CONVENTION ON NUCLEAR SAFETY
NATIONAL REPORT OF JAPAN
FOR 9TH REVIEW MEETING

July 2022

NRA , Japan
Nuclear Regulation Authority

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(NCP: International Affairs Office)

Convention on Nuclear Safety National Report of Japan
for the ninth Review Meeting

Contents

List of Abbreviations

ABWR	Advanced Boiling Water Reactor
Accident Analysis Committee Meeting	Committee on Accident Analysis of Fukushima Daiichi Nuclear Power Station
AEC	Atomic Energy Commission
APWR	Advanced Pressurized Water Reactor
ATENA	Atomic Energy Association
ATR	Advanced Thermal Reactor
BTC	Boiling Water Reactor Operator Training Center
BWR	Boiling Water Reactor
CAO	Cabinet Office
CAP	Corrective Action Program
CNO	Chief Nuclear Officer
ConvEx	Convention Exercise
CSNI