introduced to prevent equipment from working in response to wrong operation. In addition, a fail-safe system has been introduced which is designed to ensure operation of equipment on the safe side in case that failure occurs in part of a system.

For example, the Japan Electric Association formulated the “Rule on Equipment Design for Mis-Operation Prevention in Reactor Control Rooms of Nuclear Power Stations” (JEAG-4624) that specifies required items for systems to be installed in such a way as to ensure their safe operation and prevent any mis-operation in the reactor control rooms of nuclear power stations, which has become a guideline for licensees in their designing of control rooms.

As for measures licensees take to meet regulatory standards related to mis-opertaion prevention, such methods of preventing mis-operation are adopted as use of display devices on the control panel; arrangement of alarm equipment and operating devices; distinction by color for each type of liquid flowing inside the piping on site; locking

control of control panels of equipment and manual valves.

In terms of operation and control, licensees are required to set up a system to foster safety culture and a quality assurance plan, and also provide provisions related to safety education targeting staff in charge of operation and control of reactors in their Operational Safety Programs. In addition, as part of quality assurance activities, they are providing accident prediction training, including case study based on past failure examples, for staff in charge of operation and control by having them form small groups as a target of the training, in order to have safety actions established in their work.

ARTICLE 13 QUALITY ASSURANCE

Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation.

Outline of the Implementation of Article 13

The NRA has standards in place for quality assurance in the design phase of a nuclear power plant and requires a licensee to develop a quality assurance plan in its Operational Safety Program. This ensures that a quality assurance plan will be developed and implemented in all activities, from the design phase to the operational and decommissioning phases, which are important to nuclear safety. Thus, the provision of Article 13 of the Convention is achieved.

1 Regulatory Requirements and Measures

Under the Reactor Regulation Act, one of the criteria for obtaining construction approval of a nuclear facility is that the quality control methods and inspection systems comply with technical standards of the NRA Ordinance (the *NRA Ordinance on Quality Control Methods*).

In practice, this ordinance requires that a quality control supervision system be established for the design and construction of reactor facilities; that the responsibility of management executives be clearly stated; and that management of human and other resources, planning and implementation of specific duties, measurement, analysis, and continuous improvement be carried out.

Concerning operational safety activities, licensees must outline a quality assurance plan in their Operational Safety Programs, and must make continuous improvements to this plan, as well as planning, implementing, evaluating, and improving operational safety activities.

Quality assurance plans must be operated by licensee senior management; have clearly identified responsibilities, authority, and duties; and to feature mechanisms for the formulation, implementation, evaluation, and continuous improvement of such plans.

Operational safety plans must establish appropriate management methods covering external goods or services procurement; procedures for the appropriate management of operational safety documents and records; and education and training courses in safety activities.

It is necessary to clarify individual goals and requirements during operational safety activities, and to check at appropriate times that these are being carried out in accordance with the implementation plan.

To check this, licensees must conduct requisite inspections and tests, and establish an effective system to deal with incidents of noncompliance.

To evaluate operational safety activities, licensees must conduct systematic monitoring and implementation procedures; auditing should be carried out on a regular basis by persons not directly involved in the items under review.

Licensees should establish procedures to ensure the continuous improvement of operational safety activities and to institute preventive measures to avoid noncompliance situations or, should one occur, to introduce remedial measures to prevent a reoccurrence. Preventive knowledge acquired at both their own plant and other nuclear facilities should be evaluated and, where appropriate, incorporated by

licensees in their operations.

2 Implementation Status of Quality Assurance by Licensees

Based on the private-sector quality assurance standard for ensuring safety at nuclear power stations (JEAC 4111-2009), licensees formulate quality assurance plans and conduct quality assurance activities in order to meet the regulatory requirements mentioned above.

The technical adequacy of the JEAC 4111-2009 standard was evaluated by the former regulatory authority, NISA, when it was published as a set of specifications and criteria for meeting statutory performance standards; it complies with the quality assurance requirements of the IAEA's safety standard GS-R-3.

In terms of the general requirements in JEAC 4111-2009, licensees are required to establish, document, implement, and maintain a quality management system, as well as making continuous improvements. These regulations establish specific requirements for a quality management system including "responsibility of top executives," "operational management of resources," "planning and implementation of duties," and "evaluation and improvement."

Human resources requirements stipulate that key personnel involved in nuclear safety must be competent in areas such as education, training, skills and experience.

Licensees must identify needed competences and if necessary provide further education and training to ensure personnel reach the necessary standards.

Licensees should conduct procurement procedures having clearly identified the requirements for product approval procedures, processes, and equipment; personnel competence checks, and quality management systems. Moreover, the standard stipulates that procured items must be inspected on the premises of the supplier if possible to ensure that they meet set standards.

Reactor quality assurance programs are audited.

To guarantee its impartiality an audit should be conducted by the appropriate authority at the licensee's head office and it should have no direct involvement with the department running the nuclear facility. The auditing department should be directly under the president in the company's organizational structure so that he can be quickly informed of any situation needing remedial action or improvement.

In procurement management, it is common for licensees to conduct audits of suppliers directly, to ensure that the suppliers satisfy the specification sheet requirements.

Such specification sheets are given to the supplier at the time of ordering and

products are then checked upon delivery.

If checks are required during the product manufacturing process, licensees can directly check that process.

In the case of services, the specification sheet is given to the service provider in advance in order to ensure that a person with the requisite skills is recruited.

These include checking to confirm the provider has technicians with the required specific skills i.e. welding.

On the issue of outsourcing, the provider must submit to the licensee a quality assurance plan to guarantee all requirements are met.

This prevents sub-standard outsourcing to providers with inappropriate quality assurance systems.

This provides licensees in Japan with the confidence that quality assurance systems constitute one of the major elements for maintaining their own quality assurance systems; accordingly, mechanisms to enable licensees themselves to conduct audits of providers and suppliers are being developed, as required.

ARTICLE 14 ASSESSMENT AND VERIFICATION OF SAFETY

Each Contracting Party shall take the appropriate steps to ensure that:

(i) comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;

(ii) verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.

Outline of the Implementation of Article 14

In obtaining a reactor installation permit, licensees must conduct an evaluation to confirm that the basic reactor facility design can realize disaster prevention measures. During construction licensees must evaluate safety measures of all processes approved in the construction plan.

After the start of operation of the nuclear power reactor facility, the licensee is required to conduct an evaluation for improvement in the safety of the facility as well as to report to the NRA and disclose the results of the evaluation. The licensee must conduct an aging evaluation every 10 years after 30 years of operation and an evaluation for a license application before 40 years of operation to extend the period of operation.

The Reactor Regulation Act stipulates that pre-service Inspections are conducted at the construction stage, and that Periodic Facility Inspections and Operational Safety Inspections are carried out during the operational stage, with checks focusing on both the hard and soft aspects of the safety of reactor facilities.

An evaluation was conducted during the installation phase and operational life of the nuclear power facility under the supervision of the regulatory body. Thus, the provision of Article 14 of the Convention is achieved.

Article 14 (1) Safety Assessments

1 Overview of regulatory requirements

Anyone seeking to construct reactor facilities, in addition to an installation permit application, they must provide evidence that the basic design and design principles can realize disaster prevention. Such documentation will be submitted to the NRA, pursuant to the provisions of the Reactor Regulation Act.

The Installation Permit procedure is detailed in Article 18.

After obtaining a Reactor Installation Permit, licensees must obtain approval for their construction plans, as well as for the design of the fuel assembly to be loaded in the reactor.

When seeking construction plan approval, applicants must append a safety evaluation conducted by the licensee, based on the detailed design for the reactor facility. This document will cover earthquake-resistance and strength, as well as an attachment document concerning the safety-related design features specific to the equipment for which the application is being submitted.

When seeking approval for the design of the fuel assembly, applicants must attach a document covering such features of the fuel assembly as its heat, radiation and corrosion resistance, as well as a document featuring calculations of the strength of the fuel assembly (or the fuel elements, if the assembly consists of a bundle of fuel elements), a structural drawing of the fuel assembly, a flow chart for processing, and an attachment document concerning quality assurance.

Licensees must conduct welding inspections focusing specifically on areas which must withstand extra pressures and the containment vessel. Licensees welding inspections must be reviewed by the NRA.

Before beginning reactor operations, licensees must obtain approval for their Operational Safety Programs, with which they must comply to assure such operational safety.

Matters concerning construction plans, Pre-service Inspections, Fuel Assembly Design Approval, Fuel Assembly Inspections, and Welding Safety Management Reviews are detailed in Article 18.

In response to the Fukushima Daiichi accident the Reactor Regulation Act was revised in June 2012 and an evaluation system to enhance the safety of commercial power reactor facilities was introduced. This is described in Section 2-2.

2 Safety evaluation on reactor installation

2-1 Safety evaluation in the reactor installation permit phase

In the application for a reactor installation permit, the applicant is required to present the conditions used to evaluate the necessary equipment to manage accidents due to abnormal transient events, design basis accidents and severe accidents and the extent and effect of the anticipated accidents, and explain that the safety of the reactor facility is ensured, based on the results of the evaluation.

2-2 Evaluation of safety improvement

A new safety improvement evaluation program was introduced into the 2012 revised Reactor Regulation Act. The program is to require the licensee to conduct an evaluation of the safety of the power reactor facility by themselves no later than six months after the day on which periodic inspection of the facility ends. After the evaluation, the licensee must report the results of the evaluation etc. to the NRA without delay and disclose the results.

For the report of evaluation of safety improvement, the investigation, analysis or assessment conducted by the licensee is determined not to comply with the method set forth in the NRA Ordinance Concerning the installation and operation of Commercial Power Reactor, the NRA can order the licensee to change to improve the method of investigation, analysis or assessment.

2-3 Aging management

The oldest reactor facilities in Japan have been operating since the 1970s, or 40 plus years. Dealing with age-related deterioration is therefore a crucial issue.

In a technical aging evaluation, aging events to be noted in terms of aging management are identified in all of the aging events that have occurred or may occur in components and structures with safety functions and the integrity of the components and structures against the identified events is evaluated. In addition, the effectiveness of current maintenance management is evaluated and those to be added as needed are identified. This evaluation is conducted in every ten years after 30 years of operation and implementing maintenance in the coming ten years must be developed and the revised operational safety program that reflects the policy must be approved by the NRA.

2-4 Operational Extension Period

The Reactor Regulation Act prescribes an operating life of 40 years, but it is possible to

extend this once, for a period of no more than 20 years, if approval is obtained from the NRA.

In determining whether or not to extend the operation period of a facility, it is necessary to ascertain the current status of the plant in detail so extension applicants must conduct a special inspection to assess such factors as deterioration.

Licensees must carry out a technical evaluation of any deterioration, set out their maintenance and management policy during the extension period, and append these details to their extension application.

The special inspection must include all equipment, components, and structures with functions required to ensure plant safety that have not hitherto been subject to a deterioration inspection or which have only undergone partial inspection, excluding those items that should be dealt with as part of the usual maintenance process. More specifically, it involves inspections of such components as the base metal of the reactor pressure vessel, and strength checks of concrete structures by means of core sampling.

The main equipment subject to special inspections in PWR and BWR is shown in Tables 14-1 and 14-2, respectively.

Table 14-1 Equipment and Areas Subject to Special Inspection at PWR Plants and the Inspection Methods Used

Equipment Targeted	Areas Targeted	Inspection Method
Reactor vessel	- Base metal and welded parts (100% of the reactor core area)	- Check for defects using ultrasonic inspection
	- Primary coolant nozzle side (the part with the highest fatigue usage factor)	- Check for cracks by means of surface inspection or eddy-current testing
	- Bottom mounted instrumentation nozzles (all)	- Check for cracks in the welded parts in question, using MVT-1[10], and check for defects on the inner surface of the bottom mounted instrumentation nozzles by means of surface inspection or eddy-current testing
Containment vessel	- Steel plates for the containment vessel (all areas to which it is possible to get close enough to inspect) - Pre-stressed concrete containment	- Visual check of the condition of the coating - Checks of strength, concrete carbonation, and salt penetration by means of core sampling

[10] Visual inspection using a camera that can distinguish between wires with a width of 0.025mm

Equipment Targeted	Areas Targeted	Inspection Method
	vessel	
Concrete structures	- Concrete structures designed to ensure the safety of reactor equipment[11] (primary shield wall)	- Checks of strength, concrete carbonation, and salt penetration by means of core sampling

Table 14-2 Equipment and Area Subject to Special Inspection at BWR Plants and the Inspection Methods Used

Equipment Targeted	Areas Targeted	Inspection Method
Reactor pressure vessel	- Base metal and welded parts (reactor core area and all areas to which it is possible to get close enough to inspect)	- Check for defects using ultrasonic inspection
	- Primary coolant nozzle side (the part with the highest fatigue usage factor)	- Check for cracks by means of surface inspection or eddy-current testing
	- Control rod drive mechanism stub tubes and drive housing (all).	- Check for cracks in the welded parts in question, using MVT-1[1], and check for defects on the inner surface of the housing by means of surface inspection or eddy-current testing
	- Foundation bolts (all)	- Check via ultrasonic inspection, to ensure there are no anomalies within the bolts
Containment vessel	- Suppression chamber vent pipes and vent pipe bellows (Mark I, modified Mark I)	- Check for hazardous defects or cracks, by means of surface inspection of all relevant surfaces, using MVT-1[12]
	- Steel plates for the containment vessel (all areas to which it is possible to get close enough to inspect) - Reinforced concrete containment vessel	- Visual check of the condition of the coating - Checks of strength, concrete carbonation, and salt penetration by means of core sampling
Concrete structures	- Concrete structures with functions required to ensure the safety of reactor equipment[2] (reactor pressure vessel pedestal or equivalent part, etc.)	- Checks of strength, concrete carbonation, and salt penetration by means of core sampling

It is required for approval of an operational extension period of that, all construction plans required to comply with the technical standards have already been approved or submitted by the time the operational extension period is approved and the results of technical aging

[11] Support functions, shielding functions, leak-prevention functions, etc.

[12] Visual inspection using a camera that can distinguish between wires with a width of 0.025mm

evaluation comply with the requirements[13] in Table 14-3 during the extended operational life. If the results of the technical evaluation do not comply with the requirements, the implementation of the maintenance policy may be considered in an evaluation for compliance with the requirements.

Table 14-3 Requirements for the Extension of the Operation Period

Events/issues to be evaluated	Requirements
Low-cycle fatigue	As a result of evaluation of integrity, the fatigue usage factor for the area to be evaluated should be less than 1.
Neutron irradiation embrittlement	• As a result of evaluation of pressurized thermal shock, the value of the static planar strain fracture toughness in the area to be evaluated of the reactor pressure vessel should exceed the value of the stress intensity factor. • The following requirements should be met depending on the in-service state of the reactor pressure vessel. This does not apply if the upper shelf absorbed energy is equal or more than 68 J. - As a result of evaluation of ductile crack growth, in the area to be evaluated, the crack growth resistance exceeds the crack-driving force. - As a result of evaluation of crack instability, in the area to be evaluated, the crack growth resistance is equal to the crack-driving force and the minimal change rate of the crack growth resistance exceeds that of the crack-driving force. - As a result of evaluation of crack depth, in the area to be evaluated, the crack depth does not exceed 75% of the wall thickness of the reactor pressure vessel. - As a result of evaluation of a plastic instability failure, it does not occur in the area to be evaluated. • From the above evaluation results, it is determined that it is possible to set the limits of the temperature and pressure range of the primary coolant during normal heating and cooling of the primary coolant system that can be complied with as operating limits, the leakage during the service life from the reactor coolant pressure boundary or the minimum temperature of the reactor coolant in a hydraulic test.
Irradiation-assisted stress corrosion	If, as a result of evaluation of integrity, it is determined

[13] Examination criteria for the extension of the operation period of commercial power reactors

Events/issues to be evaluated			Requirements
cracking			that irradiation-assisted stress corrosion cracking may occur in the area to be evaluated, the criteria set forth in the Technical Standards should be met based on the assumption that an irradiation-assisted stress corrosion crack is generated and grows.
Thermal aging of duplex stainless steel			• As a result of evaluation of ductile crack growth, in the area to be evaluated, the crack growth resistance exceeds the crack-driving force. • As a result of evaluation of crack instability, in the area to be evaluated, the crack growth resistance is equal to the crack-driving force and the minimal change rate of the crack growth resistance exceeds that of the crack-driving force.
Decrease in electrical insulation of electrical and/or instrumentation equipment			• As a result of evaluation of integrity based on the results of inspection, there is no significant decrease in the electrical insulation of electrical and/or instrumentation equipment. • As a result of evaluation of integrity based on the results of environmental qualification testing, there is no significant decrease in the electrical insulation of electrical and/or instrumentation equipment.
Concrete structure	Decrease in concrete strength	Heat	If the concrete temperature in the area to be evaluated has exceeded the limit (90°C for penetrations and 650°C for others), a strength evaluation should be conducted and the strength of the members or structures comprising the area should exceed the design load.
		Radiation	If the cumulative radiation dose of the area to be evaluated exceeds or may exceed a level that may affect the strength of concrete, a strength evaluation should be conducted and the strength of the members or structures comprising the area should exceed the design load.
		Neutralization	If it is determined that the neutralization of concrete in the area to be evaluated has reached or may reach a depth where the corrosion of the reinforcing bars is initiated, a strength evaluation should be conducted and the strength of the members or structures comprising the area should exceed the design load.
		Chloride penetration	If significant cracking due to reinforcement corrosion caused by chloride penetration has occurred or may occur in the area to be evaluated, a strength evaluation should be conducted and the strength of the members or structures comprising the area should exceed the design load.

Events/issues to be evaluated			Requirements
		Alkali-aggregate reaction	If significant cracking due to alkali-aggregate reaction has occurred in the area to be evaluated, a strength evaluation should be conducted and the strength of the members or structures comprising the area should exceed the design load.
		Mechanical vibration	If significant cracking due to mechanical vibration has occurred in the surface of concrete in the anchorage zone in the concrete foundation of the equipment to be evaluated, a strength evaluation should be conducted and the strength of the members or structures comprising the area should exceed the design load.
		Freezing and thawing	If significant cracking due to freezing and thawing has occurred in the area to be evaluated, a strength evaluation should be conducted and the strength of the members or structures comprising the area should exceed the design load.
	Degradation of shielding performance of concrete	Heat	If the temperature of the concrete neutron radiation shield has exceeded 88°C or the temperature of the concrete gamma radiation shield exceeds 177°C, a radiation shielding evaluation should be conducted and the shielding performance of the members or structures comprising the area should not be lower than the level set forth in the reactor installation permit.
	Decrease in the strength of reinforcing bars	Corrosion	If a loss of cross-section due to corrosion has occurred in the area to be evaluated, a strength evaluation should be conducted and the strength of the members or structures comprising the area should exceed the design load.
		Fatigue caused by wind and other loads	If a fatigue failure caused by wind and other cyclic loads has occurred or may occur in the area to be evaluated, a strength evaluation should be conducted and the strength of the members or structures comprising the area should exceed the design load.
Events to be evaluated other than the above			In an event not subject to degradation management, such as degradation trend monitoring, has occurred or progressed or may occur or progress, an evaluation of integrity should be conducted based on the assumption that it occurs and progresses, and the results should meet the criteria set forth in the Technical Standards.
Evaluation of seismic safety			• The stress in equipment or a structure caused by seismic forces and the usage factor that are determined in consideration of aging events should be below the allowable seismic design limit. • The stress in equipment or a structure caused by

Events/issues to be evaluated	Requirements
	seismic forces, the crack-driving forth and the stress intensity factor that are determined in consideration of aging events should be below the allowable fracture mechanics evaluation limit under expected service conditions. • The response acceleration of equipment or a structure required to function dynamically in an earthquake that is determined in consideration of aging events should be less than the level at which the equipment or structure has been confirmed to function. • The displacement of a fuel assembly in an earthquake that is determined in consideration of aging events is less than the relative displacement at which the fuel assembly has been confirmed to function or the control rod insertion time is less than the value specified for safety evaluation.
Evaluation of tsunami safety	The stress in equipment or a structure caused by a tsunami that is determined in consideration of aging events should be below the allowable limit.

Deterioration situations subject to evaluation and the evaluation techniques to be used are outlined in technical evaluations of deterioration. The evaluation focuses on situations such as stress corrosion cracking, corrosion, embrittlement, abrasion, fatigue cracks, and other possibilities.

During an extension period licensees must submit a maintenance and management policy covering all relevant maintenance measures identified as a result of technical evaluation of deterioration.

During an extended operational period, a system for aging management is used. Under this system, licensees operating reactors 30 years or older are required to include in their Operational Safety Programs a deterioration evaluation for equipment covering a period of ten years and a maintenance and management policy, thereby ensuring compliance. Efforts are made to ensure appropriate implementation including a maintenance and management policy focused on the period up to the last day of the extended operation period of the facility run for ten years.

The content implemented in each operational cycle, fleshing out the maintenance and management policy, is reflected in the inspections of individual items of equipment and the maintenance plan, taking into account past inspection performances and the status of deterioration. These details are checked by the NRA.

Under this system, an NRA Operational Safety Inspector checks the implementation

status of the maintenance plan by such means as an Operational Safety Inspection. Figure 14-2 provides an outline.

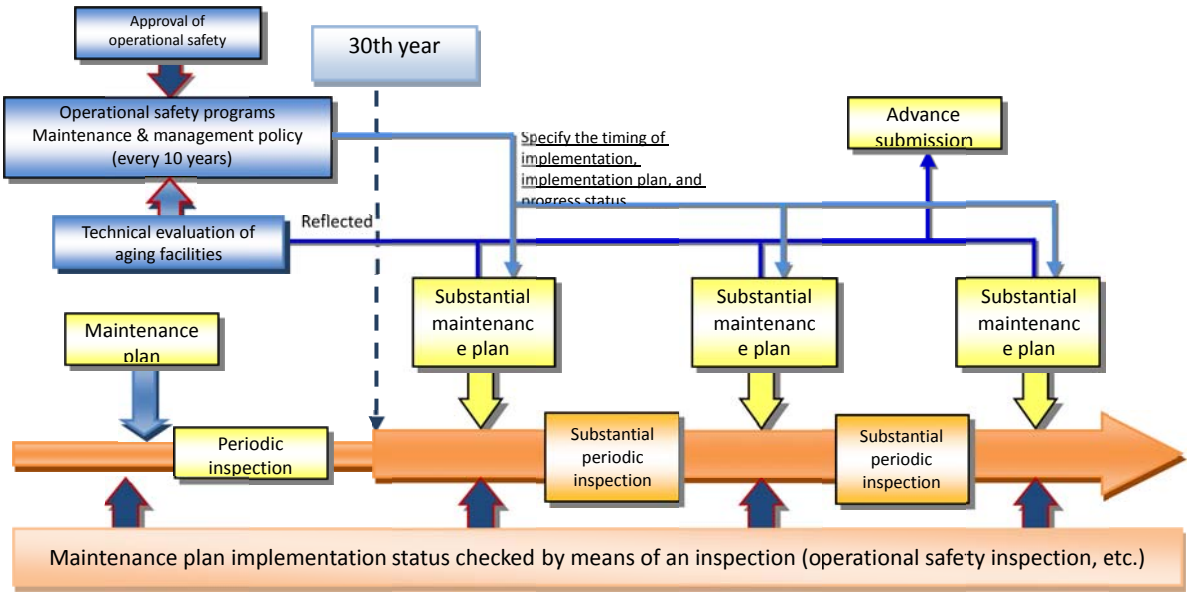

Figure 14-2 Maintenance Activities at Reactor Facilities

Article 14 (2) Verification of Safety

After receiving approval for the construction plan, the licensee may not use the facility until it has passed a Pre-service Inspection.

The licensee may not use the fuel assembly unless it has passed a Fuel Assembly Inspection.

Licensees are obliged to undergo Periodic Facility Inspections and inspections of the status of their compliance with the Operational Safety Programs.

A report on inspections pursuant to the Reactor Regulation Act is provided in Article 19.

ARTICLE 15 RADIATION PROTECTION

Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

Outline of the Implementation of Article 15

Working conditions of radiation workers at nuclear facilities ensure they are not exposed to levels in excess of those prescribed in law.

Established release control targets for gaseous and liquid wastes are set lower than legal concentration limits. Such waste is treated by filtration or allowing radioactive decay over time to reduce the concentration of radioactive material that it contains, and is managed to ensure that radioactivity concentrations outside the supervised area do not exceed the prescribed limits.

Activities to reduce the exposure dose include management of prior records of radiation exposure and task management.

Thus, it is ensured that the dose of workers and those engaged in radiation work is kept as low as reasonably achievable and does not exceed the dose limits. Thus, the provision of Article 15 of the Convention is achieved.

1 Regulatory Requirements

Radiation control in commercial power reactor facilities is provided for in the Ministerial Ordinance for Commercial Power Reactors under the Reactor Regulation Act. Baseline levels for dose limits etc. are specified in the notification (Notification on Doses) of the NRA.

Radiation controlled area, protection area and supervised area are required to be designated in a commercial power reactor facility. Radiation doses, concentrations and density in controlled areas and dose limits outside the supervised areas are specified in the Notification on Doses.

Radiation controlled area must be clearly separated by a fence or wall from other areas by placing an identification sign, and is subject to measures, such as access control and lock control, depending on the risk of radiation. A protection area is out of radiation controlled area that requires special control to ensure the safety of a nuclear reactor facility. The area must be clearly differentiated from other areas by placing a sign or offering other means of identification and are subject to measures, such as access control, lock control and a restriction on objects to be brought out in accordance with the requirements.

A supervised area is an area around a controlled area, outside of which the dose limits set by the NRA are not likely to be exceeded. People are prohibited from living in this area. A fence must be placed along the boundary to restrict the entry of people other than those who enter the area to work.

For the purpose of radiation control of radiation workers, the commercial power reactor licensee is required to ensure that the dose of radiation workers should not exceed the dose limits set by the NRA and the concentration of airborne radioactive material inhaled by radiation workers does not exceed the concentration limits set by the NRA. If it is unavoidable due to an emergency such as damage to a commercial power reactor, the licensee is allowed to engage radiation workers in emergency work within the dose limits set by the NRA. The dose limits set by the NRA are shown in the Table 15-1 below.

Table 15-1 Dose limits

Item	Dose limits
A Radiation worker	
(1) Effective dose limit	100 mSv/5 years and 50 mSv/year
(2) Women	5 mSv/3 months in addition to the limit specified in (1)
(3) Pregnant women	1 mSv for internal exposure in addition to the limit specified in (1); for the period after the employee comes to know about the pregnancy until the baby is born
(4) Equivalent dose limit for the lens of the eye	150 mSv/year
(5) Equivalent dose limit for the skin	500 mSv/year
(6) Equivalent dose limit for the surface of the abdomen of pregnant women	2 mSv; for the period after the employee comes to know about the pregnancy until the baby is born
B Radiation workers to engage in emergency work	
(1) Effective dose limit	100 mSv (250 mSv)[14]
(2) Equivalent dose limit for the lens of the eye	300 mSv
(3) Equivalent dose limit for the skin	1 Sv

For the purpose of discharge control of radioactive waste, in discharging gaseous waste, the concentration of radioactive material in the discharge gas must be reduced as much as possible in a exhaust air system by means such as filtering the gas, reducing the radiation level over time and diluting it with a large amount of air, and the concentration of radioactive material in the discharge gas must be monitored at the discharge outlet or in the discharge gas monitoring system. In discharging liquid waste, the concentration of radioactive material in the discharge water must be reduced as much as possible in a drainage facility by means of filtering the liquid, evaporating it, adsorption in an ion exchange resin column etc., reducing the radiation level over time, and diluting with a large amount of water, and the concentration of radioactive material in the discharge water must be monitored at the discharge outlet or in the discharge water monitoring system.

[14] The dose rate limit in case any event described in any number of section 2, article 7th of the "Notification to Establish Dose Limits in Accordance with the Provisions of NRA Ordinance on Activity of Refining Nuclear Source or Nuclear Fuel Materials "(NRA Ordinance No.8) occurred.

2 Licensee's radiation protection program

In addition to measures required by regulation, such as compliance with the designation of radiation controlled areas and other areas and the dose limits required by regulation, licensees have detailed radiation control measures in place, such as the use of a personal dosimeter with an alarm to measure a radiation dose at each entry into a radiation controlled area. In Japan, the ALARA concept is widely accepted by licensees. Essentially, in conducting radiation works, it is understood that unnecessary exposure should be avoided. In a nuclear power plant in operation, three elements (time, distance and shielding) in reducing exposure are implemented, such as controlling access to radiation controlled areas, reducing the duration of work by performing radiation work in a planned manner, ensuring the distance from radiation sources, and installing a shield. In addition, the water quality of primary systems is fully controlled to reduce the generation of radiation sources by activation in primary systems.

Based on the Nuclear Reactor Act, in our country, any nuclear reactor licensee is required to record the dose rate of the radiation workers and store the records during the period required by the NRA Ordinance.

The records as provided above shall be stored, provided, however, that this shall not apply where the person who has lost his position as a radiation worker or where the said records are to be passed to the organization specified by the NRA after they have been stored for 5 years or longer, the Radiation Effect Association is designated as the specified organization.

The figure below shows the ten-year total and average dose of radiation workers in nuclear power plants, excluding the Fukushima Daiichi Nuclear Power Station.

The Fukushima Daiichi Nuclear Power Station is currently in the process of recovery from the accident and the working conditions there are different from those in other power plants. The total number of radiation workers is about 47,900 in all power plants, excluding the Fukushima Daiichi Nuclear Power Station, while there are about 20,700 radiation workers in the Fukushima Daiichi Nuclear Power Station alone. In Fukushima Daiichi, a very large number of radiation workers work and doses in the work environment are high. Therefore, if the data from the Fukushima Daiichi Nuclear Power Station is included, its contribution accounts for most of the total and average dose data. In 2014, the total dose in Fukushima Daiichi was 104.55 person- Sv and the average dose was 5.0 mSv.

3 Dose reduction efforts in the Fukushima Daiichi Nuclear Power Station

In the early stages of the earthquake disaster in the Fukushima Daiichi Nuclear Power Station, the system such as that for worker access control and dose data collection and processing was damaged and electronic dosimeters and charging equipment were not available for use, making it difficult to fully perform individual dose control. Currently, the system is back in operation, and individual dose control has been in place and dose reduction efforts have been made.

TEPCO has made efforts to reduce the doses by providing a radiation shield for highly radioactive equipment on the site of the Fukushima Daiichi Nuclear Power Station, cutting trees, and performing decontamination activities such as removing surface soil and plowing to replace surface soil with subsoil.

Due to these efforts, in most of the site area of the power plant, workers can work with simple respiratory protective equipment on, such as a half-face mask or dust respirator. In dose control, significant improvements have been made to the work environment. For example, the average dose has been reduced to about 1 mSv/month.

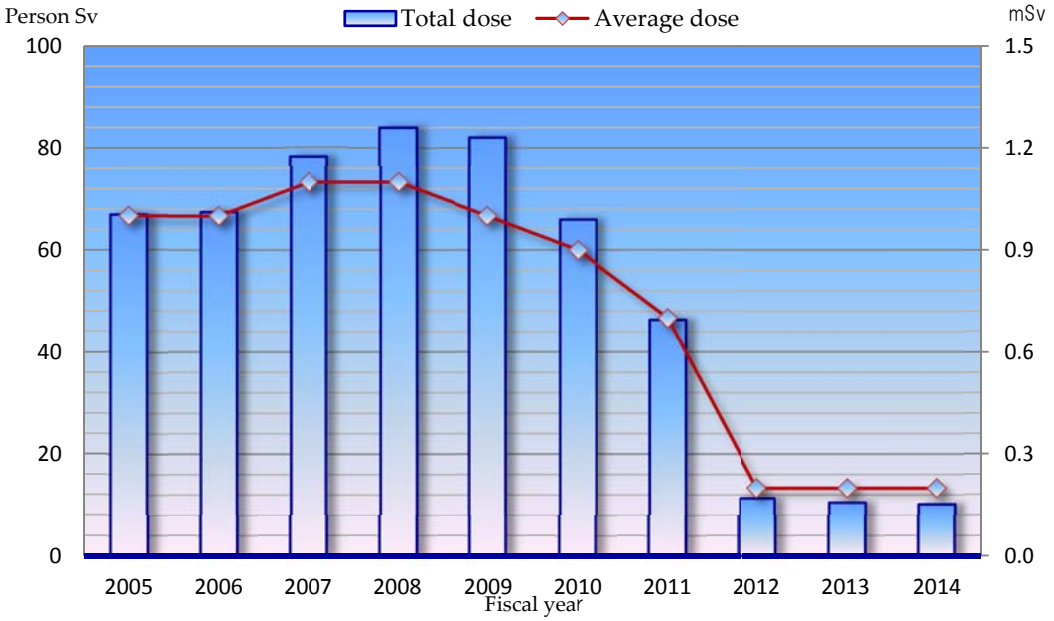

Figure 15-1 Total Dose and Average Dose

4. Release Control of Gaseous/Liquid Waste

In accordance with the provisions of the NRA Ordinance on Commercial Reactors, licensees reduce the concentration of radioactive material in gaseous waste as far as possible by such means as filtration in an exhaust air system, radioactive decay over time, or dilution, and then, measure and monitor its release.

In the case of liquid waste, they reduce the concentration of radioactive material as far as possible by filtration, evaporation, adsorbing with the ion exchange resin method, radioactive decay over time, or dilution in a drainage facility, and then, they measure and monitor its release.

Licensees prescribe and manage in their own Operational Safety Programs to control the release of gaseous and liquid waste ensuring that the legally-prescribed radioactive material concentration limits outside supervised area shall not be exceeded.

To ensure that release levels are below the legal limits outside the Surrounding Monitored Area, licensees decide the control targets based on the annual release quantity stipulated in their Installation Permit Application. They guarantee in their Operational Safety Programs that they will not exceed those levels and the NRA checks the status of compliance when conducting Operational Safety Inspections.

Figures 15-2 and 15-3 show the amount of gaseous and liquid waste discharged from reactor facilities (BWRs and PWRs) in the past ten years reported by licensees in accordance with the Reactor Regulation Act.

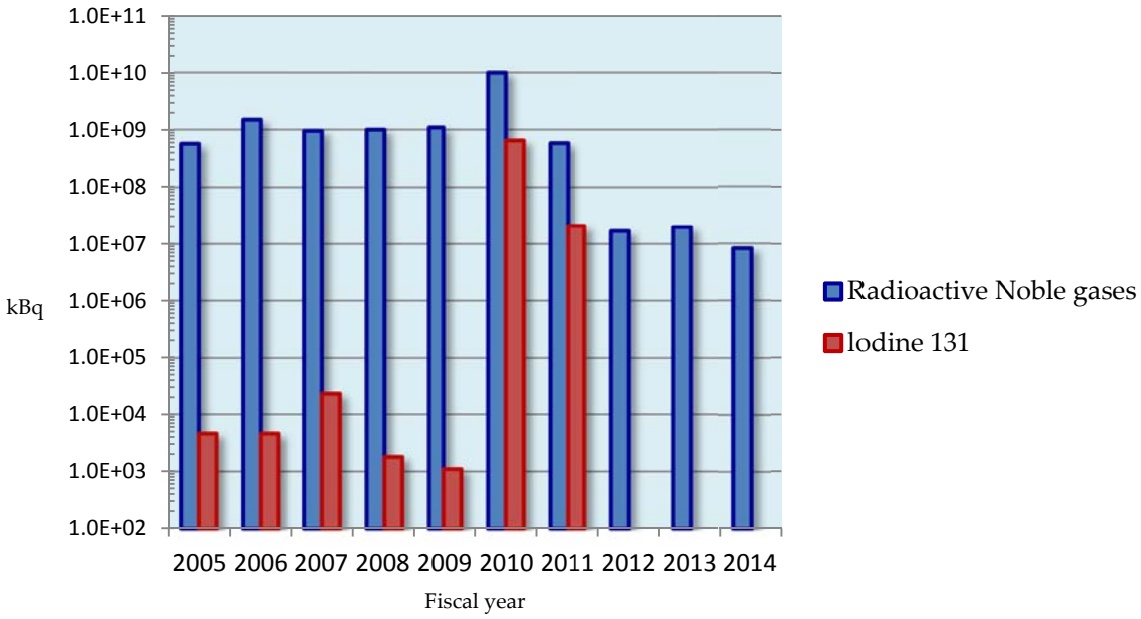

Figure15-2 The Quantity of Gaseous Waste Released

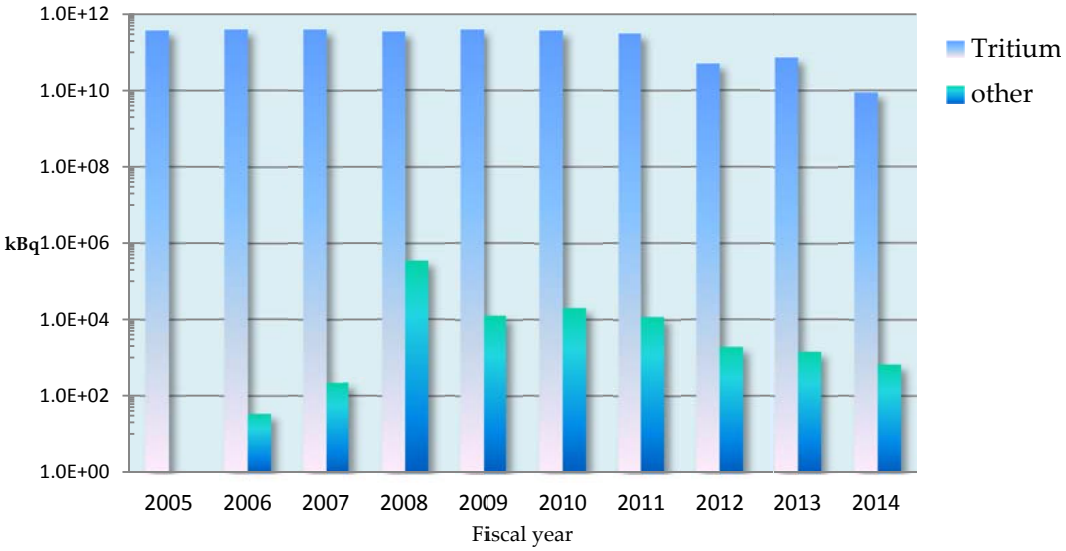

Figure15-3 The Quantity of Liquid Waste Released

5. Environmental Radiation Monitoring

To evaluate the impact of radioactive release to the surrounding environment from the nuclear facility, licensees monitor air radiation does rates and environmental

samples with the aim of improving release control and facility management.

To help protect the health and safety of nearby public communities, local governments (in prefectures where reactor facilities are located) also conduct local radiation monitoring.

After the TEPCO Fukushima Daiichi accident, the government developed a "Comprehensive Radiation Monitoring Plan (decided in August 2011, revised in March, April 2012, April 2013, April 2014, April 2015 and April 2016)" governing environmental radiation monitoring work related to Fukushima Daiichi accident.

Environmental radiation monitoring points and frequency increased after the accident, and relevant ministries and bodies including the government of Fukushima Prefecture are now working in partnership in accordance with the Comprehensive Radiation Monitoring Plan.

Environmental radiation monitoring data are uploaded on the website of the Disaster Prevention and Nuclear Safety Network for the Nuclear Environment (http://www.bousai.ne.jp/eng/), which is run by the NRA, enabling the general public to see it in real time.

ARTICLE 16 EMERGENCY PREPAREDNESS

1 Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency. For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.

2 Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.

3 Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.

Outline of the Implementation of Article 16

Basic Plan for Disaster Preparedness was developed in accordance with Basic Act on Disaster Control Measures and Nuclear Emergency Act. The Plan defines basic issues about sharing of roles in an emergency by the central and local governments and the nuclear operator (licensees) and about an emergency response. Licensees are required to develop a nuclear operator's EPR plan in accordance with Nuclear Emergency Act. Emergency exercises are conducted in accordance with these plans at the nuclear operator level and at the local and central government level.

For the purpose to improve and reinforce governmental organizations for the nuclear disaster preparedness and prevention, Nuclear Disaster Management Bureau was established in the Cabinet Office on October 14, 2014. Nuclear Disaster Management Bureau, CAO is the organization which conducts to improve and reinforce off-site activity for emergency preparedness and response in case of nuclear disasters, and to support the relevant local government organizations to develop its local disaster prevention plan and evacuation plan, financial support to the disaster prevention measure by local governments, and an exercise for nuclear emergency preparedness and response etc.

In terms of the relationship with the neighboring countries, Japan is separated by the ocean from the neighboring countries, and therefore it is unlikely that other countries will be affected by a radiological emergency. However, in light of the importance of

information sharing, Japan, China and Korea have agreed to share emergency information within the framework of the Japan-China-Korea Top Regulators Meeting. Thus, emergency response plans are in place and emergency exercises are conducted. In addition, a framework is available for information exchange with the neighboring countries. Thus, the provision of Article 16 of the Convention is achieved.

Article 16 (1) Emergency plans

1 Outline of the laws and regulations on nuclear emergencies

1-1 Nuclear emergency response under Nuclear Emergency Act.

(1) Precautionary protective measures

A nuclear operator has the responsibility of preventing occurrence and development of a nuclear emergency and taking action for recovery from a nuclear emergency. Licensee must develop a licensee's EPR plans for each nuclear site and, prior to its development, must consult with the governor and head of the prefecture and the city, town or village where the nuclear facility is located, as well as to the governors of the neighboring prefectures. After developing the plan, licensee must submit it to the Prime Minster and the NRA and disclose the summary. The Prime Minister and the NRA may order licensee to make changes to the plan if it is considered to be inadequate for preventing occurrence and development of a nuclear emergency.

Licensee must establish a nuclear emergency preparedness organization for each nuclear site, place nuclear emergency preparedness personnel, and provide an update of the status of nuclear emergency preparedness personnel to the NRA and the governor and head of the prefecture and the city, town or village where the nuclear facility is located, as well as to the governors of the neighboring prefectures. The NRA may order licensee to establish a nuclear emergency preparedness organization or place nuclear emergency preparedness personnel if it is considered that licensee is in violation of this requirement.

Licensee must appoint a nuclear emergency preparedness manager for each nuclear site to manage the nuclear emergency preparedness organization and a deputy nuclear emergency preparedness manager to assist the nuclear emergency preparedness manager. After appointing the nuclear emergency preparedness manager and the deputy nuclear emergency preparedness manager, licensee must report the appointment to the NRA and the governor and head of the prefecture and the city, town or village where nuclear facility is located, as well as the governors of the neighboring prefectures. The NRA may order licensee to appoint or dismiss a nuclear emergency preparedness manager or a deputy nuclear emergency preparedness manager if licensee is in violation of this requirement or the nuclear emergency preparedness manager or the deputy nuclear emergency preparedness manager is in violation of this law.

Upon occurrence of an event specified in the government ordinance, the nuclear

emergency preparedness manager must report it to the Prime Minister, the NRA and the governor and head of the prefecture and the city, town or village where the nuclear facility is located, as well as to the governors of the neighboring prefectures. This notification is commonly called Article 10 Notification because it is required by Article 10 of Nuclear Emergency Act. Events subject to Article 10 Notification is called specified events.

Licensees are required to install and maintain the necessary radiation measurement instruments to make Article 10 Notification and to have in place the necessary nuclear emergency prevention equipment for the nuclear emergency preparedness organization to perform its duties, such as radiation hazard prevention equipment and emergency communication equipment, and to inspect and maintain the equipment. Radiation measurement instruments installed by licensee are subject to inspection by the NRA. The Prime Minister or the NRA can order licensee to take necessary action if it is considered that licensee is in violation of these requirements. Licensee must keep a record of the doses detected by the installed radiation measurement instruments and disclose the record.

The Prime Minister designates a facility for each nuclear site that will be used as the center for emergency response actions and post-nuclear emergency actions. This facility is called an off-site center. Licensees must provide the Prime Minister with the necessary documents to take emergency response actions and post-nuclear emergency actions. The documents will be available at the off-site center.

The Government's emergency exercises are conducted in accordance with the plan developed by the Prime Minister.

Licensees must conduct emergency exercises, report the results of the exercises to the NRA and disclose the summary. The NRA may order, through consultation with the Prime Minister, licensee to take action, such as improving the excercise procedures, if the exercises are considered to be inadequate for preventing occurrence or development of a nuclear emergency.

Nuclear Emergency Act provides for the obligation of other licensees to strive to cooperate. Licensees must strive to cooperate in the event of a nuclear emergency in a nuclear site of other licensees by sending nuclear emergency preparedness personnel and lending nuclear emergency response equipment.

(2) Emergency response actions

In Japan, the Prime Minister declares a nuclear emergency situation.

If an event occurs that falls under the category of an emergency, the NRA will immediately provide the Prime Minister with an information on the status of the event, the areas where emergency response actions should be taken, a brief description of the event, a proposed announcement on what needs to be communicated to residents in the areas, and proposed instructions on emergency response actions such as evaluation and sheltering-in-place. Following this, the Prime Minister will immediately declare a nuclear emergency situation

If a nuclear emergency situation is declared, Nuclear Emergency Response Headquarters will be set up. The Prime Minister will serve as the chief of the Nuclear Emergency Response Headquarters. The Nuclear Emergency Response Headquarters will develop a policy for the implementation of emergency response actions and provide overall coordination of the emergency response actions and the post-nuclear emergency actions. In the area where the nuclear facility is located, local nuclear emergency response headquarters to perform some of the administrative work of the Nuclear Emergency Response Headquarters will be set up within the Nuclear Emergency Response Headquarters.

Following the declaration of a state of nuclear emergency, the emergency response headquarters of the local government (prefecture, city, town or village) will be set up in the area where the nuclear facility is located. The local nuclear emergency response headquarters and the emergency response headquarters of the local government will set up a nuclear emergency joint response conference to exchange information on the nuclear emergency and develop cooperation in the implementation of emergency response actions.

If a specified event occurs, the nuclear emergency preparedness manager must immediately order the nuclear emergency preparedness organization to take emergency actions to prevent occurrence or development of a nuclear emergency. Licensee must report the summary of the action to the Prime Minister, the NRA, the governor and head of the prefecture and the city, town or village where the nuclear facility is located, as well as to the governors of the neighboring prefectures.

(3) Measures following the nuclear emergency

Measures following the nuclear emergency include a survey of the concentration, density and dose of radioactive material, medical procedures including a medical examination of residents and a mental and physical health consultation, public relations activities to prevent economic damage caused by rumors, and measures to prevent development of the nuclear emergency or recover from the emergency. For measures following the nuclear emergency taken by administrative agencies and local

governments, licensees must take actions such as sending nuclear emergency preparedness personnel and lending nuclear emergency response equipment.

1-2 Basic Plan for Disaster Preparedness

The Central Disaster Management Council formulated a Basic Plan on Disaster Response based on the Basic Act on Disaster Control Measures and the Nuclear Emergency Act.

Basic Plan for Disaster Preparedness is a fundamental plan for the Government's disaster prevention measures to respond to various disasters in a comprehensive manner. The section of Basic Plan for Disaster Preparedness that describes nuclear emergency preparedness defines basic issues on the nuclear emergency preparedness of the Government, licensees and local governments and their responsibility (sharing of responsibility). EPR Guide developed by the NRA applies to specialized and technical issues specific to nuclear emergencies.

Broadly, the following measures are set forth in Basic Plan for Disaster Preparedness:

- Precautionary protective measures: ensuring the safety of facilities; disseminating knowledge of disaster prevention; promoting researches on nuclear emergency prevention etc. ; implementing measures to prevent recurrence; preparing for emergency response actions and recovery from a disaster; preparing for emergency response to an accident during the transport of nuclear fuel material etc. outside a nuclear site
- Emergency response measures: collecting and communicating information immediately after the occurrence of an emergency; setting up an emergency contact system and an activity system; activities to provide protection, such as evacuation and sheltering-in-place, and information; activities to assist the life of nuclear accident sufferers; maintaining social order, including crime prevention; securing traffic for emergency transportation and conducting emergency transportation activities; rescue, first-aid, medical and fire extinguish activities; activities to procure and supply materials; activities related to health and hygiene; accepting voluntary support; emergency response to an accident during the transport of nuclear fuel material etc. outside a nuclear site; response to the combination of natural disaster and a nuclear emergency
- Measures to recover from a disaster: canceling the declaration of a Nuclear Emergency Situation; measures following the nuclear emergency; assisting accident sufferers in reviewing their life; abolition of the Nuclear Emergency

Response Headquarters

1-3 Guide for Emergency Preparedness and Response

Under the provisions of the Nuclear Emergency Act, the NRA must develop guidelines for nuclear emergency response to ensure the smooth implementation of precautionary protective actions, emergency response actions and measures following the nuclear emergency and make the guidelines available to the public without delay.

The purpose of NRA EPR Guide is to allow licensees, the head of designated administrative agencies and designated local administrative agencies, local governments, designated public organizations, designated local public organizations, and others to take nuclear emergency actions in a smooth manner. The Guide went into effect on October 31, 2013 and, since then, they have been revised repeatedly. The ultimate goal of the guidelines is to ensure that in the event of an emergency, protective actions will be taken to minimize the radiation effects on residents etc. in the surrounding area of a nuclear facility.

Described below are the main provisions of the Guide for Emergency Preparedness and Response

(1) Preliminary Measures for Nuclear Emergency Preparedness and Response

・Establishment of the Nuclear Emergency Response Zone

In the event of a nuclear emergency, the magnitude of the effect that an unusually large amount of radioactive material or radiation released has on the surrounding environment and the time for the effect to come into play depend on the form of the abnormal event, the characteristics of the facility, the weather conditions, the environmental conditions in the surrounding area, the living conditions of residents, and other factors. Therefore, it is necessary to take the appropriate action for the event in a flexible manner. To take action to protect residents etc. against radiation exposure efficiently in a short time, it is necessary to in advance, assume the occurrence of an unusual event, to define areas that may be affected by the event, taking into account factors, such as the characteristics of the facility, and to put in place measures, particularly for nuclear emergencies.

Nuclear emergency planning zones for nuclear emergency response actions are designated for the type of nuclear facility based on the distance from the facility. For commercial power reactors, a precautionary action zone (PAZ) is defined as an area where precautionary protective actions, such as immediate evacuation depending on the EAL, should be prepared in the stage before radioactive material is released into

the environment in order to avoid the deterministic effect of radiation exposure in a rapidly developing accident. The rough target of the PAZ is approximately within a radius of 5 km from the power reactor facility.

An urgent protective action planning zone is defined as an area where emergency protective actions should be prepared based on the EAL and OIL to minimize the risk of the deterministic effect of radiation exposure. The rough target of the UPZ is approximately within 30 km of the power reactor facility.

The designation of these nuclear emergency planning zones is based on the international standards and the lessons learned from the accident at the Fukushima Daiichi Nuclear Power Station.

- Nuclear emergency category and Emergency Action Level (EAL)

In Japan, emergencies situations are divided into three categories: an alert, a site area emergency and a general emergency condition.

An alert is a phase in which, in a nuclear facility, an unusual event occurs or may occur that has or may have no immediate radiation effects on the public and preparations need to be made to collect information, conduct emergency monitoring and implement protective actions such as the evacuation of those who need to evacuate in a site area emergency. In this phase, licensee must immediately report the occurrence of an event in the alert category and the state of the facility to the central government. The central government must confirm the occurrence of the alert event based on the information from licensee and provide it to the local governments and the public and other stakeholders without delay. The central government and the local governments must start to prepare for the implementation of relatively time-consuming protective actions in the PAZ near the nuclear facility.

A site area emergency is a phase in which, in a nuclear facility, an event that may have radiation effects on the public occurs and preparations need to be made to take main protective actions, such as evacuation in an emergency, in the surrounding area of the facility. In this phase, licensee must immediately report the occurrence of an event in the site area emergency category and the state of the facility to the central government and the local governments. The central government must confirm the occurrence of the site area emergency and provide information to the local governments, the public and other stakeholders without delay. The central government, the local governments and licensee must enhance the information collection activities to grasp the development of the event by emergency monitoring and other means and, mainly in the PAZ, must

prepare for the implementation of precautionary protective actions, such as the evacuation of basically all residents etc., and evacuate those who need to evacuate in a site area emergency.

A general emergency is a phase in which, in a nuclear facility, an event occurs that is very likely to have radiation effects on the public and protective actions need to be taken promptly to avoid the deterministic effect of radiation exposure and reduce the risk of the deterministic effect. In this phase, licensee must immediately report the occurrence of an event in the general emergency category and the state of the facility to the central government and the local governments. The central government must confirm the occurrence of the general emergency and provide information to the local governments, the public and other stakeholders without delay. The central government and the local governments must take precautionary protective actions in the PAZ, such as the evacuation of basically all residents and the administration of stable iodine. As in the PAZ, precautionary preventive actions, such as evacuation, need to be taken in the UPZ, depending on the scale of the event as well as on how much time has passed.

In the Guide for Emergency Preparedness and Response, the EAL used to determine the category of an emergency is defined for each of the three emergency categories and for each of the three reactor types (BWR, PWR and FBR), as well as for different conditions in the reactor, such as the condition that no nuclear fuel material exists in the reactor vessel in Fukushima Daiichi Nuclear Power Station Units 1 to 4.

- Operational Intervention Level (OIL)

In a general emergency, after release of radioactive material, due to the spread of the radioactive material, there are likely to be points with a high air dose rate in a relatively wide area. To prepare for such an event, the central government, the local governments and licensee need to conduct emergency monitoring promptly, determine the necessary protective actions to be taken by evaluating the results of the monitoring against the criteria for the implementation of protective actions and take the actions. After release of radioactive material, in areas where the air dose rate is high, the zones will be determined in a few hours and emergency protective actions, such as the evacuation of residents, will be taken to minimize the effect of exposure. In areas where the air dose rate is relatively low, the zones will be determined in a day and early protective actions, such as temporary relocation, will be taken in a week or so to avoid unnecessary exposure.

Operational intervention levels (OILs), which are indicated measurable values, such as the air dose rate and the concentration of radioactive material in environmental

samples, are specified as the criteria for determining whether these protective actions should be taken. Table 16-1 shows the relationship between the OIL and the protective actions.

Table 16-1 OILs and Protective Actions

<table>
<tr><th></th><th>Classification</th><th>Description</th><th>Initial Values</th><th>Outline of Protective actions</th></tr>
<tr><td rowspan="2">Urgent protective actions</td><td>OIL1</td><td>Criteria for advising local residents to evacuate within a few hours or sheltering, in order to prevent radiation effects from surface soil, inhalation of re-suspended radioactive material, or inadvertent ingestion</td><td>500μSv/h
(air radiation dose rate when measured 1m above the ground)</td><td>Identification of zones and evacuation within a few hours (including ordering those who cannot easily move to shelter indoors temporarily)</td></tr>
<tr><td>OIL4</td><td>Criteria for conducting decontamination to prevent inadvertent ingestion and external exposure via skin contamination</td><td>βrays:40,000 cpm
(Counting rate measured by detector at several centimeters off the skin)
βrays:13,000 cpm(Value 1 month later)
(Counting rate measured by detector at several cm off the skin)</td><td>Contamination screening of those who are ordered evacuation or relocation and prompt primary decontamination when the results exceed the criteria</td></tr>
<tr><td>Early protective actions</td><td>OIL2</td><td>Criteria for restricting ingestion of local produce and advising local residents, to temporarily relocate within a week or so, in order to prevent radiation effects from surface soil, inhalation of radioactive material, or inadvertent ingestion</td><td>20μSv/h
(Air radiation dose rate measured at 1m from ground)</td><td>Identification of zones within a day or so and restriction of ingestion of local produce, as well as temporary relocation within a week or so</td></tr>
<tr><td rowspan="2">Restriction on intake of food and drink</td><td>Food and drink screening standards (corresponding to OIL3)</td><td>Criteria for identifying areas where measurement of radionuclide concentrations in food and drink should be carried out in preparation for possible food and drink restrictions at OIL6</td><td>0.5μSv/h
(Air radiation dose rate measured at 1m from ground)</td><td>Identification of zones where radionuclide concentrations in food and drink should be measured</td></tr>
<tr><td>OIL6</td><td>Criteria when restricting food and drink intake in order to prevent radiation exposure via ingestion</td><td><table><tr><th>Nuclide</th><th>Drinking water, milk, dairy products</th><th>Vegetables, cereals, meat, eggs, fish, other</th></tr><tr><td>Radioactive iodine</td><td>300Bq/kg</td><td>2,000Bq/kg</td></tr><tr><td>Radioactive cesium</td><td>200Bq/kg</td><td>500Bq/kg</td></tr><tr><td>a nuclide of plutonium and transuranic elementS</td><td>1Bq/kg</td><td>10Bq/kg</td></tr><tr><td>Uranium</td><td>20Bq/kg</td><td>100Bq/kg</td></tr></table></td><td>Analysis of radionuclide concentrations in food and drink within a week, and prompt restrictions on food and drink intake if results are in excess of the criteria</td></tr>
</table>

- Development of an emergency monitoring system

In an emergency, information on the air dose rate from radioactive material in the surrounding environment, the concentration of airborne radioactive material and the concentration of radioactive material in environmental samples provides the basis for appropriately implementing protective actions for residents and those engaged in disaster prevention work. Measures will be taken to prevent loss of the emergency monitoring function.

In the implementation of emergency monitoring, the central government will supervise emergency monitoring; develop an implementation policy; develop a plan for conducting emergency monitoring and a plan for the organization of monitoring personnel; provide instructions on the implementation of the monitoring and overall coordination; collect and disclose data; evaluate the results of the monitoring and change the implementation plan as the event develops; and conduct wide-area monitoring in waters and airspace. The local governments will develop the emergency monitoring plan and conduct emergency monitoring in nuclear emergency planning zones

Licensee will provide information on the source of the radioactive material released and cooperate in emergency monitoring in the surrounding area of the facility and other areas.

If the situation develops into a site area emergency, the central governments will set up an emergency monitoring center in the off-site center with the necessary functions to conduct emergency monitoring in the area where the nuclear facility is located, so that the central government, the local governments and licensee can work together to conduct emergency monitoring. The emergency monitoring center consists of the central government, the prefecture where the nuclear facility is located, the neighboring prefectures, the designated public organizations [15], licensee, and supporting organizations, and is responsible for collecting information on environmental radiation levels due to the nuclear emergency and providing information to be used to determine whether OIL-based protective actions should be taken and information to be used to evaluate radiation effects from the nuclear emergency on the residents etc. and the environment.

- Development of a medical care in a nuclear emergency

[15] Japan Atomic Energy Agency and National Institute of Radiological Sciences

- A medical care to allow specified first-aid emergency health care institutions to provide health care in a nuclear emergency and a chain of command are in place even at ordinary times to allow for appropriate health care activities in a nuclear emergency. The Government designates advanced radiation exposure treatment support centers and nuclear emergency health care and general support centers, and reviews them for compliance with the facility requirements every three years or so. The prefecture and the city, town or village where the nuclear facility is located designates and registers primary nuclear emergency care hospitals and nuclear emergency health care support institutions, and review them for compliance with the facility requirements every three years or so.

- Preemptive intake of the iodine tablets

For the purpose of preemptive intake of stable iodine tablets in a nuclear emergency, at ordinary times, the local governments will provide stable iodine tablets to residents in the PAZ in preparation for an emergency. Iodine tablets are stored in a public facility. When the tablets are provided in preparation, a physician will explain the preventive effect of the tablet, the time to take it and its side effects. In the event of a general emergency, protective actions, such as evacuation, will be taken in the UPZ, depending on the state of the plant and the air dose rate. In addition, a system for the supply and intake of stable iodine tablets will be put in place.

- Setting-up of an off-site center

The Local Nuclear Emergency Response Headquarters of the central government and the emergency response headquarters of the local governments set up a nuclear emergency joint response conference to exchange information in the event of a nuclear emergency and an off-site center as a center for implementing nuclear emergency response actions in a coordinated manner in the area where the nuclear facility is located. The off-site center is located in an area, considering the guidelines for PAZ and UPZ and has the necessary systems in place to maintain its function as the primary emergency facility to take the necessary actions for radiation protection and emergency actions such as alternative facility and multiple lines of communication channels. .

(2) Emergency response actions

- Comprehend an unusual state and taking emergency response actions

Upon being informed of an alert or a site area emergency by a nuclear operator, the central government and the local governments will start to prepare for the implementation of protective actions and provide information to residents in preparation for a general emergency. Upon being informed of a general emergency by a nuclear operator, residents in the PAZ will be required to evacuate and UPZ will be required to take precautionary preventive actions, such as sheltering-in-place. If an unusually large amount of radioactive material is or may be released from the nuclear facility, residents will shelter in place as needed in consideration of the condition of the facility and the release of radioactive material in areas other than those where precautionary preventive actions are taken. In consideration on the results of emergency monitoring, additional protective actions are implemented, such as evacuation from areas other than those where precautionary preventive actions and restrictions on eating and drinking.

- Emergency monitoring

In the event of an alert, the central government, the local governments, licensee, and the relevant designated public organizations will prepare for emergency monitoring. In the event of a site area emergency, the central government will set up an emergency monitoring center, make a request for the necessary personnel under the plan for the provision of monitoring personnel and start emergency monitoring.

- Evacuation, temporary relocation and sheltering-in-place

If an unusually large amount of radioactive material is or may be released into the surrounding area of the nuclear facility, depending on the nuclear emergency planning zone, all residents in the PAZ will be required to evacuate immediately, and residents in the UPZ will be required to shelter in place when the situation develops into a general emergency. Subsequently, a phased-evacuation will be considered depending on the state of the nuclear facility. In addition, after radioactive material are released, areas exceeding OIL 1 will be determined based on emergency monitoring and residents will be evacuated within a few hours, and areas exceeding OIL 2 will be determined and residents will be temporarily relocated within a day or so.

In the event of a general emergency, evacuation will be implemented in the PAZ depending on the priority zones for nuclear emergency response actions. However, sheltering-in-place will be implemented if it has a higher priority than evacuation. In the UPZ, sheltering-in-place will be implemented until a phased-evacuation or other OIL-based protective actions are taken.

- Development and support of local disaster management plans and evacuation plans

Relevant local governments are required to develop local disaster management plan based on the Basic Act on Disaster Control Measures, and the local government such as prefectures, and municipalities should plan the basic measures for nuclear disasters.

A regional disaster plan (the section for nuclear disaster) (hereafter, it's called local disaster management plan") is developed by the related local public organizations within the radius 30 km range for the most part from a nuclear power plant, based on the Basic Plan for Disaster Preparedness and the NRA EPR Guide at present.

For local disaster management plan, materialization of the contents and the system performance are important, and an aggressive support by the national government is expected in the case that local public bodies have hardship to progress local evacuation plan or measures for persons needed for special treatments etc.

In order to support the improvement and reinforcement of local disaster management plans and evacuation plans and evacuation plan developed by local government such as prefectures, cities, towns and villages, based on the decision of the Nuclear Emergency Preparedness Council in September, 2013, Nuclear Disaster Management Bureau ,CAO established a "Regional Nuclear Emergency Preparedness Committees" (Hereinafter it's called "Committees".) as a task team and put a working group under it for a problem solution in every area where a nuclear power plant is located in March, 2015.

In the working group of each area, measures for the support of developing emergency preparedness and response, coordinating measures among wide areas, supports by the government are studied, and government and local governments are working to materialize and improve the local disaster management plans and evacuation plans together.

In the area where the local disaster management plan was admitted to be materialized and improved, the " Committees " are required to confirm that their emergency measures are concrete and reasonable, considering the NRA EPR Guide, and Nuclear Disaster Management Bureau reports to Nuclear Emergency Preparedness Council results of examination and consultation for the plans by Committees, and then, will ask to Council their approval.

In the area where the emergency measures has been confirmed, in addition to the support of materialization and improvement of the emergency measures, and confirmation(Plan) of the emergency measures, the exercise(Do) based on the

emergency measures confirmed by the “conference” is conducted, items to be improved from the exercise results(Check) are extracted, and the emergency measures at the area are improved(Action), considering the items, so the PDCA cycle was introduced and the regional disaster prevention system is improved continuously.
As for the local emergency measures, "Emergency measures in Sendai Area" was reviewed at the Sendai area working team special meeting in fiscal year of 2014, and the confirmation results were agreed by Nuclear Emergency Preparedness Council .
And the "Emergency measures in Ikata Area" was reviewed at the Ikata area nuclear Disaster prevention Conference in fiscal year of 2014, and "Emergency measures in Takahama Area" was reviewed at the Fukui area nuclear Disaster prevention Conference , and those results were agreed by the Nuclear Emergency Preparedness Council .

2 Nuclear Emergency Exercises

Previously, nuclear emergency exercises have been carried out by the national and the local governments and licensees, in order to check the effectiveness of emergency response systems in accordance with the Nuclear Emergency Act. However, following the Fukushima accident these exercises are under review. Future exercises must now incorporate ‘lessons learned’ from Fukushima Daiichi accident including the possibility of a complex earthquake-tsunami-nuclear accident disaster which had never before been experienced as well as incorporating more realistic evacuation exercises. Such exercises range from large-scale national government exercises to those carried out by licensees within their site. The explanations on each item are following.

2-1 Exercises planned by the Government

Hitherto, local governments have planned nuclear emergency exercises. The national government provided support and coordination. Following the enactment of the Nuclear Emergency Act, for which the 1999 JCO criticality accident was the catalyst, the national government planned and implemented exercises, , taking the initiative.
The Fukushima Daiichi accident marked the first time that such a nuclear emergency situation had been declared in Japan, and the nuclear emergency response system, including nuclear emergency exercises, was put to the test. Based on this experience, the NRA is now reviewing the emergency management system, as well as nuclear emergency exercises.
Nuclear Energy Disaster Prevention Drill is an exercise conducted by national

governmental organizations, local government organizations and nuclear operators in order to verify the system and organizations against the nuclear disaster, based on the Nuclear Energy Act, and the 2015 Nuclear Energy Disaster Prevention Drill was conducted for Shikoku Electric Power Company's Ikata Nuclear Power Station for the following purposes:

- Confirmation of performance of emergency response system of national government, local governments and nuclear operator, and confirmation of cooperation system by relevant organizations.
- Confirmation of systems and procedures set as manuals in the central organization and the site organizations in a nuclear emergency situation that is caused by the large-scale earthquake.
- Verification of further improvement of system performance of the emergency preparedness and response based on the "Emergency measures in Ikata Area"
- Extraction of lesson-learned from the exercise results and improvement of emergency measures etc.
- Acquirement of personnel's skill for nuclear emergency preparedness and response and promotion of resident understanding for the nuclear disaster prevention.

Items to be improved were collected from the specialist's advice and questionnaire results from the resident who participated in the 2015 Comprehensive nuclear emergency response exercise, and the "The result report of the 2015 Nuclear Energy Disaster Prevention Drill " was issued in March, 2016.

Improvement of the "Emergency measures in Ikata Area" and/or various procedures and manuals will be proceeded through the study in the Committee from now on, based on the items pointed out in the result report from the view point of operation and communication of the locations for disaster measures such as a measure to prevent isolation of Cape Sata, a measure to mitigate traffic jam and confirmation of evacuation time periods.

And for Nuclear Energy Disaster Prevention Drill, executing methods and menu of exercise should be improved continuously, so that the exercise will become more effective and practical.

2-2 Exercises planned by a licensee

In accordance with Nuclear Emergency Act, licensees must conduct nuclear emergency exercises, report the results of the exercises to the NRA and disclose the summary.

Activities in the exercises of a licensee include non-scenario-based training and sharing of good practice through mutual visits of licensees.

For example, in a power plant, component training programs on individual procedures to improve the skills to perform work procedures and a comprehensive training program that combines several component training programs are conducted. The component training programs include, for example, accident management training to ensure that a prediction of the development of an event and a judgment and selection of means of bringing the event under control will be made in an appropriate manner; emergency response training to ensure that in the event of a nuclear emergency, a power supply will be provided and emergency action to provide the sources of cooling water will be taken in a prompt and appropriate manner; emergency exposure medical treatment training to ensure that those who suffered from radiation injuries will be taken out of a controlled area and decontaminated and will receive emergency treatment; and evacuation instruction training to ensure that visitors in a nuclear power plant will be instructed to evacuate in the event of an emergency and those other than the emergency response personnel will be instructed to evacuate when a state of emergency is declared.

In the comprehensive training program, more extensive training is conducted with the participation of the power plant as well as the head office. For example, in a power plant, training is provided on accident management, emergency response, organization of nuclear emergency preparedness personnel, reporting, emergency exposure medical treatment, monitoring, evacuation instructions, and emergency operations. In the head office, training is provided on reporting, emergency support organization activities, power plant support activities, and media relations.

Nuclear Emergency Act requires that a nuclear operator report the results of emergency exercises to the NRA. The NRA may order, through consultation with the Prime Minister, licensee to improve the drill procedures and take other necessary actions if the results of the exercises are determined not to be adequate for preventing occurrence or development of a nuclear disaster. The Basic Plan on Disaster Preparedness states that the NRA will evaluate the results of exercises for severe accidents. The NRA developed indices for the evaluation of nuclear operator emergency exercises and evaluates the exercises by taking opportunities such as general exercises.

2-3 The exercise drawn up by the local governments

Local governments which have jurisdiction over the area where the relevant nuclear site is located and the neighboring governments should put the drills into effect once a

year based on Disaster Measures Basic Law. In the drills conducted by the relevant prefectures, the local governments (including the governor), the actual working units, such as police, fire services, the Maritime Safety Agency and Japan Self-Defense Forces, and nuclear operator should participate. And, exercises on evacuation of residents and screening tests for evacuation from emergency zones are carried out, with residents' cooperation and the actual working units' participation.

More concretely describing, conducted, exercises for evacuation from the PAZ and UPZ those for emergency communications and, in several areas, exercises for emergency public communication using an emergency broadcast system and public information vehicles. Moreover, in some cases, exercises for sending emergency alert emails are conducted.

In order to materialize local disaster management plans and evacuation plans and to study these effectiveness, for the areas in which the plans' improvement are confirmed, Committees will be supporting to plan and carry out the exercises, to propagate methods of evaluation, to practice the PDCA cycle for the plans etc.

Besides, to personnel belonging to local government's organs for nuclear emergency preparedness, several trainings (for the beginners, for drivers of transport services (e.g. bus drivers), for nuclear emergency preparedness headquarter staff) and map exercises at headquarter are carried out.

2-4 Participation in International Exercises

Japan is a contracting party to the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. In order to be prepared to certainly send out notification under the provisions of these conventions in case of emergencies, Japan continuously participates in the ConvEx organized by the IAEA.

Article 16 (2) Information to the Public and Neighboring Countries

1 Measures for Providing Public Information

To enhance widespread public dissemination of disaster response plans, local residents participate in national and local government emergency exercises. Local authorities explain a disaster response plan to local residents who then simulate evacuations to actual refugee facilities and radiation surveys are carried out.

NISA launched its emergency information mailing service in July 2008. To enable people to register their mobile phone e-mail addresses in advance and promptly receive emergency information. This system inherited by the NRA in September 2012 as N-alert.

During a nuclear emergency, the media will provide information to local residents. Press briefings, highlighted by television and radio broadcasts, will be held as required at the local off-site disaster prevention centers and at the Emergency Response Center in Tokyo, and these will provide local residents with relevant information.

Information posted on websites provide emergency information.

2 Providing Information to Neighbor Countries

Japan is an island nation located in the East Asia region and shares no land borders with its neighboring countries. However, its geographical neighbors across the sea – China and South Korea – also have reactor facilities. Considering the experience of the Fukushima Daiichi accident, sharing information in case of nuclear emergency is an issue of mutual importance. In August 2009, Japan, China and South Korea set up the framework of Top Regulators Meeting (TRM). TRM countries agreed to establish a rapid sharing of emergency information in 2014. Although the three countries had continued to exchange information at the working level as necessary, the Fukushima Daiichi accident re-emphasized the importance of the trilateral information exchange mechanism. Therefore, discussions to further improve information exchange mechanism are currently underway.

At the TRM Meeting in November 2011, the three countries agreed on, Cooperative Nuclear Safety Initiative of Japan, The People's Republic of China, and The Republic of Korea, which includes enhancement of information exchange, cooperation for responding to severe accidents, as well as nuclear emergency preparedness and response capacity.

Besides the aforementioned tripartite cooperation mechanism, , Japan disseminates information by proactively utilizing the Unified System for Information Exchange in Incidents and Emergencies (USIE) web portal run by the IAEA's Incident and Emergency Centre (IEC).

3 Response in the Event of a Nuclear Accident and a Radiological Emergency in a Neighboring Country

To carry out the provisions of the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, the government designated the Ministry of Foreign Affairs as the National Warning Point (NWP) and National Competent Authority for an Emergency Abroad (NCA(A)), in the event of a nuclear accident or radiological emergency occurring outside the territory of Japan. In the event of a radiological emergency outside the territory of Japan, including that in a neighboring country, the Ministry of Foreign Affairs will receive the notification provided through all kinds of channels, share immediately with the National Competent Authority for a Domestic Emergency (NCA(D)) and other relevant authorities, and take any necessary action. When international emergency assistance is requested, Japan will provide assistance after discussing and agreeing bilaterally on terms of the assistance Moreover, pursuant to the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency article 2. paragraph 4, the National Assistance Capabilities (NAC) of relevant Japanese organizations have been registered with the IAEA Response Assistance and Network (RANET).

ARTICLE 17 SITING

Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:

(i) for evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime;

(ii) for evaluating the likely safety impact of a proposed nuclear installation on individuals, society and the environment;

(iii) for re-evaluating as necessary all relevant factors referred to in sub-paragraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation;

(iv) for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation.

Outline of the Implementation of Article 17

Natural conditions and the social environment and all other related factors in the area where the power reactor is to be built are reviewed by the NRA in the process of application for a reactor installation permit. Factors that may affect the safety of individuals, society and the environment are evaluated as well. These factors will be re-evaluated if a licensee wishes to modify the existing reactor installation permit and if the regulatory standards have been revised and compliance measures are required.

In Japan, it is a requirement for the installation of a nuclear facility that it does not affect the safety of the area outside the environmental surveillance area. Since Japan is surrounded by water, the neighboring member states will not be affected and therefore there are no systems in place, such as consultation on the installation of a nuclear facility, but it is possible to use the framework for information sharing with the neighboring countries.

From the above, the measures of the Japanese Government are in compliance with the provisions of Article 17 of the Convention.

Article 17 (1) Evaluation of Factors Related to Siting Location

Factors relating to the siting location that may affect the safety of reactor facilities are evaluated during the Reactor Installation Permit review process. Licensees are required to conduct adequate studies of external events that could occur at the siting location and to take these into account in the design of such facilities.

In order to apply for the Installation permit, the licensee shall submit the application documents to the NRA, describing the following items;

- The name and address and, in the case of a juridical person, the name of its representative
- The purpose for which the reactors are to be used
- Type, thermal power output and quantity of the nuclear power reactor
- The name and location of the nuclear power reactor
- Position, structure and equipment of the nuclear power reactor and affiliated facility.
- Construction Plan of nuclear reactor facility
- The types and the annually planned amount of consumption of nuclear fuel materials
- Method for disposal of spent fuel
- Radiation Control management in the nuclear facilities
- Facilities necessary to handle an accident

And, the followings instructions are required;

- The purpose to use a nuclear power reactor
- Thermal power output of the nuclear power reactor
- The amounts of funds required for the construction and the Procurement plan.
- Acquisition plan of a nuclear fuel materials
- Technical capability related to the installation and operation of nuclear reactor facility
- The status of the weather, ground, water channel, seismic and social environment of the site location where the nuclear reactor is installed
- Map around the site of nuclear reactor facility
- Safety design of the nuclear reactor facility
- Control of Radiation
- Maintenance of facilities and a organizations necessary to handle an accident

- Licensee's memorandum, registration certificate, inventory, balance sheet and statement of profit and loss

In consideration of the above, the NRA determines that the reactor will not be used for non-peaceful purposes; the applicant has the necessary technological ability and financial basis; the applicant has the necessary technological ability to implement the necessary measures to prevent occurrence and development of a severe accident; and the location, construction and equipment of the reactor is in compliance with the NRA Ordinance on Standards for the Location, Structure, and Equipment of Commercial Power Reactor NRA Ordinance on Standards for the Location, Structure, and Equipment of Commercial Power Reactors , which provides for the regulatory requirements of the NRA. The NRA will grant a reactor installation permit if the power reactor satisfies all the conditions to conform to NRA regulatory requirements.

The NRA Ordinance on Standards for the Location, Structure, and Equipment of Commercial Power Reactors prescribes regulatory requirements for each of the necessary facilities (SSCs for DB) to prevent occurrence or development of a design basis accident and for severe accident. There are requirements for the ground on which the SSCs for DB are to be built. For example, the SSCs for DB are not allowed to be built on an active fault. There are general requirements for the facility to prevent damage from earthquakes, tsunamis and other natural events, and anthropogenic events, fires and floods and to prevent unauthorized entry and operator errors. Also, there are requirements for individual facilities. Facilities with a safety function that is particularly important to safety are required to be independent unless otherwise stated. A facility is not allowed to be shared by several power reactors, except if its safety is improved by sharing. Other safety facilities may be shared under the condition that the safety of the power reactor facility is not compromised. A safety power supply system that will be connected to several power reactor facilities must not stop power supply to the power reactor facilities simultaneously. A power supply system that will receive power from an emergency power supply for other power reactor facilities must not be too dependent on the emergency power supply system.

There are provisions for safety facilities to manage a severe accident in addition to the prevention of damage from the ground on which the facility is to be built, earthquakes, tsunamis and fires. A safety facility for severe accident should be located in a place where the radiation doses are not likely to be high and should have a shield in place so that an accident can be managed. Unless otherwise stated, a permanent safety facility for severe accident is not allowed to be shared by several reactor

facilities but may be shared if its safety is improved by sharing. Measures, such as unification of the standards, must be implemented for a portable safety facility so that it can be used in several reactor facilities. To prevent a portable facility from being unavailable due to a common cause, such as a natural event, consideration must be given to where the facility should be located and stored. Appropriate measures must be implemented for both a permanent and a portable facility so that the facility does not lose its function due to a common cause.

As severe accident management facilities, a specialized safety facility must be built to reduce the release of an unusually large amount of radioactive material in the event of an intentional large airplane crash or terrorist attack. The specialized safety facility is a facility that can be used until external support becomes available in events such as intentional air crash, having necessary equipment for preventing damages to reactor containment vessels, and must be designed and constructed so that it does not lose its function in the event of an air crash into the reactor building.

The Reactor Regulation Act requires that a power reactor facility, new or existing, conforms to the NRA Ordinance on Standards for the Location, Structure, and Equipment of Commercial Power Reactor. If the Ordinance is revised, the facility must comply with the revised one.

Article 17 (2) Prevention of Impacts on Individuals, Society, and the Environment Resulting from Reactor Facilities

Effects on residents and the environment in the surrounding area of a nuclear facility are evaluated in the reactor installation permit review process. The Reactor Regulation Act requires that, the location, structure and equipment of the power reactor facilities conform with the standards specified by the Ordinance of the NRA as being such that those designs are enough to prevent disasters resulting from nuclear fuel material, material contaminated by nuclear fuel material, or the power reactors.

The NRA Ordinance on Standards for the Location, Structure, and Equipment of Commercial Power Reactor requires that SSCs for DB as being such that air dose rates due to direct gamma rays from the power reactor facility during normal operation and due to sky-shine gamma rays in the surrounding area of the facility can be reduced to sufficiently low levels. A radioactive waste treatment facility must be capable of treating radioactive waste generated in a power reactor facility so that, during normal operation, the concentration of radioactive material in the air outside the supervised

area and in the water at the boundary of the supervised area can be reduced to a sufficiently low level.

It is required to take the necessary actions to prevent damage to the reactor containment vessel and release of an unusually large amount of radioactive material to the outside of the facility in the event of a severe accident. Therefore, it is required to install the necessary systems to reduce the spread of radioactive material outside the facility in the event of significant core damage.

The licensee must conduct a basic design of the reactor facility so that it complies with these requirements and submit a reactor installation permit application to the NRA. In accordance with the provisions of the Reactor Regulation Act, the reactor installation permit application must contain the main construction and capability of the reactor facility and the conditions and results of the calculation of effective doses outside the supervised area, as well as the conditions used to evaluate the extent and effect of anticipated operational occurrences, design basis accidents and severe accidents and the results of the evaluation. The NRA will grant a reactor installation permit if the basic design presented in the reactor installation permit application conforms to the NRA Ordinance on Standards for the Location, Structure, and Equipment of Commercial Power Reactor.

Article 17 (3) Re-evaluation of Factors Related to Siting Location

Japan does not have a system for renewal of the reactor installation permit and a system for periodical re-evaluation of the permit conditions. If there are changes in the conditions for the reactor installation permit or if the regulatory requirements are revised and back-fit is required, the permit conditions will be re-evaluated in the form of a change to the reactor installation permit.

Factors that cause a change in the permit conditions include new findings on active fault lines. If new active fault lines are found or if the evaluation of active fault lines under the site is revised or the results of the evaluation conducted for a reactor installation permit needs to be revised, the licensee must conduct evaluation and revise the reactor installation permit.

Since a change in the basic design of the reactor facility or a new construction or addition involves a change in the permit conditions, re-evaluation is conducted.

The social factors may not directly lead to a change in the permit conditions. This is because, for example, if there is an increase in the population of the surrounding area

of a power plant, the supervised area is defined so that the dose limit is not exceeded at any locations outside the area and the permit conditions are not directly affected by the increase or decrease in the population outside the environmental surveillance area.

Article 17 (4) Discussion with Other Countries That Could be Affected by Reactor Facilities

Japan is an island country surrounded by water and has no land border with the neighboring countries. All nuclear facilities in Japan are located along the coastline because they use seawater as the ultimate heat sink. However, the closest nuclear power plant to the closest neighboring country is more than 100 km away from the land of the country. Therefore, it is understood that the location of nuclear facilities does not affect the neighboring countries. For this reason, there is no system of consultation with the neighboring countries and there is no need to make arrangements for consultation with them.

From the perspective of information sharing, Japan has a framework for information exchange among Japan and the two neighboring countries: China and Korea.

ARTICLE 18 DESIGN AND CONSTRUCTION

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defense in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;

(ii) the technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;

(iii) the design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.

Outline of the Implementation of Article 18

Japanese regulations require the integration of defense-in-depth into the design of a nuclear reactor facility. In addition to the requirement for first to third layers, measures for prevention of core damage, CV failure, mitigation of dispersion of radioactive material, and Loss of Large Area in Design Extension Condition are required. To obtain approval of the design of a nuclear reactor facility, the licensee must demonstrate compliance with the standards by using proven technologies or conducting demonstration testing. In addition, high reliability and ease of operation are required of safety equipment and systems.

Thus, the provision of Article 18 of the Convention is achieved.

Article 18 (1) Implementing a Defense in Depth Strategy

1 Basic policy on Defense in Depth in Japan

In the past, before NRA's regulatory requirements were developed, Defense in Depth concept was stated in Reactor Regulation Act and Regulatory Guides issued by Nuclear Safety Commission, and requested as follows; for 1st layer, ensure high reliability sufficient to meet importance of SSC to prevent occurrence of abnormality; for 2nd layer, necessary measures for early finding of abnormality and shut-down nuclear reactor to prevent expansion of abnormality; for 3rd layer, core does not severely damaged and core is sufficiently cooled in case of Design Basis Accident occurred to mitigate Design Basis Accident.

In the new regulatory requirements issued by NRA, measures to eliminate common cause failure are significantly strengthened, based on the lessons from the Fukushima Daiichi NPS accident. In addition to the requirements mentioned above, measures to prevent severe core damage in case of loss of function of equipment for addressing Design Basis Accident, and measures to prevent Containment Vessel failure in case of severe core damage, are required. Further, new regulatory requirements require measures against Containment Vessel failure because Japan experienced Fukushima Daiichi NPS accident. The new regulatory requirement also requires measures against loss of large area of nuclear facilities due to extreme natural disaster, intentional airplane crash or other terrorism.

It is required in the regulatory requirement that each layer of Defense in Depth independently performs its function effectively.

2 Requirements in the each layer of Defense in Depth

2.1 Prevention of abnormality

For the purpose of prevention of abnormality, it is required that ensuring high reliability sufficient to meet importance of SSC to prevent occurrence of abnormality, design with sufficient safety margin, as well as reactor has its core stability characteristics, preventing mis-handle, failsafe design, and interlock function, etc.

In the regulatory requirements, measures for seismic safety, tsunami safety, reliability of power source, and fire protection are strengthened and introducing measures for internal flooding, volcano, tornado, forest fire etc., are newly required.

2-2 Prevention of expand abnormality

In order to detect deviation from normal operation state and make it under control, measures to prevent anticipated transient, anticipated event in the nuclear power plant during operation, from expanding accident such as preparing specific system and mechanism in the design, and establishing operation procedure to regain safety state of nuclear power plant, are required.

2-3 Mitigation of Design Basis Accident

In case of expansion of anticipated transient or expected initiating event and cannot control it in the previous layer and allow to progress to Design Basis Accident, it is required that core is not severely damaged and be able to maintain sufficient cooling by the Engineered Safety System and core stability characteristics.

2-4 Prevention of Severe Core damage in the Design Extension Condition without severe core damage

Licensees are required to confirm effectiveness of measures to prevent severe damage of core in the case of Design Extension Condition without severe core damage.

Design Extension Condition without severe core damage is identified as a "postulated accident sequence groups". NRA Ordinance, taking research results into account, stipulates accident sequence groups which cover most of accident sequences with significant core damage as "designated accident sequence groups".

Table 18-1 Designated Accident Sequence Groups

BWR	PWR
Loss of high-pressure and low pressure water injection function	Loss of heat removal function of secondary cooling system
Loss of high-pressure water injection and depressurization function	Loss of AC power
Loss of all AC power	Loss of auxiliary component cooling function
Loss of decay heat removal function	Loss of Containment Vessel heat removal function
Loss of reactor shutdown function	Loss of Reactor shutdown function
Loss of water injection during LOCA	Loss of ECCS water injection function
Containment Vessel bypass (Interface system LOCA)	Loss of ECCS recirculation function
	Containment Vessel bypass (Interface system LOCA, steam generator tube rapture)

Considering the difference of each plant, internal events are evaluated by applying PRA and external events are evaluated by PRA or other applicable means. As a result, in case that the accident sequence group which has significant frequency or impact is identified although it is not included in the "Designated Accident Sequence Group", it is required to add into "Postulated Accident Sequence Group".

In the next step, important accident sequences are identified in each of the Postulated Accident Sequence Group from the point of the number of equipment which loses its function simultaneously, length of time of margin, level of equipment capacity necessary to prevent core damage, and whether represent the characteristic of the accident sequence group in question. Evaluation of effectiveness are performed to confirm that equipment against severe accident meets the evaluation requirements (e.g., maximum temperature of fuel cladding is below 1,200 degree Celsius) obtained by simulation code analysis, and sufficiency of plan regarding necessary man-power and fuel etc., from the view point of whether equipment required as severe accident measures can prevent severe core damage in the important accident sequence.

Equipment required to address Design Extension Condition have to meet following regulatory requirements; the equipment do not lose its function simultaneously with safety function of equipment to address Design Basis Accident caused by common cause; the equipment have anti-seismic function, etc. In addition to these requirements, high reliability is required to permanently installed equipment. For mobile equipment, meeting general industrial standards and multiple deployment of equipment (coolant injection, power source, etc.) are required.

2-5 Prevention of Containment Vessel Failure in the Design Extension Condition with core melting

Licensees are required to confirm effectiveness of measures to prevent Containment Vessel failure in the case of the Design Extension Condition with core melting.

Design Extension Condition with core melting is identified as "CV failure mode". NRA Ordinance, taking research results into account, stipulates "Designated CV failure mode" as the typical CV failure mode. Practical items stipulated as CV failure mode make certain of assuming are; Static loads by internal pressure/temperature (damage by CV over-pressurization/over-heating); High pressure melt ejection/direct heating of CV atmosphere; Ex-vessel fuel-coolant interaction; Hydrogen explosion; Direct contact with CV (shell attack); Melted core and concrete interactions (MCCI). Considering the difference of each plant, internal events are evaluated by applying PRA and external

events are evaluated by PRA or other applicable means to identify CV failure mode based on the characteristics of each plant. As a result, in case of the CV failure mode which has significant frequency of occurrence or impact is identified although it is not included in the "Designated CV failure mode", it is required to add into "Postulated CV failure mode".

In the first step, for every Postulated CV failure mode, severe accident sequence from the point of load etc., against CV is identified as evaluated accident sequence from among CV failure sequences based on the results of PRA. Subsequently, evaluation of effectiveness is conducted to confirm that equipment against severe accident meets the criteria such as maximum operating pressure or limiting pressure, provided by simulation code analysis, and sufficiency of plan regarding necessary man-power and fuel etc., from the view point of whether equipment required as severe accident measures can prevent CV damage.

Equipment required to address Design Extension Condition with core melting have to meet following regulatory requirements; the equipment perform its function in the condition of accident; redundancy, diversity, and dispersed in the different locations have to be ensured in case that equipment to address DBA have no similar function, e.g., water injection to CV bottom, hydrogen explosion, etc.; equipment have anti-seismic function, etc. In addition to these requirements, high reliability is required to permanently installed equipment. For mobile equipment, meeting general industrial standards and multiple deployment of equipment (coolant injection, power source, etc.) are required.

2-6 Measures to suppress dispersion of radioactive material

As stated in 2-4 and 2-5, NRA Ordinance requires measures to prevent severe core damage and CV failure, as measures to address Design Extension Condition. NRA Ordinance requires equipment to suppress dispersion of radioactive material to outside of site based on appropriate analysis of dispersion mode from the point of preventing abnormal level of release of radioactive material into the environment, even if assuming severe core damage and CV failure occur beyond Design Extension Condition. For example, water cannon is required to suppress dispersion of radioactive material in aerosol form leaking from reactor building.

2-7 Measures to address Loss of Large Area

Loss of Large Area is the large-scale destruction of nuclear installation caused by extreme natural disaster, intentional airplane crash or other terrorism. Extreme natural

disaster means the natural disaster beyond design basis in NRA Ordinance on Standards for the Location, etc.
In NRA Ordinance, measures with mobile equipment and Specialized Safety Facility, as installed facility, are required.

(1) Measures with mobile equipment

Loss of Large Area by airplane clash, etc., leads to severe destruction of certain area of nuclear installation. In this case, it is important to take measures not by based on assumption of certain accident sequence but to avoid losing all measures for decreasing release of radioactive material, based on the destruction occurred.

In case of natural disaster extremely beyond design basis or large airplane crash, it is required mobile equipment is not become unavailable simultaneously by taking measures of dispersed deployment, etc.

In practical; access route have to be repaired by heavy machinery stored in dispersed locations when access route such as road etc., are destroyed by natural disaster beyond design basis, etc.; ensuring to prepare connection points in the opposite side of damaged side to be able to connect mobile equipment such as feed water pump or power source in case of connection points are lost by airplane crash into one side of reactor building, are required.

(2) Measures with Specialized Safety Facility

Specialized Safety Facility "shall be equipped with adequate measures for preventing the loss of necessary function due to the intentional crashing of a large airplane into the reactor building". Practical requirements are; ensure enough distance, e.g., more than 100m, between Specialized Safety Facility and reactor building to prevent simultaneous failure of both facilities; or Specialized Safety Facility have to equipped in robust structure that can withstand the intentional airplane crash or facilities which has equivalent or more effective. Licensees have to prove that evaluated equipment has to keep its necessary function by performing structural evaluation of building and functional evaluation of equipment at the event of airplane crash, with specifying characterization of airplane and identifying exact point of crash.

"Equipment to prevent CV failure" shall be equipped in Specialized Safety Facility. Practical requirements are; Depressurization function for Reactor Coolant Pressure Boundaries, e.g., equipment for reactor depressurization operation from emergency control room; Cooling function of molten core in the reactor, e.g., equipment for

injecting low pressure water inside the reactor; function for cooling molten core that has fallen to the bottom of the CV, e.g., equipment for cooling water injection into the bottom of the CV; CV cooling/depressurization/radioactive material reduction function, e.g., equipment for injecting water into CV sprays; CV heat removal/depressurization function, e.g., venting system of CV excluding exhaust stacks; Function of prevention of CV failure by hydrogen explosion, e.g., hydrogen concentration control equipment; Support function , e.g., equipment for power source, instrumentation, and communication. And installing the emergency control room to control above mentioned functions in emergency is also required.

3 Regulatory Procedures Relating to Design and Construction of Reactor Facilities

3-1 Regulation in the design and construction phase

There are licensing process for installation permit which is explained at article 17th, and a process of construction permit, shown below. The applicant shows the conformance to the regulatory requirement for basic design by Installation permit, and the detailed design explaining specific equipment design of nuclear facility is reviewed in the Construction Permit phase.

The licensee shall submit the application of Construction Permit to the NRA before commencing construction and obtain the permit from the NRA.

In case of constructing nuclear reactor facilities newly, the applicant shall describe matters concerning detailed equipment design and attach explanatory documents as required by NRA Ordinances for reactor unit, nuclear fuel material handling facility and storage facility, reactor cooling system facility, instrumentation and control facility, radioactive waste disposal facility, radiation controlled facility, reactor containment facility etc., on the application for Construction Permit.

When the existing nuclear reactor facility is remodeled, licensee shall obtain the approval for the construction permit, or notify to the NRA in accordance with the contents of the remodeling work.

When the NRA acknowledges that the applied Construction Permit is compliant with the approved Installation permit and that the design and quality assurance method of the applicant is compliant with technical standards of NRA Ordinances, it shall approve the Construction Permit.

The licensee conducts construction work of nuclear facility after the construction permit is approved by the NRA. The NRA confirms that the construction work is

conducted in accordance with the approved Construction Permit by the pre-service inspection.

Pre-service Inspection is conducted for every construction work based on the NRA Ordinances. A licensee of fabricating nuclear fuel assembly to be used for nuclear facility shall obtain approval of the design from the NRA before the fabrication. Any fuel assembly is not allowed to use until it passes the fuel assembly inspection by NRA to confirm that it is fabricated in accordance with the approved design.

Moreover, welding parts of important equipment such as primary containment vessel shall be inspected by the licensee based on the Reactor Regulation Act.

Any licensee of reactor facility shall undergo the examination by the NRA regarding his/her system (organization, inspection methods etc.) for carrying out the self-inspection on welding.

The Reactor Regulation Act requires licensee to comply NRA Ordinance on Standards for the Location, Structure and equipment of Commercial Power Reactors and on the ordinance of Commercial Reactors Technical Standards, and if these ordinances are revised, conventional nuclear reactors also shall be compliant with the new regulatory requirements.

The licensing procedure for the type certification and the type designation was newly introduced by the revision of the Reactor Regulation Act in 2012.

The type certification is given by the NRA when the specified equipment by the NRA Ordinance Concerning the Installation and Operation of Commercial Power Reactors, is applied and confirmed to be compliance with the NRA Ordinance on Standards for the Location, Structure and equipment of Commercial Power Reactors. The equipment which the certificate is given has no need to prove compliance for every application because it has already been regarded as it is compliant with the NRA Ordinance on Standards for the Location, Structure and equipment of Commercial Power Reactors. That is expected to contribute for more efficient licensing process.

For the certified equipment which is given the type certification, the NRA reviews the application, and if it is based on and equal to the type certified design, and is compliant with the Commercial Reactors Technical Standards Ordinance, the type can be designated.

The specified equipment which the type designation is given has no need to prove compliance for every construction permit application because it has already been regarded as it is compliant with the Commercial Reactors Technical Standards Ordinance, which is expected to contribute to more efficient licensing process of

construction permit.

3-2 Regulatory Requirements

In the next phase, the licensee with a reactor installation permit must conduct a detailed design of the reactor facility and, prior to the construction of the facility, must obtain approval of the design from the NRA in accordance with the provisions of the Reactors Regulation Act. Table 18-2 is a list of articles. Facilities (facilities subject to the design standards) to prevent occurrence or development of a design basis accident are classified into classes as shown in Table 18-3.

Table 18-2 Classification of facilities subject to the design standards

Class 1	Vessels, pipes, pumps, valves	Components comprising the reactor coolant pressure boundary
	Support structures	Structures to support Class 1 components
Class 2	Vessels, pipes, pumps, valves	Components required to safely shut down a power reactor or ensure the safety of a power reactor facility in an environmental condition, such as a design basis accident or until the period fall in to design basis accident, that may indirectly cause radiation hazards to the public as a result of damage or failure and other error.
		Components that are for a circuit in which a fluid (steam, feed water) circulates with the main purpose of driving a steam turbine and are located between a Class 1 component in the steam line downstream of a Class 1 component and the stop valve closest to the component and between a Class 1 component in the feed water line upstream of a Class 1 component and the stop valve closest to the component
		Components other than the above that are located between a penetration in the reactor containment vessel and the isolation valve inside or outside of the vessel
	Support structures	Structures to support Class 2 components
Class 3	Vessels, pipes	Vessels(which are belong to subjected to design standard facilities) or pipes (limited to pipes containing a fluid in which the concentration of radioactive material is more than 37 mBq/cm^3 (37 kBq/cm^3 if the fluid is a liquid or pipes with a maximum operating pressure of more than zero MPa), other than ducts, that are for a Class 1 component, a Class 2 component, a reactor containment vessel, a radiation control facility, or a reactor containment facility (limited to emergency gas treatment systems)
Class 4	Pipes	Ducts that are for a radiation control facility or a reactor containment facility (limited to emergency gas treatment systems) and contain a fluid in which the concentration of radioactive material is more than 37 mBq/cm^3 (excluding Class 2 pipes)
Reactor containment vessel support structures		Structures to support the reactor containment vessel

Table 18-3 Classification of operating conditions

Operating Condition I	Normal operating condition of a power reactor facility
Operating Condition II	A condition in a design basis accident or in an environment that is anticipated before the situation develops into a design basis accident, other than Operating Condition I, Operating Condition III, Operating Condition IV and Testing Condition
Operating Condition III	A condition that requires an emergency shutdown of the power reactor operation due to an unusual event, such as a failure or malfunction of a power reactor facility, in a design basis accident or in an environment that is anticipated before the situation develops into a design basis accident
Operating Condition IV	A condition in which an event anticipated in the safety design of a power reactor facility has occurred in a design basis accident or in an environment that is anticipated before the situation develops into a design basis accident
Testing Condition	A condition in which a power reactor facility is being subjected to the maximum operating pressure in a hydrostatic test

As shown in Table 18-4, severe accident management installments are classified into classes and regulatory requirements are set for each class.

Table 18-4 Classification of severe accident management facilities

Severe Accident Class 1	Vessels, pipes, pumps, valves	Vessels which are subjected to treatment installments for severe accident , pipes, pumps (Limited to facilities to manage specified severe accidents)
	Support structures	Structures to support Severe Accident Class 1 components
Severe Accident Class 2	Vessels, pipes, pumps, valves	Vessels, pipes, pumps or valves for permanent severe accident management systems (excluding those for specified severe accident management facilities)
	Support structures	Structures to support Severe Accident Class 2 components
Severe Accident Class 3	Vessels, pipes, pumps, valves	Vessels, pipes, pumps or valves for portable severe accident management systems

In addition to above, method of quality assurance and the organization for its inspection of the licensee of power reactor operation are reviewed to be technically appropriate through the licensing process of construction permit in order to confirm the licensee's quality control methods etc. from the stage of design and construction of nuclear facilities.

3-3 Compliance to the regulatory standard

The licensee is conducting modification such as addition of necessary facility in order to comply with regulatory standard set forth by NRA. For example, they take measure to install a protection wall around the sea water pump assuming higher Tsunami, and install a protection bank around the nuclear facility.

And the weir for storage is installed at the water intake port to secure cooling water during a certain period of time in case of undertow of Tsunami. The additional fuel storage tank for emergency diesel generator engine is increased for the capacity of more than 7 days consecutive operation in order to improve reliability of emergency power in case of loss of off-site power.

As measures for the case of failure of Emergency Shutdown, an automatic operation panel is newly installed enables to close MSIV[16] and inject emergency boric water to place Power Reactors in a Subcritical State even if control rod cannot be inserted.

As measures for cooling, reliability is improved by increasing permanent cooling water pumps to diversify the function of water injection into the reactor pressure vessel and the primary containment vessel.

In order to prevent the hydrogen explosion, measure to prevent failure of the containment vessel are taken such as additional installation of equipment enable to ignite hydrogen or recombine to water.

Article 18 (2) Application of Proven Technologies

Though the Reactor Regulation Act and other regulatory requirements does not force licensees to use only technology proven by the experience or test/analysis, it is a regular manner to use proven technology for application of the Construction Permit, and if licensee adopts a new technology, he shall prove that the technology comply with the technical standards of NRA by conducting verification test etc.

Measures that Licensees should take in the Application of Proven Technologies, the NRA Ordinance Prescribing Standards for the Location, Structure, and Equipment of Commercial Power Reactors and their Auxiliary Facilities requires the highest standards of reliability for safety structures, systems, and components with safety functions, and that their design is such that this can be maintained.

[16] Main Steam Isolation Valve

This should not impede the application of new technologies, but licensees are required to ensure the reliability of these technologies when designing reactor facilities.

Safety facilities should function in all envisaged environmental conditions up to the occurrence of a design basis accident; moreover, in order to check their soundness and capabilities, they must be tested or inspected while the reactor facility is operating or shut down.

More specifically, in obtaining Reactor Installation Permits and Approval of Construction Plans, it is necessary for licensees to verify the technologies used in the design of reactor facilities.

Licensees are taking the following measures.

- The hardware of Reactor Protection System (RPS) is physically and functionally separated, by the measure that signals from the RPS are only sent from the system, but any signal from the outside is not received by RPS, and any hardware is not allowed to connect the RPS directly. And access from outside is protected by the measure that signal from the RPS Panel is limited only to those to send.
- As the measure to limit access, physical access is limited by the access control at the entrance of the nuclear facility, and access to the software is limited by the maintenance tool of RPS Panel control device and by key control of connector to the maintenance tools to prevent unauthorized change.
- For the software of the Reactors Protection System (RPS), a specific software of which verification and validation have been done in every phase of design, fabrication, test and design change control, so that a general computer virus can't activate in accordance with the industrial standards[17][18].
- As measures to protect RPS from the disturbance by thunder, induction surge and electromagnetic waves etc., isolation circuit etc. is installed at the point of connection of electric power or signal cables to RPS panels.
- A licensee requires the supplier to take the protection measure for virus, security measures to prevent sabotage to the RPS design. The supplier takes measures such as to prohibit connection with the internet directly, and use only the limited tools for connection for the maintenance.

[17]Standard for adopting RPS on digital calculator（JEAC4620）

[18] Guide for digital RPS on verification and validation（JEAG4609）

Article 18 (3) Design for Highly Reliable, Stable, and Easily Manageable Operations

Safety facilities should designed that they function in all envisaged environmental conditions up to the occurrence of a design basis accident by the regulatory requirement, so high reliability is requested.
Moreover, it is requested that safety facilities can be operated easily.
Facilities for taking response in the event of the severe accident are required to function effectively and can be operated certainly in the environmental condition when an envisaged severe accident occurs.
Licensee adopts design for the main control room that has main instrument and control equipment for safety facility, and enables centralized monitor and control the plant.
Considering obtain good operability and surveillance from the view point of human engineering, in order to prevent mis-operation and mis-judgement and to operate easily, the control panel is designed that the location of display, alarm and operating equipment are decided properly.
For the local operation, identification management such as color classification and locking management are adopted to prevent mis-operation.
In order to improve operability, proper tool for a local hand-operation valve or a platform for local operation is set near the main control room and inside the radioactive controlled area.

ARTICLE 19 OPERATION

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the initial authorization to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;

(iii) operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;

(iv) procedures are established for responding to anticipated operational occurrences and to accidents;

(v) necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;

(vi) incidents significant to safety are reported in a timely manner by the holder of the relevant license to the regulatory body;

(vii) programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies;

(viii) the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.

Outline of the implementation of Article 19

In order to use the nuclear facilities, the licensee has to pass the pre-service inspection to confirm that the construction work has been carried out in compliance with the approved plan for construction work and that the nuclear facilities conform to the technical standards set forth in the Technical Standard Rules.

Moreover, the licensee shall obtain the approval for the operational safety program which specifies rules concerning in–service safety preservation activities. The operational safety program specifies the limiting conditions of operation and measures in case of accidents, as well as operation and maintenance.

The licensee obtains technical support from the plant supplier or its vendors for inspection or construction during the period of in-service.

And the licensee manages the "Nuclear Information Archives (NUCIA)", database for nuclear facilities' information which is disclosed to the public, for the purpose of sharing operating experiences.
The NRA has utilizes the nuclear information notification system for sharing operating information internationally.
The licensee has obligation to report to NRA about accident etc. based on the Nuclear Regulation Act.
Spent nuclear fuels and radioactive waste are stored inside the nuclear site temporally. Radioactive waste will be treated by necessary disposal or volume reduction, and transferred to the final disposal site. As the clearance system is adopted in Japan, waste whose radiation level under the criteria can be treated as general industrial wastes, that contribute the volume reduction of radioactive waste.
Therefore, Japan conforms to the article19 of Convention.

Article 19 (1) Initial Authorization

There is no system for operating license in our country, and it's possible to use nuclear facilities concerned by the licensee who obtained nuclear reactor construction permit, did construction work of nuclear reactor facilities and passed the pre-service inspections. Moreover, the licensee must set forth their Operational Safety Programs to ensure the operational safety of the facility, and obtain NRA approval before commencing operation.

The NRA conducts the pre-service inspection in order to confirm that the nuclear facility has been constructed in accordance with the approved construction plan through the construction to operation phase. Pre-service inspection is the inspection prescribed in the Nuclear Regulation Act, and the licensee shall not use the nuclear facility until after they have passed the inspection. Pre-service inspection is the approval activity for the nuclear reactor facilities to get into the operational phase. The acceptance criteria for the pre-service inspection are that the construction work has been carried out in compliance with the approved plan for the construction work and that the power reactor facilities conform to the technical standards[19] set by the NRA. The NRA Nuclear Facility Inspector conducts the pre-service inspection in accordance with the construction phase described in the Table 19-1.

When the NRA receives an application, it shall set forth the inspection implementation procedures specifying the method of inspection as well as other necessary matters. This inspection implementation procedure is set forth by each application.

As the safety analysis has already been conducted and approved by NRA at the design stage, it is not conducted newly in the pre-operational inspection stage, as a rule.

When the NRA acknowledges that a licensee has passed a Pre-Service inspection, it shall deliver a Pre- Service inspection certificate regarding such application.

Design of nuclear fuel assembly shall be reviewed and approved by NRA in advance.

Any nuclear fuel assembly with approved design shall be inspected by the NRA, regarding its fabrication and enrichment process, and the licensee of power reactor operation shall not use it until after it has passed the inspection.

When the NRA inspect and acknowledges that the fabrication and enrichment of the fuel assembly is carried out in compliance with the approved design, and that the fuel

[19] :The NRA Ordinance on Technical Standards for Commercial Power Reactors Facilities (NRA Ordinance, No.6 dated June28,2013)

assembly conforms to the technical standards[20] specified by NRA, it shall deliver a Pre-Service inspection certificate.

Inspection items for nuclear fuel assembly are described in the Table 19-2.

Table 19-1 Items Inspected in Each Construction Process during the Pre-service Inspection

Construction Process	Matters Inspected
1. The reactor unit, nuclear fuel material handling and storage facilities, reactor cooling system facilities (excluding steam turbines), instrumentation and control system facilities (excluding power reactor operation control devices), radioactive waste disposal facilities (excluding exhaust stacks), radiation control facilities or reactor containment facilities, when it is possible to carry out tests relating to their structure, strength, or leakage	The following inspections (excluding those focused on portable machinery or appliances) relating to the structure, functions, or performance of the reactor unit, nuclear fuel material handling and storage facilities, reactor cooling system facilities (excluding steam turbines), instrumentation and control system facilities (excluding power reactor operation control devices), radioactive waste disposal facilities (excluding exhaust stacks), radiation control facilities or reactor containment facilities: (1) Inspection of material (2) Inspection of dimensions (3) Inspection of external appearance (4) Inspection to check assembly and mounting (5) Inspection of pressure resistance (6) Inspection for leakages (7) Inspection to check the status of foundations on which the reactor containment facility has been directly installed
2. When the mounting of the lower half of the steam turbine casing has been completed and the assembly of the auxiliary boiler unit has been completed	(1) The following inspections to check the structure, functions, or performance of the steam turbine: (a) Inspection of materials (b) Inspection of dimensions (c) Inspection of external appearance (d) Inspection to check assembly and mounting (2) The following inspections to check the structure, functions, or performance of the auxiliary boiler: (a) Inspection of material (b) Inspection of dimensions (c) Inspection of external appearance (d) Inspection to check assembly and mounting (e) Inspection of pressure resistance (f) Inspection for leakages
3. When the state of the power reactor allows the	Inspection to check the necessary functions or

[20] The NRA Ordinance on Technical Standards of Fuel Assembly used for Commercial Power Reactors (NRA Ordinance, No.7 dated June28,2013)

Construction Process	Matters Inspected
fuel to be inserted	performance of the nuclear fuel material handling and storage facilities, reactor cooling system facilities, instrumentation and control system facilities, radioactive waste disposal facilities, radiation control facilities, reactor containment facilities, emergency power supply system, normal power supply system, fire protection equipment, flood protection facilities, fuel equipment for driving auxiliaries (excluding that relating to the emergency power supply system and the auxiliary boiler), emergency water intake equipment, on-site civil engineering structures, and the Office for Emergency Response, when the state of the power reactor is such that the fuel can be inserted
4. When critical reaction operations can commence in the power reactor	Inspection to check the necessary functions or performance of the reactor unit, reactor cooling system facilities, instrumentation and control system facilities (excluding power reactor operation control devices), and generators, when the reactor reaches criticality
5. When all construction work in the construction plan has been completed	Inspection to check the overall performance of the power reactor facilities when the reactor is generating output and any other inspections required in order to check the completion of construction work

Table 19-2 Items Inspected in Each Engineering Process during the Fuel Assembly Inspection

Engineering Process	Matters Inspected
1. The fuel material, cladding material, and other components, when they are in a state in which tests relating to their composition, structure, or strength can be carried out	Inspection to check the results of analysis of the chemical composition of the fuel material, cladding material, and other components, and other inspections relating to the composition, structure, or strength of these components
2. The fuel assembly, which is an assembly of fuel elements, when processing of the fuel elements has been completed	The following inspections relating to the fuel assembly, which is an assembly of fuel elements: (1) Inspection of dimensions (2) Inspection to check the degree of bend (3) Inspection of external appearance (4) Inspection of surface contamination density (5) Non-destructive inspection of welded areas (6) Helium leak inspection (excluding cases in which an inspection will be carried out in relation to (3) in item 3. below)
3. When engineering has been completed	The following inspections of the assembled fuel assembly: (1) Inspection of dimensions (2) Inspection of external appearance (3) Helium leak inspection (excluding cases in which an

Engineering Process	Matters Inspected
	inspection will be carried out in relation to (6) in item 2. above)

Any licensee of power reactor operation shall, specify operational safety programs before commencing the operation of the power reactors and obtain the approval of the NRA. Operational Safety Programs also prescribe the measures that should be taken under conditions that could have a direct impact on safety, such as the establishment of limiting conditions for operation to ensure the safe operation of reactor facilities, and measures in the event of deviation from limiting condition for operation.

Licensees must comply with their Operational Safety Programs when operating and maintaining reactor facilities.

The matters that should be regulated in the Operational Safety Programs are prescribed in the NRA Ordinance on Commercial Reactors, as shown below.

- Matters relating to systems for compliance with relevant legislation and Operational Safety Programs (including the involvement of senior management)
- Matters relating to systems for fostering a safety culture (including the involvement of senior management)
- Matters relating to quality assurance at reactor facilities (including matters relating to root cause analysis methods and systems for implementing this, the positioning of procedure manuals in Operational Safety Programs, and the periodic evaluation of reactor facilities)
- Matters relating to the duties and organization of those who operate and manage reactor facilities (excluding those listed in the next item)
- Matters relating to the scope and content of the duties of Chief Reactor Engineers, the authority required by them in supervising operational safety, and their organizational positioning
- Matters relating to the scope and content of the duties of Chief Electrical Engineers, the authority required by them in supervising operational safety, and their organizational positioning
- Matters relating to the scope and content of the duties of Chief Engineers of Boilers and Turbines, the authority required by them in supervising operational safety, and their organizational positioning
- The following matters relating to operational safety education among those who operate and manage reactor facilities:
- Matters relating to the policy on implementing operational safety education (including the formulation of implementation plans)

- The following matters relating to the content of operational safety education:
  (1) Matters relating to compliance with relevant legislation and Operational Safety Programs
  (2) Matters relating to the structure, performance, and operation of reactor facilities
  (3) Matters relating to radiation control
  (4) Matters relating to the handling of nuclear fuel material and items contaminated with such material
  (5) Matters relating to measures that should be taken in an emergency
- Other matters required in relation to operational safety education concerning reactor facilities
- Matters relating to the operation of reactor facilities
- Matters relating to the operation period of reactors
- Matters relating to safety reviews of the operation of reactor facilities
- Matters relating to the establishment of controlled areas, conservation areas, and supervised areas and restrictions on entry to these
- Matters relating to exhaust gas and effluent monitoring equipment
- Matters relating to the monitoring of dose, dose equivalent, radioactive material concentrations, and the surface contamination density, as well as matters concerning the decontamination
- Matters relating to the management of radiation detectors
- Matters relating to patrol to and inspections of reactor facilities and procedures arising from these
- Matters relating to receipt and send out of nuclear fuel material, as well as its transport and storage, and other matters relating to its handling
- Matters relating to the disposal of radioactive waste
- Matters relating to measures that should be taken in an emergency
- Matters relating to the development of systems for conducting activities to maintain the integrity of reactor facilities in the event of a severe accident, large-scale damage, fire, or internal flooding
- Matters relating to appropriate recording and reporting of operational safety at reactor facilities (including the status of compliance with Operational Safety Programs)
- Matters relating to the maintenance management of reactor facilities (including matters relating to systems for the implementation of licensee's welding

inspections and Periodic Licensee's Inspections, matters relating to the technical evaluation of age-related deterioration, and the long-term maintenance management policy)

- Matters relating to the sharing of information with other licensees, focused on technical information concerning operational safety obtained from contractors who have carried out maintenance checks
- Matters relating to the disclosure of information concerning noncompliance, in the event that such noncompliance has occurred
- Other matters required in relation to the operational safety of reactor facilities

Operational Safety Programs can be revised after being approved, due to such factors as those relating to the organization of the licensee or modification of the reactor facilities.

If intending to change their Operational Safety Programs, licensees must obtain the approval of the NRA for the amended programs.

Moreover, the NRA may order the amendment of Operational Safety Programs in accordance with the provisions of the Reactor Regulation Act, if it deems this to be necessary in order to prevent a disaster resulting from nuclear fuel material, material contaminated by nuclear fuel material, or reactors.

The Operational Safety Programs are the most important documents in the operation of a reactor facility, so licensees put together various operating procedure manuals and testing guidelines that set forth the procedures for the actual operation and maintenance of reactor facilities.

These provisions subordinate to Operational Safety Programs are managed appropriately under the quality management systems of licensees, including matters relating to consistency with their Operational Safety Programs.

Article 19 (2) Limiting Condition for Operation

1 Regulatory Requirements Concerning Limiting Conditions for Operation

In Japan, in accordance with the provisions of the Reactor Regulation Act, licensee must set forth their Operational Safety Programs and obtain NRA approval therefor before commencing operation of a reactor facility.

The figures for the limiting conditions for operation of reactor facilities correspond to such values as the shutdown margin and thermal limit value of the reactor, and are

all prescribed in the Operational Safety Programs.

If a licensee fails to comply with the limiting conditions for operation, the NRA may order the licensee concerned to take such action as shutting down the reactor facility, in accordance with the provisions of the Reactor Regulation Act.

In the event that a reactor facility deviates from its limiting conditions for operation, the licensee is required to immediately declare a deviation from the limiting conditions for operation and report this to the NRA.

Licensees must take measures to revert from a state of deviation from the limiting conditions for operation within the allowed time of operation permitted in the event of a deviation from limiting conditions for operation. However, if it cannot resolve the deviation within the time allowed, it must modify the reactor's status in such a way as to ensure that the limiting conditions for operation do not apply.

This includes shutting down the reactor.

If the NRA receives a report of a deviation from the limiting conditions for operation from a licensee, it examines the root cause and provides other licensees with feedback, if necessary.

2 Establishment, Implementation, and Revision of Limiting Conditions for Operation

Operators at reactor facilities take turns to operate and monitor the reactor, and are responsible for such practical duties as ensuring compliance with the limiting conditions for operation and taking the necessary steps in the event of deviation from these.

The limiting conditions for operation and measures to be taken in the event of deviation from them are specifically documented in Operational Safety Programs and operators are required to implement those procedures correctly.

The limiting conditions for operation are conditions relating to the safe operation of reactor facilities, and there are cases in which it is necessary to alter them, such as when related equipment is modified.

As described above, the limiting conditions for operation are detailed in operational safety programs and if they are revised, it is necessary to obtain approval from the NRA for that revision.

More specifically, when revising the limiting conditions for operation, licensees must not only conduct their own review, including a safety evaluation, but also undergo a

review by the NRA.

Article 19 (3) Procedures for Operation, Maintenance, Inspection, and Testing

1 Operation, Maintenance, Inspection, and Testing of Reactor Facilities

1-1 Periodic Facility Inspections

In Nuclear Facility, Reactor unit, nuclear fuel material handling facility and storage facility, reactor cooling system facility, instrumentation and control facility, radioactive waste disposal facility, radiation controlled facility, reactor containment facility, emergency power supply equipment and Main bodies and accessory equipment of steam turbines shall be inspected in Periodic Facility Inspection by NRA. During the Periodic Facility Inspection, NRA Nuclear Facility Inspector participates in witness of some part of Licensee's inspections, or review licensee's inspection records.

In accordance with the Reactor Regulation Act, the timing of the Periodic Facility Inspection is stipulated in the NRA Ordinance, which prescribes that reactors and their auxiliary equipment are to undergo inspection at intervals of 13, 18, or 24 months, as specified by the NRA in a public notification.

When an application for Periodic Facility Inspection is submitted from a licensee, the NRA shall set forth the Inspection Implementation Procedures by stipulating inspection methods and other necessary matters. This procedure is prepared for every application of each nuclear facility to be inspected.

Through the Periodic Facility Inspection, compliance to the Technical Standards for Commercial Power Reactors Facilities is confirmed.

1-2 Periodic Licensee's Inspections and Periodic Safety Management Reviews

The licensee is obligated to conduct the periodic self-inspection to confirm the compliance with Technical Standards for Commercial Power Reactors Facilities.

Nuclear Facilities where a periodic self-inspection should be performed are component of, reactor unit, nuclear fuel material handling facility and storage facility, reactor cooling system facility, instrumentation and control facility, radioactive waste disposal facility, radiation controlled facility, reactor containment facility, emergency power supply equipment, auxiliary boiler unit, fire protection facility, inundation protective facility, auxiliary machine driving fuel system, emergency water intake system and main bodies and accessory equipment of steam turbines.

A licensee's periodic inspection shall be implemented by the following methods such as an open-up/overhaul/non-destructive inspection or any other method that sufficiently confirms occurrence of any damage, deformation, wear, and abnormality in any part, or by a test drive or any other method that sufficiently confirms functions and operation, and a sufficient method to confirm during operation any sign of occurrence of abnormality due to damage, deformation, wear or the like in each part.

When a licensee who carries out a periodic self-inspection finds, at the time of the periodic self-inspection, that is likely to cease to conform with the technical standards[21] after the elapse of a certain period of time, he/she shall evaluate the time when said part is expected to cease to conform with the technical standards, and record and preserve the results thereof, and at the same time, shall make a report to the NRA.

Targets to be evaluated are the core shroud and the shroud support, out of the vessel, piping and core support structure those belonged to Class 1 Components defined in technical standards rules.

Method to evaluate the time when the part cease to conform with technical standards is, to presume the cause of crack generation, specify its shape and size, predict the development of the crack in a fixed period based on the size and evaluate the time when the crack is expected to cease to conform with the technical standards, in the condition that the crack develops as expected.

If it's necessary to repair as a result of this evaluation, timing to conduct, scope and method to repair shall be evaluated and confirmed to be appropriate.

The licensee has to be inspected about the regime for its periodic self-inspection through the periodical safety management inspection by NRA.

This inspection is conducted on the items specified by the NRA such as licensee's regime to conduct periodic self-inspection, inspection methods, schedule management.

1-3 Operational Safety Inspections

Operational Safety Inspections are designed to check that licensees comply with the Operational Safety Programs previously approved by the NRA in the operation and maintenance of reactor facilities. They are carried out four times a year, with each inspection taking about two weeks.

Safety inspectors of NRA are permanently stationed in the Nuclear Regulation Office

[21] Article 18th of Technical standard Rules prescribes specifically, Class 1 Components, Class 1 Support Structures that are being used must not have any cracks or other defects that may trigger damage thereof, and the pressure part of Class 1 Components that are being used must not have any cracks penetrating said pressure part or other defects..

near nuclear sites. As explained in the Article 8th, a senior safety inspector is assigned as an office chief, and a nuclear emergency preparedness officer is assigned as a deputy office chief, and adequate number of nuclear safety inspectors for the nuclear facility is designated.

During the Operational Safety Inspections, Operational Safety Inspectors may, in accordance with the provisions of the Reactor Regulation Act, enter business establishments, inspect documents and equipment, ask questions of relevant personnel, and request the submission of the requisite samples.

Furthermore, as well as the quarterly inspections in accordance with the provisions of the NRA Ordinance on Commercial Reactors, the status of compliance with the Operational Safety Programs may be inspected when conducting the Periodic Facility Inspections prescribed in the Reactor Regulation Act, in the event that the following operations will be carried out.

- Operations relating to the startup or shutdown of a reactor
- Operations relating to refueling
- Operations relating to the switchover of the residual heat removal seawater system in BWR
- Operations relating to the reduction of the water level within the reactor vessel in PWR and operations relating to the removal of residual heat carried out while the water level within the reactor vessel is reduced
- When exercises which are recognized by the NRA as necessary to inspect are carried out for key response personnel who would be involved in dealing with a severe accident or large-scale damage

The NRA checks the implementation status of such maintenance activities as part of its Operational Safety Inspections.

The Operational Safety Inspection is conducted to confirm that the operation and maintenance of licensees is performed in accordance with their Operational Safety Programs, so an certain activity is focused out of all activities, each process of its planning, enforcement, evaluation and improvement are examined, and complementally, compliance status of requirements of Operating Safety Program's all articles are confirmed for every two years.

The Senior Nuclear Safety Inspector develops a inspection policy every year, based on NRA policy for operating safety inspection and evaluation result of last year's inspection, and furthermore, develops a plan for operational safety inspection before the inspection. The operational safety inspection is conducted based on this plan.

If a fact which is thought as violation is found through the inspection, the Senior

Nuclear Safety Inspector makes a judgment of degree of violation based on the judgment criteria of operational safety program violation. The judgment is conducted from the viewpoints of influence to the safety function, radiation exposure and quality assurance.

There are 3 levels of "violation1, 2, 3" and one "observation" for the classification, and if the result is judged as any of "violation1, 2, 3", it must be reported to the NRA. The NRA receives information from the licensee, requests the report including measure to prevent recurrence and make an additional inspection in accordance with the violation level.

By the Reactor Regulation Act, violation of Operational Safety Program is placed in the important violation by which licensing permission may be rescinded or suspension of operation may be ordered for a period not exceeding one year.

When the Senior Nuclear Safety Inspector judges the violation level, licensee's opinion is also heard and considered properly.

The result of the operational safety inspection is summarized and reported to NRA every quarter of the year, and disclosed to the public through the website of the NRA.

1-4 Maintenance management of reactor facilities

Licensees must take the following measures in relation to checks, tests, inspections, repairs, replacement, modification, and any other measures deemed necessary to the maintenance of reactor facilities (maintenance management), both while the reactor is operating and while shut down, in accordance with the provisions of the NRA Ordinance on Commercial Reactors.

- Set forth a policy concerning the maintenance management of reactor facilities (hereinafter referred to as the "maintenance management policy") to ensure that the reactor facility performance detailed in the Reactor Installation Permit is being maintained.
- Set out targets for maintenance management that should be achieved in accordance with the maintenance management policy (including quantitative maintenance management targets relating to systems of high importance in regard to the reactor and maintenance management).
- Formulate a plan for the implementation of maintenance management that sets out the following matters, in order to achieve the maintenance management targets, and implement maintenance management in accordance with this plan.

  - Matters relating to the timing of the commencement and the duration of the plan concerning the implementation of maintenance management
  - Matters relating to methods used for conducting checks, tests, inspections, repairs, replacement, and modifications (inspections, etc.) of reactor facilities, and the frequency and timing thereof
  - Matters relating to measures to ensure operational safety taken when conducting inspections, etc. of reactor facilities
  - Matters relating to checks of the results of inspections, etc. of reactor facilities and methods of evaluating these
  - Matters relating to corrective and preventive measures concerning methods of conducting the inspections, etc. that should be carried out at reactor facilities, in light of checks of the results of such reactor facility inspections, etc. and the results of the evaluation thereof, as well as the frequency and timing thereof
  - Matters relating to records of maintenance management at reactor facilities
- Periodically evaluate the reactor facility maintenance management policy, the maintenance management targets, and plans for the implementation of maintenance management.
- Reflect the results of the evaluation referred to in the item above in the reactor facility maintenance management policy, the maintenance management targets, or plans for the implementation of maintenance management.
- Take special measures in relation to the steps referred to in the foregoing items, tailored to the particular condition of the reactor facility in question, in the event that operation of the reactor is suspended for a considerable period of time or in other situations that differ from the norm from the perspective of the maintenance management of a reactor facility.

In addition, if a licensee has formulated or amended a long-term maintenance management policy, this must be reflected in the maintenance and management policy. A report on measures to deal with the aging of facilities is provided in Article 14.

1-5 On-site inspections

In accordance with the provisions of the Reactor Regulation Act, the NRA may conduct on-site inspections to the extent necessary for enforcing the Act.

During these on-site inspections, NRA staff may enter the offices or business establishments of licensees and inspect documents, records, and other articles, as well as questioning the personnel there.

These inspections include inspections of manufacturers, etc. The NRA may directly inspect those involved in the design or construction of nuclear facilities, as well as those involved in the manufacture of equipment for such facilities.

1-6 Chief Reactor Engineers and Operation Supervisor

Chief Reactor Engineers, who are deployed at each reactor by the relevant licensee, are selected from among those who have qualifications certified by means of a national examination, and have the practical experience[22] stipulated in the NRA Ordinance; it is necessary to formally notify the NRA of their appointment and dismissal.

If deemed necessary in terms of operational safety, Chief Reactor Engineers may give their opinions to the station chief, provide staff at all levels with advice and recommendations, and participate in the formulation of plans for operational safety.

Operation Supervisor are appointed by licensees and deployed at each reactor.

The Reactor Regulation Act requires that records concerning fuel assemblies, reactor inspections, operation, radiation control, maintenance, anomalies or accidents, and weather be included in the operational records compiled and retained by licensees.

Moreover, the Reactor Regulation Act stipulates that the results of Periodic Licensee's Inspections be recorded and saved, covering such matters as the focus of inspections, as well as the methods used to conduct them and the results thereof.

2 Establishment, Implementation, and Revision of Operation Manuals

The NRA Ordinance on Commercial Reactors stipulate that licensees must set forth manuals, procedural manuals, and other documentation relating to operational safety, based on their Operational Safety Programs, and must comply with these.

Procedural manuals are required to be documented, following an approval procedure within the nuclear power station, and applied to the operation and maintenance of the reactor facility in question.

[22] The Rules on Commercial Reactors stipulate that at least three years of practical experience are required, adding together the periods listed below.

(i) Period of involvement in duties relating to construction work on or maintenance management of power reactor facilities
(ii) Period of involvement in duties relating to the operation of power reactors
(iii) Period of involvement in duties relating to the analysis and evaluation of the safety of power reactor facility design
(iv) Period of involvement in duties relating to the design or management of power reactor fuel assemblies

Moreover, in the event that the procedure is altered, due to such reasons as the modification of equipment, licensees are required to ensure that those carrying out tasks do not follow the incorrect procedure.
Procedural manuals are required to be made available in such a way as to ensure that all staff involved in the operation and maintenance of a reactor facility can make appropriate use of them, such as placing them in the control room.
Procedural manuals are documents put in place on the basis of Operational Safety Programs, so they are included in the scope of application of quality management systems.
Procedural manuals are reviewed regularly and revised if necessary.

Article 19 (4) Procedures for Dealing with Events Occurring during Operation

1 Regulatory Requirements Concerning Responses to Abnormal Events

In the NRA Ordinance on Commercial Reactors, licensees are obliged to take the necessary steps, in the form of emergency measures, to prevent radiation hazards.
This is prescribed in Operational Safety Programs as a measure that should be taken in an emergency.
Furthermore, licensees are obliged to detail "matters relating to the operation of reactor facilities" in their Operational Safety Programs.
As well as procedural manuals focused on the handling of normal operation, these include procedures relating to handling operation in the event of an accident or other abnormal situation, thereby ensuring a smooth response to accidents and abnormal events.
Matters prescribed in relation to "steps in the event of an abnormal situation" include status checks, the removal of root causes, the necessary measures in order to prevent escalation, and measures following reactor scram.
The operating procedures in an emergency are one of the operating procedures based on the Operational Safety Programs. During the operational safety inspection, the NRA checks the procedures and system for their implementation.

2 Operating Procedures in an Emergency

The emergency operating procedures are put in place as provisions subordinate to and

based on the Operational Safety Programs; they include procedures formulated as standards based on events such as the occurrence of an earthquake or a fire, as well as those formulated as standards based on changes in the operational parameters of the reactor.

3 Responses to Severe Accidents

As well as stipulating the following with regard to responses to severe accidents, the NRA Ordinance on Commercial Reactors prescribe that these measures shall be evaluated periodically, with the requisite measures being taken on the basis of the results.

- Formulating the plans required in order to carry out activities to maintain the integrity of reactor facilities in the event of a severe accident, etc.
- Deploying the personnel required in order to carry out activities to maintain the integrity of reactor facilities in the event of a severe accident, etc. (key response personnel)
- Implementing regular education and exercises at least once a year among key response personnel
- Furnishing vehicle-mounted generators, fire trucks, fire hoses, and other materials and equipment required in order to carry out activities to maintain the integrity of reactor facilities in the event of a severe accident, etc.
- Setting forth the following matters required in order to carry out activities to maintain the integrity of reactor facilities in the event of a severe accident, etc. and ensuring that key response personnel comply with these
  - Matters relating to measures to prevent significant core damage
  - Matters relating to measures to prevent the containment failure
  - Matters relating to measures to prevent damage to fuel assemblies stored in spent fuel storage facilities
  - Matters relating to measures to prevent damage to fuel assemblies when the reactor is shutdown
- Putting in place the systems required in order to carry out activities to maintain the integrity of reactor facilities in the event of a severe accident, etc., other than those listed above

Moreover, the NRA Ordinance on Commercial Reactors stipulate that matters relating to putting in place systems for carrying out activities to maintain the integrity of

reactor facilities in the event of a severe accident, large-scale damage, fire, or internal flooding should be detailed in Operational Safety Programs; accordingly, licensees take measures to prepare for a severe accident.

Article 19 (5) Engineering and Technical Support

There is no regulation of engineering or technical support for licensees.
This enables licensees to respond flexibly, at their own discretion, if they require engineering or technical support to ensure the safety of reactor facilities.
If licensees outsource technical support for duties relating to the operation and management of reactor facilities to a specialist contractor, it is vital that the contractor to which the work is outsourced is equipped with the necessary capabilities and conditions to ensure the safety of reactor facilities; accordingly, Operational Safety Programs require licensees to monitor and manage contractors appropriately, on the basis of their own quality management systems, and their performance in this regard is checked by the NRA in inspections such as Operational Safety Inspections.

Article 19 (6) Reporting of Events and Failures

1 Regulatory Requirements

In the event of an accident or failure at a reactor facility, licensees are obliged to report this fact immediately, in accordance with the Reactor Regulation Act, and also have an obligation to provide the NRA with a report on the situation and the measures taken to deal with it within ten days of its occurrence.
Moreover, in the event of a specified event or emergency prescribed in the Nuclear Emergency Act, licensees are required to notify the Prime Minister and NRA of this fact immediately.

2 Outline of Reporting Criteria and Reporting Procedures for Events, Failures, etc.

The criteria for reporting an event in accordance with the provisions of the Reactor Regulation Act are prescribed in the NRA Ordinance on Commercial Reactors.

Licensees are required to report such cases to the NRA, based on these criteria.
The NRA has constructed a system that enables reports of event to be accepted 24 hours a day, 365 days of the year. In the event that should be reported, the licensee immediately provides an initial report to the duty NRA officer and continues to provide reports thereafter in accordance with legislation.
Upon receiving such reports from licensees, the NRA releases such information as the details of the event, the NRA's response, and the provisional INES rating without delay.

3 Reporting of Events and Failures during the Past Three Years

The annex provides list of events reported by licensees to the NRA and its predecessor, NISA, during the period FY2013-2015, in accordance with the provisions of the Reactor Regulation Act.
There were 5 events each in FY2013, FY2014, and FY2015.

4 Investigation of the Causes of Events or Failures and Measures to Prevent Their Recurrence

Licensees have a primary responsibility to deal with events that occur at their reactor facilities and must take responsibility for everything from investigating the root cause of the event to implementing measures to prevent recurrence.
The NRA checks that this process is being carried out appropriately, or provides guidance to ensure that this is the case.
As well as investigating the event, compiling a report outlining the root cause and measures to deal with it, and submitting the report to the NRA, licensees also publish their reports.
The NRA examines the details reported by the licensee concerning the root cause and measures to prevent recurrence, in order to check the validity of the investigation and the measures formulated by the licensee as a result.
Moreover, with regard to measures to prevent recurrence of the event in question, licensees are required to take preventive measures not only in regard to knowledge gained from events occurring at their own reactor facilities, but also knowledge gained from events that have occurred at other facilities, in accordance with the provisions of the Reactor Regulation Act.

5 Use of INES

In July 1989, Japan began to use its own nuclear event evaluation scale to assign ratings to events that occurred within Japan, but since August 1992, it has used the INES to evaluate an event.
NRA accepts the report from the licensee of an accident or failure in accordance with laws such as the Reactor Regulation Act, and after judging that the cause and measures in the report is appropriate, decide the INES rating based on the report. Besides, in case of judging level of event occurred at TEPCO's Fukushima Daiichi NPS after approval of its Implementation Plan, INES rating is not applied for the event less than INES 6 level. That's why the criteria of the defense in depth and standard to manage radiation barrier for the facility is not appropriate to apply.
INES is the communication tool to convey importance of safety of an event in nuclear facilities, and a rating is announced at a website of the NRA. Event which INES rating is level 2 or higher than level 2 will be registered on the NEWS website IAEA manages, and if necessary, event which INES rating level is lower than level 2 is also registered.

Article 19 (7) Making Effective Use of Operational Experiences

1 Measures for Effective Use of Operational Experiences

If a safety significant event occurs, licensees are required to report this to the NRA without delay, in accordance with the provisions of the Reactor Regulation Act. Once in receipt of the report concerning the event, the NRA immediately publishes the details and checks the response of the licensee to the event. Moreover, once the root cause has been identified and a decision has been taken on measures to prevent recurrence, these are also published.
Having received advice from experts in operation management, inspection, and radiation control, the NRA scrutinizes information concerning the event and strives to identify safety lessons from it, if necessary, it requests that licensees reflect these lessons in their operation and maintenance activities, or reflects them in its own regulatory activities.
The NRA has a system to collect and evaluate domestic and abroad information related nuclear safety. The Reactor Safety Examination Committee and the Nuclear Fuel Safety Examination Committee are established to collect domestic and abroad information

related nuclear accident, and overseas regulatory movement, and to analyze, to report and to make advise to NRA.

In the information collection and analysis process in the Secretariat of the NRA, through the first step of screening process, information with possibility related to regulation of our country is chosen from collected information, and through the second step of screening process, "technical information which needs measure to be taken" is selected,

The Secretariat of the NRA study about the "technical information which needs measure to be taken" and develop the measure, report to the Reactor Safety Examination Committee and the Nuclear Fuel Safety Examination Committee periodically, get the advice and report to NRA periodically.

In such manner, decision by NRA is conducted and reflected to the regulation in our country.

It's prescribed in the NRA Ordinance, as the obligation, licensee must define an operational safety program covering the matters related to sharing of technical information on operational safety among licensees when such knowledge is gained by a licensee that conducted maintenance or inspection.

This regulation is a measure for licensee to share event information among licensees and utilize for nuclear safety, even if it has only small influence.

The licensee manages the "Nuclear Information Archives (NUCIA)", database for nuclear facilities' information which is disclosed to the public, cooperating with JANSI.

Database of NUCIA contains operating information from the first nuclear reactor in 1966 to the current reactors or reprocessing plant, and is shared not only by licensees but also the public for the transparency.

In addition to that, as for the collection, analysis, assessment and utilization of operating information among licensees, JANSI, as a third party which is independent from electricity utilities, collect domestic and abroad information such as event at nuclear facility, analyze, assess and provide the result to the domestic electricity utility.

In addition, during its review process, the NRA instructs licensees to share the information and take necessary measures for evens that should be reported to the NRA, in accordance with legislation.

2 International Sharing of Operational Experiences

As a country that has experiences of operating many reactor facilities, Japan believes

that it is vital to share these experiences with a wide range of countries on the international stage, and that it has a responsibility to do so in order to improve global nuclear safety.
The NRA shares information internationally via mechanisms for sharing information about events with international organizations such as the IAEA and OECD/NEA, as well as through bilateral cooperation.
Mechanisms relating to the sharing of operational experiences with international organizations include the proactive provision of information via the Incident Reporting System (IRS). In Japan, the mechanism involves the NRA gathering information about operational experiences within Japan, compiling it as a database, and providing these data to the IRS.
In terms of bilateral activities, information is shared through a long-established system of regular meetings etc., to exchange information.

Article 19 (8) On-site Management of Spent Fuel and Radioactive Waste

1 On-site Management of Spent Fuel

In addition to the spent fuel pools used at many reactor facilities, dry storage casks are used to store spent fuel at some power stations.
In storing spent fuel, licensees are required to take the necessary measures to cool the fuel, and to ensure that the design of the storage system is such that the fuel is kept subcritical. The Pre-service Inspections check that construction work has been carried out according to this design, while the Periodic Licensee's Inspections carried out by licensees check that the soundness of the storage facility is being maintained during the lifetime of the reactor facility.
The on-site management of spent fuel is positioned in safety regulations as part of measures to ensure the operational safety of reactor facilities, so its implementation status is checked in Operational Safety Inspections.

2 On-site Management of Radioactive Waste

Licensees are required to take appropriate measures in relation to the transport, storage, and/or disposal on-site of radioactive waste as part of the measures required for operational safety, in accordance with the provisions of the Reactor Regulation Act.

If disposing of radioactive waste at a site, licensees are required to ensure that this takes place under the supervision of someone who has the requisite knowledge concerning disposal and radiation protection associated with disposal.

The measures that should be taken to dispose of radioactive waste are prescribed according to the nature of such waste.

Gaseous radioactive waste is required to be discharged using an exhaust facility, or to be retained as waste in disposal tanks.

Liquid radioactive waste is required to be discharged using a drainage facility, retained as waste in disposal tanks, or placed in containers or solidified along with the container and stored at a retained waste facility, or incinerated at an incineration facility.

Solid radioactive waste is required to be incinerated at an incineration facility, placed in containers, or solidified along with the container and stored at a retained waste facility. Alternatively, radioactive waste that is extremely difficult to dispose of using these methods, such as large items of machinery, and radioactive waste that requires the decay of radioactivity over time is required to be stored at a retained waste facility.

The NRA Ordinance on Commercial Reactors prescribe requirements and criteria for each disposal method in relation to the type of radiation monitoring necessary to prevent radiation hazards and the containers required for disposal, thereby ensuring the appropriate handling of radioactive waste. Licensees store radioactive waste generated by their own reactor facilities at on-site storage facilities, until it can be taken to a disposal facility.

Radioactive waste is classified into gaseous, liquid, and solid waste. Gaseous radioactive waste is exhaust gas generated by ventilating components and rooms in the radiation controlled area, and it is discharged via exhaust stacks while using exhaust radiation monitors to monitor it.

Liquid radioactive waste is effluent generated within the controlled area, which is filtered, demineralized, and concentrated; apart from some that has an extremely low level of radioactivity, the treated liquid is re-used in the facility, as a general rule, rather than being discharged into the environment.

Solid waste such as scrap material generated in the course of maintenance and repair work during the period of Periodic Facility Inspections is either placed as it is into drums, or incinerated, melted, or compressed in order to reduce the volume before being placed into drums, and is then stored at the on-site radioactive waste storage facility.

In Japan, there are no legal provisions imposing an obligation to minimize the volume

of radioactive waste generated, but as there is a limit to the quantity of radioactive waste that can be stored on-site, and it costs money to treat and dispose of waste, licensees voluntarily strive to minimize the amount of radioactive waste by such means as evaporative concentration of liquid waste and the compression or melting of solid waste.

The on-site management of radioactive waste is positioned in safety regulations as part of measures to ensure the operational safety of reactor facilities, so its implementation status is checked in Operational Safety Inspections.

3 Clearance Procedures

In Japan, of the scrap material generated due to the operation and maintenance of reactor facilities or decommissioning measures, radioactive waste with an extremely low radioactivity concentration is safely classified as "material not required to be handled as radioactive waste" after the approval and confirmation by the NRA, following which it is appropriately and rationally recycled or disposed of (Clearance system).

The methods of measuring and evaluating the radioactivity concentration of items for which licensees are seeking clearance are formulated in accordance with the provisions of the Reactor Regulation Act, and the regulatory authority approves radioactivity concentration measurement and evaluation methods and checks the result of such measurements.

The NRA is involved at the following two stages.

- Stage 1: The NRA judges and approves the validity of the radioactivity concentration measurement and evaluation methods formulated by licensees
- Stage 2: Using records and sampling, the NRA checks that licensees are carrying out radioactivity concentration measurement and evaluation using the methods for this for which approval was granted, as well as confirming that the licensee concerned is below the clearance level

In addition, this system targets not only reactor facilities, but also other nuclear fuel cycle facilities.

D Annexes

1 List of nuclear installations

2 List of accidents and failures reported under the Reactor Regulation Act during the reporting period

3 The overview of Conformity Review for Sendai NPS

4 List of IRRS Review Result

5 Result of IAEA OSART review and measures taken by Tokyo Electric Power Company

6 References

1 List of nuclear installations

Licensee	Power Station	Unit	Reactor Type	Output (MWe)	Commissioned	Status
Hokkaido Electric Power Co., Inc.	Tomari	1	PWR	579	Jun 22, 1989	In Operation
		2	PWR	579	Apr 12, 1991	In Operation
		3	PWR	912	Dec 22, 2009	In Operation
Tohoku Electric Power Co., Inc.	Onagawa	1	BWR4	524	Jun 01, 1984	In Operation
		2	BWR5	825	Jul 28, 1995	In Operation
		3	BWR5	825	Jan 30, 2002	In Operation
	Higashidori	1	BWR5	1,100	Dec 08, 2005	In Operation
		2	ABWR	1,385		In Planning
Tokyo Electric Power Co. Inc.	Fukushima Daiichi	1	BWR3	460	Mar 26, 1971	Permanent Shutdown
		2	BWR4	784	Jul 18, 1974	Permanent Shutdown
		3	BWR4	784	Mar 27, 1976	Permanent Shutdown
		4	BWR4	784	Oct 12, 1978	Permanent Shutdown
		5	BWR4	784	Apr 18, 1978	Permanent Shutdown
		6	BWR5	1,100	Oct 24, 1979	Permanent Shutdown
	Fukushima Daini	1	BWR5	1,100	Apr 20, 1982	In Operation
		2	BWR5	1,100	Feb 03, 1984	In Operation
		3	BWR5	1,100	Jun 21, 1985	In Operation
		4	BWR5	1,100	Aug 25, 1987	In Operation
	Kashiwazaki-Kariwa	1	BWR5	1,100	Sep 18, 1985	In Operation
		2	BWR5	1,100	Sep 28, 1990	In Operation
		3	BWR5	1,100	Aug 11, 1993	In Operation
		4	BWR5	1,100	Aug 11, 1994	In Operation
		5	BWR5	1,100	Apr 10, 1990	In Operation
		6	ABWR	1,356	Nov 07, 1996	In Operation
		7	ABWR	1,356	Jul 02, 1997	In Operation
	Higashidori	1	ABWR	1,385		Under Construction
Chubu Electric Power Co., Inc.	Hamaoka	1	BWR4	540	Mar 17, 1976	Decommissioning
		2	BWR4	840	Nov 29, 1978	Decommissioning
		3	BWR5	1,100	Aug 28, 1987	In Operation
		4	BWR5	1,137	Sep 03, 1993	In Operation
		5	ABWR	1,380	Jan 18, 2005	In Operation
Hokuriku Electric Power Company	Shika	1	BWR5	540	Jul 30, 1993	In Operation
		2	ABWR	1,206	Mar 15, 2006	In Operation
Kansai Electric Power Co., Inc.	Mihama	1	PWR	340	Nov 28, 1970	Permanent Shutdown
		2	PWR	500	Jul 25, 1972	Permanent Shutdown
		3	PWR	826	Dec 01, 1976	In Operation
	Takahama	1	PWR	826	Nov 14, 1974	In Operation
		2	PWR	826	Nov 14, 1975	In Operation
		3	PWR	870	Jan 17, 1985	In Operation
		4	PWR	870	Jun 05, 1985	In Operation
	Ohi	1	PWR	1,175	Mar 27, 1979	In Operation
		2	PWR	1,175	Dec 05, 1979	In Operation
		3	PWR	1,180	Dec 18, 1991	In Operation
		4	PWR	1,180	Feb 02, 1993	In Operation

Licensee	Power Station	Unit	Reactor Type	Output (MWe)	Commissioned	Status
Chugoku Electric Power Co., Inc.	Shimane	1	BWR3	460	Mar 29, 1974	Permanent Shutdown
		2	BWR5	820	Feb 10, 1989	In Operation
		3	ABWR	1,373		Under Construction
	Kaminoseki	1	ABWR	1,373		In Planning
Shikoku Electric Power Co., Inc.	Ikata	1	PWR	566	Sep 30, 1977	Permanent Shutdown
		2	PWR	566	Mar 19, 1982	In Operation
		3	PWR	890	Dec 15, 1994	In Operation
Kyushu Electric Power Co., Inc.	Genkai	1	PWR	559	Oct 15, 1975	Permanent Shutdown
		2	PWR	559	Mar 30, 1981	In Operation
		3	PWR	1,180	Mar 18, 1994	In Operation
		4	PWR	1,180	Jul 25, 1997	In Operation
	Sendai	1	PWR	890	Jul 04, 1984	In Operation
		2	PWR	890	Nov 28, 1985	In Operation
		3	APWR	1,590		In Planning
Japan Atomic Power Company	Tokai		GCR	166	Jul 25, 1966	Decommissioning
	Tokai Daini		BWR5	1,100	Nov 28, 1978	In Operation
	Tsuruga	1	BWR2	357	Mar 14, 1970	Permanent Shutdown
		2	PWR	1,160	Feb 17, 1987	In Operation
		3	APWR	1,538		In Planning
		4	APWR	1,538		In Planning
Electric Power Development Co.,Ltd. (J-POWER)	Oma	1	ABWR	1,383		Under Construction
Japan Atomic Energy Agency	Advanced Thermal Reactor "Fugen"		ATR	165	Mar 20, 1979	Decommissioning
	Prototype Fast Breeder Reactor "Monju"		FBR	280		Under Construction

Notes:

In Planning:	NPS for which the operator submitted a license application, but not yet approved
Under Construction:	NPS has been licensed, but has not yet passed a pre-service inspection
In Operation:	NPS that has passed a pre-service inspection
Permanent Shutdown:	NPS that where operations have been ceased for decommissioning
Decommissioning:	NPS whose decommissioning plan has already been approved

2 List of accidents and failures reported under the Reactor Regulation Act during the reporting period

Accidents and failures reported in FY2013

Power Station	Accidents and Failures	Date	INES
Fukushima Daiichi NPS	Releasing traces of radioactive substance inside the radiation controlled area	Aug 19, 2013	Below scale
Fukushima Daiichi NPS	Releasing traces of radioactive substance inside the radiation controlled area	Oct 02, 2013	Below scale
Fukushima Daiichi NPS	Releasing traces of radioactive substance inside the radiation controlled area	Oct 09, 2013	Below scale
Fukushima Daiichi NPS	Releasing traces of radioactive substance inside the radiation controlled area	Feb 06, 2014	Below scale
Fukushima Daiichi NPS	Releasing traces of radioactive substance inside the radiation controlled area	Feb 20, 2014	Below scale

Accidents and failures reported in FY2014

Power Station	Accidents and Failures	Date	INES
Fukushima Daiichi NPS	Releasing traces of radioactive substance inside the radiation controlled area	Apr 13, 2014	Below scale
Fukushima Daiichi NPS	Releasing traces of radioactive substance inside the radiation controlled area	Jun 09, 2014	Below scale
Fukushima Daiichi NPS	The loss of required function for Implementation plan	Sep 17, 2014	Below scale
Fukushima Daiichi NPS	Releasing traces of radioactive substance inside the radiation controlled area	Dec 17, 2014	Below scale
Fukushima Daiichi NPS	Releasing traces of radioactive substance outside the radiation controlled area	Feb 22, 2015	Below scale

Accidents and failures reported in FY2015

Power Station	Accidents and Failures	Date	INES
Fukushima Daiichi NPS	Releasing traces of radioactive substance outside the radiation controlled area	May 27, 2015	Below scale
Prototype Fast Breeder Reactor "Monju"	Deformation of Diesel generator(B) Cylinder head Indicator cock	Jul 17, 2015	0
Fukushima Daiichi NPS	Releasing traces of radioactive substance inside the radiation controlled area	Sep 15, 2015	Below scale
Takahama NPS Unit 4	Automatic reactor shutdown due to Power generator Automatic shutdown	Feb 29, 2016	0
Kashiwazaki-Kariwa NPS Unit 5	Unexpected operation of control rod	Mar 08, 2016	0

3 The overview of Conformity Review for Sendai NPS

The followings are the outline of the Conformity Review result for Kyushu Electric Power Company Sendai NPS as an example of the Conformity Review by the NRA during reporting period.

New Regulatory Requirement which is enforced in July, 2013, has added the measurement of severe accidents and has strengthened design standard than previous standard. This appendix provides review results on the measurements for prevent occurrence of a severe accident and the measurements for assumed case of occurrence of a severe accident.

1 The measurements for prevent occurrence of a severe accident

(1) Setting the standard seismic motion

New Regulatory Requirements requires that the important seismic facilities shall be designed such that their safety functions will not be compromised by a seismic force by the standard seismic motion. Furthermore, standard seismic motion requires to be set after assessment of both "Set seismic motion to specifying the seismic center" which assess subsurface structure on the site for considering influence on propagation characteristics of seismic wave and specifying earthquake source fault by detailed survey on active fault and "Set seismic motion without specifying seismic center" which estimate that it may occur a certain scale of earthquake even the ground are not active fault according to detailed survey.

Licensee reviewed the length of active fault and set 540 gal as "Set seismic motion specifying seismic center" and 620 gal as "Set seismic motion without specifying seismic center" within the review process. By these standard seismic motions, licensee has designed the important seismic facilities such that their safety functions will not be compromised.

The NRA reviewed that these standard seismic motion are decided based on the latest knowledge and the important seismic facilities are designed such that their safety functions will not be compromised by a seismic force by the standard seismic motion.

(2) Set design basis tsunami

New Regulatory Requirements requires that the design basis response systems shall be designed such that their safety functions will not be compromised by the design basis

tsunami. Furthermore, the design basis tsunami are required to be decided as tsunami occurrence factor, by the consideration for combination of seismic and non-seismic factor, such as landslides.

During review process, licensee set tsunami height of 3.52 meter in height at rise side in front of water intake and 3.8 meter at lower side base on the consideration earthquake which fault did not originally assume. In addition, licensee assesses run-up height as maximum 6 meter in height by taking into account of impact by tide and storm surge. For tsunami protection measurements, there are 8 meter in height tsunami protection enclosed in 15 meter in height protective barrier for protection of sea water pomp which is important for facilities has installed in the 5 meter high area. Furthermore, licensee installed reservoir weir for ensure cooling water when the undertow. The NRA reviewed that these design basis tsunami are decided based on latest knowledge and reviewed that the design basis response systems are designed such that their safety functions will not be compromised by the design basis tsunami.

(3) Volcanic Hazards

Regulation Requirements requires that safety functions of nuclear safety facilities shall not compromise in case of the assumed volcano eruption. And licensee shall assess the impacts by the volcano eruption by selecting volcano which may have impact to the nuclear facility, and evaluate the specific impacts. For the case of volcanic events which may affect safety of NPS, if the same scale of eruption such as Sakurajima Satsuma volcanic events which had occurred 12,800 years ago, if may have eruption in the future, licensee estimate there will have 15 meter deposition in the site.

Licensee has concluded that caldera near to the site has possibility for the occurrence of huge volcanic eruptions which eruptive volume is more than 100 cubic kilometers is sufficiently small. Because the most recent eruption was 30,000 years ago, the eruption average interval was around 90,000 years ago from the past data and currently there are no information that magma chamber are on shallow level. Licensee indicated policy for monitoring of volcanic events during operation period.

Licensee's design policy is the design of reactor building and installations could withstand if volcanic ash accumulates 15 centimeter and install filter to prevent of flow of volcanic ash. Considering the loss of offsite power and blockage, licensee prepares installments in the site as necessary measurements. Also licensee performed the actual testing and confirms that vehicles can pass by removing the ash even if volcanic ash accumulates 15 centimeter.

The NRA confirmed assessments for volcanic phenomenon which is implemented by

licensee are based on latest knowledge. Because the potential of volcanic phenomenon which it cannot cope by original design is small, and monitoring caldera is appropriate activity along the guidelines. In addition, the NRA assesses that licensee's design policy meet Regulatory Requirements.

(4) The measurements against natural phenomenon and human action

Regulatory Requirements requires that the safety systems shall be such that their safety functions will not be compromised in the event of postulated natural phenomena and events by human factor.

Licensee design the safety system such that their safety functions will not be compromised in case of earthquake, tsunami, flooding, typhoon, tornado, frozen, precipitation, snow covering, lightning strike, landslide, biological influence, forest fires, excluding volcano, storm surge and in combination of these phenomenon. Especially it must withstand tornado wind speed of 100 meters per second and installments of fire belt for minimizing the effect from forest fire are additional measurements.

In consideration of human action such as aircraft crash, collapse of dams, explosion, fire from nearby factory, licensees are required to design safety systems such that their safety functions will not be compromised. Furthermore in preparation for additional fire on the fuel storage tank in the site, additional protection fire wall was installed.

The NRA evaluated the design policy and concluded that the design basis is appropriate and their design is such that their safety functions will not be compromised in case of natural phenomenon and human action.

(5) The measurements against internal fire

Regulatory Requirements require fire prevention, detecting and alerting fire at an early stage, fire extinguishing, and measurements reduce the impact from internal fire. Licensee must have redundancy by fire extinguishing equipment on every section such as using fire retardant power cable, equipment in combination with different type of fire detection equipment, design for extinguishing whole fire section by halon gas fire extinguishing equipment. In addition, in order to prevent failure simultaneously. In the case of fire, equipment with safety systems is separated by fire-resistant walls for about 3 hours.

The NRA evaluated that licensee ensure sufficient safety measures by design policy of detect and fire extinguishing, system separation.

(6) The measurement against internal flooding

Regulatory Regulation requires that the safety functions will not be compromised in case of internal flooding. Licensee has to assume water leak by the failure of components by earthquake, water leak due to pipes failure, and drainage water for extinguishing.

Licensee must design that safety functions will not be compromised by internal flooding. For internal flooding measurements, licensee installs equipment above the level which the flooding impairs function, installs water prevention cover on the component, detects steam blow down and isolate the line, or drainage the water.

The NRA evaluated that licensee has designed to prevent loss of safety functions by internal flooding.

(7) Improvement of reliability against off-site power

Regulatory Regulation requires at least two off-site power supply lines must be independently, among that one off-site supply line must be installed at transmission tower different from other two off-site supply line, in the case of multiple units in the site, more than three transmission lines must be connected. Licensee connects independently each of off-site power two 500,000 volts lines and a 220,000 volts line to off-site power. These transmission lines configuration are design to have sufficient function in the case of differential settlement, an inclination and earthquake and can receive power even if one of two supply lines may lost.

The NRA evaluates that licensee ensure reliability for off-site power, because they are able to receive from power from three power supply lines independently.

(8) Improvement of reliability against emergency power

Regulatory Requirements requires installing multiple emergency power supply for the loss of off-site power, storage enough fuel in the site for operating constantly more than 7 days and fuel storage tank can withstand to assumed maximum earthquake.

In order to ensure system safety, licensee install two emergency power supply systems of which one system has enough capacity in every unit, and install more fuel storage tanks for operating constantly more than 7 days. Tank trucks drive between usual fuel storage tank and new fuel storage tank for transporting fuel and four tank trucks are located separately due to avoid failure at the same time in the case of natural disasters.

The NRA evaluate that licensee has redundancy for emergency power supply and can generate power for seven days even if there is no external support.

(9) Improvement of reliability against the Station Blackout

Regulatory Regulation requires obtaining the AC electric power to prevent the severe accident in the case of Station Black-out, and to be able to supply DC power from the battery by the time when the AC electric power is supplied by the above AC power.

The licensee newly installs two High-capacity power supply vehicles with air coolers, four High voltage power supply vehicles, two mid-voltage power supply vehicles, and newly install two sets of on-site permanent batteries, six portable DC power supply in addition to four sets of battery for Reactor Protection System, and installs multiple power panels etc. to connect with power supply vehicles etc.

The NRA has confirmed that the licensee can supply AC/DC power in case of the Station Blackout since variety of AC/DC power supply equipment are installed diversely and redundantly, and multiple connectors of those are installed properly.

2 The measurements against assumption of severe accidents occurrence

Licensee is required to take measurements on assumption of severe accidents occurrence even if the measurements on prevention severe accidents are already implemented. Licensee is required to take measures to shutdown reactor certainly in the case existing installments are not available, the measurements for cooling reactor to prevent fuel melt down, the measurements for confine the radioactive material in the case on melt down of nuclear fuel and the measurements for minimize release of the radioactive material when release of the radioactive material not avoidable.

(1) The measurements for reactor shut down

Regulation Requirements requires the measurements for prevention of bringing reactor core damage in the event of failure on the emergency reactor shutdown system.

Licensee takes measure to isolate steam automatically and confine them to rise temperature then lower generating power finally insert enough amount of boric-acid solution in the event of insertion of a control rod not available on emergency.

(2) Measures to prevent Core Damage

Regulatory Regulation requires a measure to prevent core damage by the water injection to the reactor core, depressurization or secure the heat sink from the core, in case the conventional measures for water injection lose its function.

And it also requires a measure to prevent core damage by the water injection to the

secondary system in case all the functions of conventional measures to water injection or depressurization of Reactor is lost.
Licensee has measures to hand operated depressurization and water injection to the reactor core by the additionally installed pumps, assuming accident of loss of conventional water injection and heat removal measures in addition to the leakage of coolant. Licensee also has measures to secure the ultimate heat sink by pumping the sea water using the large capacity pumping vehicles through the reactor cooling water system heat exchangers, and remove heat from the reactor, assuming the loss of function of conventional systems for removing heat to the sea as well as loss of water injection.
Furthermore, licensee has measures for cooling the reactor indirectly by injecting water into the steam generator, assuming all the water injection measures of conventional systems are lost.

(3) Measures to prevent damage of primary containment vessel after core melt
Regulatory Regulation requires to restrain a rise of pressure and temperature of the primary containment vessel and to prevent primary containment vessel damage by melted fuel's eroding concrete of the primary containment vessel lower part even if core damage occurs.
Licensee installs the additional pumps for the containment vessel spray alternative water injection in order to restrain a rise of pressure and temperature of the primary containment vessel, and cool the melted objects flown inside the PCV by injection of water through the PCV spray.
Licensee also installs 13 equipment to ignite hydrogen compulsorily and as well as installs 5 equipment to recombine hydrogen and oxygen passively.

(4) Measures to mitigate the dispersion of radioactive materials
Regulatory Regulation requires the measure to mitigate the dispersion of radioactive materials to the outside of the site boundary when a reactor core is damaged and the primary containment vessel is damaged.
Licensee has large volume water injection vehicles and water cannons in case of loss of containment function of primary containment vessel.

(5) Organization, procedure and training, etc.
Regulatory Regulation requires establishing the organizations, procedures, education and training to prevent occurrence and enlargement of severe accident as well as

countermeasures as the above-mentioned equipment.
As for the organization to cope with severe accident, the Emergency Command and Control room whose leader is a directors of the Nuclear Power Station is established and the system to command and direction and the role of each employee is clarified.
52 personnel to be able to handle the simultaneous severe accidents for Unit 1 and Unit 2 are reserved all the time. Those personnel is required to be able to handle the accident for seven days after the occurrence of the accident by the fuels and resources on site, and the system and organization for the support from outside within 6 days shall be established.
As for the establishment of procedures and training, the criteria for recognizing and foreseeing plant status, and judgment in accordance with the plant status shall be clarified, the procedures for usage of equipment is established, and education and practice are conducted repeatedly.
And training assuming the environment of high radiation, night and bad weather, etc. is also conducted to maintain and improve the ability of the personnel.
Facilities to cope with severe accident are stored in the separated multiple locations to mitigate the influence of natural disaster such as earthquake, and the paths for transportation shall be obtained, and the multiple communication measures inside the site shall be obtained.

(6) The base facilities to handle a severe accident

Regulatory Regulation requires installing an Emergency Response Center as the base facility where the directors conducts at the severe accident occurs. In Sendai Nuclear Power Station, licensee installs the building constructed by concrete with radiation shield, which can bear against the earthquake or Tsunami, and contains necessary equipment and materials for the employees on site head office to direct, collect information, has capacity for 100 employees at the maximum when the severe accident occurs. This facility has display equipment for plant parameters, communication device by artificial satellite, exclusive power generator, air cleaner etc. to enable the activity for 7 days without outer support.
The evaluated dose rate for seven days inside this facility by the same condition of Fukushima Daiichi NPS accident was at most 34 mSv.

(7) Measures for large-scale damage of nuclear reactor facilities

Regulatory Regulation requires the organization, procedure, education and training

resource and materials in case of large scale of damage due to the large scale of natural disaster, crash of large airplane, or the terror etc.
The licensee shall prepare the on-site organization to be able to cope with for a while as well as allocate employees on site and in the neighboring areas dispersive.
The licensee prepares procedures of measures against large scale of natural disasters, crash of large airplane, large scale of fire due to the airplane fuel, and procedure of measure assuming case when the monitoring and operation at the Main Control Room can't be done. Facilities and materials are stored at the place where is apart from more than 100 meters from the Reactor Building, and the same kind of facility is stored separately at distant multiple location not to lose the function simultaneously.

3. Study on the monitoring of a volcanic activity.

When the abnormal symptom which may possibly lead to a large-scale eruption is detected by the monitoring of a volcanic activity around the nuclear facilities, the NRA needs to take some measure such as request to shut down the reactor. Therefore, the NRA held the "Study team on monitoring of volcanic activity around nuclear facilities[23]" twice in fiscal year 2015 in order to collect information on the volcanology related large-scale eruption and study.
Thereafter, "The Summary Proposal from the Study Team on monitoring of volcanic activity around nuclear facilities" was reported to the NRA on the 25th NRA Commission Meeting in fiscal year 2015.
Based on this proposal, the NRA decided that the Reactor Safety Examination Committee will study how to evaluate monitoring volcanic activity for the NRA, and also study the target for the NRA at the judge to require the plant shutdown on the 46th NRA Commission Meeting in fiscal year 2015.
On the 7th Reactor Safety Examination Committee, (dated March 25th 2016), it was decided to establish "The Nuclear Reactor Facility Volcanic Activity Study Group" to study above matter.

[23] The outline of "The Summary Proposal from the Study Team on monitoring of volcanic activity around nuclear facilities" ;
The NRA will study its measures by considering the information about monitoring method or results related volcanic activities around the nuclear facility from each operator from now on. It is necessary for the NRA to take any outer specialist's advises of volcanology and the related field of technology and science, or from related research institute and related administrative agency, shares information and construct the firm relation to cooperate together.

4 List of IRRS Review Result

RECOMMENDATIONS (R), SUGGESTIONS (S) AND GOOD PRACTICES (GP)

AREA		Recommendations, Suggestions or Good Practices
1. LEGISLATIVE AND GOVERNMENTAL RESPONSIBILITIES	GP1	Good Practice: The prompt establishment of a legal and governmental framework supporting a new independent and transparent regulatory body with increased powers.
	GP2	Good Practice: NRA's prompt and effective incorporation of the lessons learnt from the TEPCO Fukushima Daiichi accident in the areas of natural hazards, severe accident management, emergency preparedness and back-fitting of existing facilities, into the new regulatory framework.
	R1	Recommendation: The government should ensure that the Japanese regulatory authorities having responsibilities relevant to nuclear and radiation safety develop and implement an effective, collaborative process for the exchange of information regarding policies, authorizations, inspections and enforcement actions to provide coordinated and effective regulatory oversight that should also ensure a harmonized regulatory framework under their respective responsibilities.
	S1	Suggestion: NRA should consider improving its liaison with the relevant organizations for joint inspections and oversight of outsourced inspections.
	R2	Recommendation: The Government should empower the regulatory body to establish requirements for authorization or approval processes for service providers for monitoring of occupational and public exposures, and environmental monitoring in general, and verify that these requirements are met by licensees.
3. RESPONSIBILITIES AND FUNCTIONS OF THE REGULATORY BODY	R3	Recommendation: NRA should put greater priority and allocate more resources on its oversight of the implementation of radiation protection measures by licensees as well as its participation in the development of international standards in radiation protection and related research activities in collaboration with NIRS.
	R4	Recommendation: NRA should evaluate the effectiveness of its current organisational structure, implement appropriate cross cutting processes, strengthen the collection of information from interested parties when planning its annual activities and develop tools to measure its performance and use of resources.
	R5	Recommendation: NRA should further develop and implement the activities related to the evaluation of

AREA		Recommendations, Suggestions or Good Practices
		competencies, execution of training programmes, on the job training, internal job rotation, and strengthening safety research, co-operation with technical support organisations (JAEA), universities, research organisations and international and overseas organisations, to ensure it has both qualified and experienced staff to fulfil its regulatory responsibilities in nuclear and radiation safety.
	S2	Suggestion: NRA should consider developing a strategy for attracting new and retaining its current technical expertise through seeking to improve the attractiveness of NRA as an employer of choice and the roles that its staff undertake by providing them with more responsibilities, the ability to directly influence safety performance of licensees, options to regulate in all various sectors of the industry, ability to develop legislative requirements that impact national policy, and having a clear career path to senior levels within the NRA.
	S3	Suggestion: NRA should consider reviewing the effectiveness of the mechanisms to communicate the outcomes of the regulatory review and assessment, further regulatory expectations and current issues to licenses/ applicants.
4. MANAGEMENT SYSTEM OF THE REGULATORY BODY	R6	Recommendation: NRA should complete, document and fully implement its integrated management system for all regulatory and supporting processes needed to deliver its mandate. Grading of the application of management system should be applied consistently and generic processes should be fully developed such as control of documents, products, records and management of change. The effectiveness of the NRA management system should be monitored and measured in a comprehensive way to identify opportunities for improvement.
	S4	Suggestion: NRA should consider introducing specific measures such as awareness training or surveys to promote and sustain high level of safety culture in the conduct of its activities.
	S5	Suggestion: NRA Commissioners should consider taking a strategic approach to the implementation of the management system demonstrating their commitment to the project by initiating a specific multi-year management system development plan and by reviewing its implementation on periodic basis.
	S6	Suggestion: NRA should consider developing a hierarchical structure for the management system that is easy to use and which supports effective and consistent implementation of

AREA		Recommendations, Suggestions or Good Practices
		regulatory activities. Specific descriptions of each process should be developed in a unified format including requirements, risks, interactions, inputs, process flow, outputs, records and measurement criteria.
5. AUTHORIZATION	S7	Suggestion: NRA should consider enhancing the interfaces and overall coherence of the existing three regulatory processes related to NPP ageing management.
	R7	Recommendation: NRA should incorporate the findings of the facility inspection into the review and assessment and the authorization process for radiation sources.
	R8	Recommendation: NRA should establish requirements relating to consideration of decommissioning during all life stages of nuclear and radiation facilities and criteria for the release of sites at the end of decommissioning.
6. REVIEW AND ASSESSMENT	S8	Suggestion: NRA should consider reviewing its current operating experience feedback process to: • determine whether its criteria allow the reporting of enough safety significant events; • ensure lessons learned from these events, including return to service from extended shutdowns, are taken into account by the licensees and actually result in appropriate and timely measures at the facilities.
	S9	Suggestion: NRA should consider reviewing the regulatory requirements for all nuclear facilities to ensure that submissions by licensees give full systematic consideration to human and organizational factors and human errors in the design of the plant, and the sufficiency of qualified and experienced NRA resource to assess this.
7. INSPECTION	R9	Recommendation: The government should improve and simplify the inspection framework to: • Increase NRA flexibility to provide for efficient, performance based, less prescriptive and risk informed regulation of nuclear and radiation safety; • Ensure NRA inspectors have formal rights for free access to all facilities and activities at any time; • Allow NRA decisions about reactive inspections to be made at the lowest possible level. Based on the revised inspection framework the NRA should develop and implement a programme of inspection of all facilities and activities specifying types and frequency of regulatory inspections (including scheduled inspections and unannounced inspections) in accordance with a graded approach.
	S10	Suggestion: NRA should consider improving training and

AREA		Recommendations, Suggestions or Good Practices
		retraining of its inspectors in order to improve their competencies for inspections, associated assessments and decision making.
8. ENFORCEMENT	R10	Recommendation: NRA should establish a documented enforcement policy with criteria and processes for determining graded sanctions or penalties for non-compliances, and a provision for processing orders to minimise the decision time for corrective actions if there is imminent likelihood of safety significant event.
9. REGULATIONS AND GUIDES	R11	Recommendation: NRA should: • improve and document its process for regularly evaluating and reviewing regulations and guides and as the emerging need arises; • supplement the regulations with guidance documents where necessary; and • improve its guidance on periodic safety assessments.
10. EMERGENCY PREPAREDNESS AND RESPONSE	R12	Recommendation: NRA and other authorities having jurisdiction for radiation sources should develop a single set of requirements and guidance for EPR in relation to radiation sources including requirements related to emergency plans, arrangements for timely notification and response, and quality assurance programme using graded approach.
	S11	Suggestion: NRA should consider strengthening its plans and procedures to consistently respond to emergencies related to radiation sources.
	R13	Recommendation: NRA should establish: • complete set of Emergency Action Levels for nuclear facilities other than NPPs and associated guidance to promptly define Emergency Action Levels for all licensees; • verification process that licensees participate in provision of information to the public within emergency planning zones around nuclear facilities at the preparedness stage.
	S12	Suggestion: The Government should consider ensuring that the relevant authorities establish consistent requirements for categories of emergency workers performing similar tasks.
12. INTERFACE WITH NUCLEAR SECURITY	S13	Suggestion: NRA should consider expediting improvements in the arrangements to assess, oversee and enforce nuclear safety and security in an integrated manner.

5 Result of IAEA OSART review and measures taken by Tokyo Electric Power Company

Recommendation			
Assessment Field	Items	Findings by the IAEA	TEPCO Response Policy
Leadership and management for safety	Power station group structure and functions	The power station needs to establish work safety policy standards, clearly convey standards that meet the risks to leaders, have the leaders understand those risks, and make sure the standards are met. Potential accidents and low level events should be reported and recorded, and subjected to trend analysis.	• Standards (detailed scope of application and numeric values, etc.) corresponding to the risks shall be clarified for all work safety rules 【standards to be created in December 2015】 • Management observation (MO) shall be dispatched to observe the workers' movements during field patrols. Also, by coordinating activities conducted by the VERIFY teams*, record and analyze trends with understanding and complying of the rules onsite. 【In Progress】 *Team for performing onsite checks to determine whether or not recurrence risks and rules are being complied to with regards to past work accidents and fires, and identifying problem areas.
Education and training	Employee certification training	The power station needs to employ a training method that complements lectures in order to maintain the effectiveness of lectures.	• In order to improve the effectiveness of lectures, "Instructor Guidelines (methods for conveying the objectives and expectations of lectures, and methods for promoting dialogue and giving lectures in an easy-to understand manner by using diagrams and photographs)" will be created and instructors shall give lectures based on the Instructor Guidelines. 【To begin in December 2015】

Operation	Groups and functions	Operations Management needs to create a more comprehensive guideline for activities related to operation tasks	• Guidance regarding activities related to operation tasks shall be drawn up while referring to U.S. guidance. 【Scheduled to be enacted April 2016】 • Clarify responsibilities and restrictions of positions below the shift supervisor and document in the manual 【Scheduled to be reflected on the February 2016 manual】 • Consider method to verify (alcohol check etc.) operator's ability to work. 【Under consideration】
Maintenance and technical support	Equipment certification	The power station needs to establish and implement a comprehensive equipment certification program.	• Manuals and guidelines shall be created for equipment critical for safety to continue with the following activities: 【list being created】 • A master list of equipment certification requirements, such as environmental resistance, shall be created and used for maintenance management. • Any fluctuations in plant operation conditions and environmental conditions shall be periodically measured and a continual assessment shall be conducted to guarantee that equipment critical for safety meet certification requirements • If certification standards, such as environmental resistance are revised, the impact of the revision shall be done.
Items to verify regarding feedback for operating experience	Operating experience program effectiveness	The power station needs to implement an integrated system that manages all information regarding operating	• A mechanism for gathering and analyzing minor events, such as close calls, for the entire power station to be built. 【Under consideration】

		experience (OE), and adequately establish and implement elements of the OE program regarding reporting, selection, analysis, corrective action, trend analysis and effectiveness evaluation.	• Operating experience (OE) information, including information from overseas, shall be continually applied to further improve safety and work processes 【Under consideration】
Emergency response plan and countermeasures	Emergency countermeasures	The power station, based on the current emergency plan (Nuclear Power Operator Disaster Prevention Plan), shall prepare its own emergency response plan which includes operation concepts and basic functions of all primary emergency response departments. Also, existing emergency procedures and guidelines shall be completed, and its details shall be comprehensive and clear. There is also a necessity to enforce standardization.	• A basic plan for handling a state of emergency and nuclear emergencies shall be created along with individual procedures that clarify how each functional unit is to respond. 【During the creation】 • Training will be continually implemented in a planned manner based on the emergency response plan and individual procedures. 【 To be implemented after creation of the procedures】
Suggestion			
Training and certification	Employee certification and training	The power station should consider creating pass or fail criteria for periodic Main Control Room (MCR) operator evaluations	• A standard for determining whether an operator is fit to continue work in his/her position shall be created and used. 【to begin in December 2015】 • Methods for re-evaluation and follow-up training for employees that do not meet these standards to continue. 【Under consideration】
		The power station	• In order to maintain and

		should consider establishing an official on-going training program based on systematic education and training methods for maintenance and engineering personnel (radiation protection, chemistry, fuel management etc.)	improve performance, training to be implemented constantly will be added to the changes and training for new equipment to be conducted by each department. 【 education and training criteria will be determined in December 2015】
Operations	Fire protection program	The power station needs to make a decision for organizing onsite fire brigade, and onsite dedicated fire brigade retraining and protection in order to guarantee an effective response to fire alarms.	• Upon reviewing the meeting point with the operator, conduct training so that the onsite fire brigade's firefighting personnel can arrive at the scene of fire in the shortest amount of time and make any necessary improvements. 【to be reflected in December 2015】
Maintenance and technical support	Configuration management	The power station and the head office need to officially approve the design rights function and establish methods for ensuring that important plant design documents are complete, reliable, and available, and also that detailed design documents can be stored for a longtime while the power station is in operation.	• To understand the systems and equipment designs, equipment drawings are to be reorganized and confirmed so that the location of systems and equipment shown in the documents match the actual equipment. This should guarantee that the manufacturing and operations are maintained as designed. 【Reorganization to start in October 2015】
Radiation protection	Radiation task management	The power station needs to examine what would be the appropriate organization and common practices for contamination management.	• During work, contamination inspectors will always be placed at the exits of contaminated areas to inspect workers and objects for contamination. (only objects were inspected previously) 【To be implemented from November 2015】

			• Improve the area so that workers can be checked for contamination before using toilets in controlled areas. 【To be implemented from November 2015】 • Enhance contamination inspection at the exit of controlled areas. (review frequency of inspections for supplies used in the controlled area and start contamination inspection when transporting materials from the large freight entrances) 【To be implemented from November 2015】
	Occupational exposure management	The power station needs to examine how to improve the organization and common practices according to ALARA (As Low As Reasonably Achievable) principles.	• Set a value and manage personal dose. 【done November 2015】 • Devise measures for protecting workers who engage in sampling during accidents from radiation, to be reflected in the procedures. 【started November 2015】
Emergency response plan and countermeasures	Emergency countermeasures	The power station needs to examine how to reconfigure and improve the TSC (technical support center) layout based on operating experience, training and designs of other similar facilities.	• The layout of the seismic isolated building will be reviewed to design new areas for main office personnel and work areas for each division. The work areas of each work unit will be changed, such as using existing conference rooms inside the seismic isolated building 【review layout: completed November 2015】
Severe accident management	Procedures and guidelines	The power station needs to update EOP (Emergency Operating P), SOP (Severe Accident Operating Procedures) and AMG	• The findings with regards to EOP/SOP/AMG (including the current AOP and details already mentioned in tsunami AMG) to be organized and EOP/SOP/AMG to be revised

		(Accident Management Guide) in order to expand the scope of documents to cover accidents at spent fuel pools during operation shutdown and design extension conditions. The plant has AOP (Abnormal Operating Procedures) and fixed response plans noted in the tsunami AMG, but these plans need to be formally incorporated into EOP/SOP.	are to include procedures that contain policies for responding to shutdown accidents and spent fuel pool accidents. 【 During the creation of drafting】
	Verification and confirmation of procedures and guidelines	The power station should consider creating an official approval procedure regarding the feasibility of these procedures when an accident occurs.	• Narrow the gap between world standards (IAEA, BWR-OG) and the validation and verification of EOP/SOP/ AMG revisions. 【An adequacy assessment has been underway since October 2015】 • Validation and verification for each guide of EOP/SOP/AMG revision will be created while referencing overseas case studies and following IAEA safety standards guidelines. 【The adequacy confirmation guide has been created. Verification guide planned to be created by March2016】
Good practice			
Training and certification	Employee certification and training	The power station holds training to prepare and ready design extension conditions to improve performance.	• The training simulator of Units 6 and 7 has been remodeled to simulate severe accident conditions to improve the skills of operators. • At the Fukushima Daiichi NPS, special training is being implemented in order to deal

			with the physical and mental stress that operators experience during a severe accident. • For recovery team training, workers practice drills carrying supplies with them (full facemasks and protective clothing, etc.) assuming high-dose and severe environments. • More than 100 employees have been certified to use special vehicles during emergencies (fire trucks, debris removal vehicles, etc.), and those employees periodically take part in training.
Operations	Departments and functions	Organizational relicensing training period	• Operators undergo the following training on how to move between units so that they can understand the characteristics of each unit. - Unique functions and characteristics of each unit - Characteristics of remodeled places and locations where construction is underway - Differences in safety regulations for each unit
	Fire protection program	Temporary flammable material management	• Flammable materials are being temporarily managed well in the following manner: - When contractors temporarily store flammable materials, they must submit an application to the TEPCO group in charge that has jurisdiction over the area and receive a permit. - After a permit is obtained, the flammable materials storage location map information is updated so

			that the group in charge can perform a daily patrol inspecting the location based on the information on the field map and make corrections as necessary.
Maintenance and technical support	Power source related power station renovations	The flexibility and capability of alternate AC/DC power systems used to restore power during design extension conditions.	• Emergency power sources, such as mobile gas turbine trucks and power-supply trucks, etc., have been positioned on high ground. • Furthermore, cables are always connected to the emergency power supply and the power station so that these equipment can be started up in a short period of time.
	Civil engineering structures safety reinforcement measures	Power station protection measures against tsunamis	• The maximum height of the tsunami that the power station is assessed, is at 7.6m (runup height) but a seawall 15m high has been constructed in order to implement conservative tsunami countermeasures. • Furthermore, considering possible flooding on the premises of the power station, damp proof panels and watertight doors have been installed around and inside each reactor building, and the penetrability of wires have been waterproofed, making it a model example of tsunami countermeasures.
Emergency response plan and countermeasures	Emergency response	Methods for enhancing tracking of the situation	• A chat system (system that converts speech into text to share) and a common operating picture (data that puts power station parameters into visualized data) is being used as a method of communication between each work unit

			during an emergency to share accurate information. • Furthermore, this information is shared with TEPCO head office, the national government, the Nuclear Regulation Agency, and local governments, etc. for organized situational awareness.
	Emergency countermeasures	Intensive simulation training program for emergency response teams	• The power station has all of the emergency response departments do intense training every month. • Training scenarios deal with complicated problems and severe conditions over a wide area in a systematic manner. Training is also conducted as realistically as possible. • The participation rate of the power station workers for training has also reached a high level.
Severe accident management	Severe accident management analysis support	Use of computational aids to support event response	• The following computation system is being built in order to check the power station's situation during an emergency. - Software tools that can calculate the time until TAF (Top of Active Fuel) based on scram time, current RPV (reactor pressure vessel) coolant injection speed, RPV water level, RPV pressure and PCV (reactor containment vessel) input information are being developed. - Software tools that can assess the impact of rising water temperatures in the SFP (spent fuel pools) based on input data of the

			temperature inside of the reactor and water levels are being developed. Software tools that can estimate when to vent and the amount of discharged radiation are being developed.
	Use of PSA, PSR and OEF	Analysis is being used proactively in order to extend the plant design to handle design extension conditions	• PSA (probabilistic safety assessment) and other analyses are being conducted to determine latent advantages to design changes during the design concept stage. • For example, during spare analysis that was conducted, it was determined that doses to which MCR operators and onsite response personnel are exposed to can be greatly decreased by employing filter air holes, iodine filters and controlling the pH of the primary containment vessel. • Based on this insight, iodine filters were installed, and a system was designed to use the MUWC (make-up water condensate system) to inject sodium hydroxide into the primary containment vessel in order to control pH.

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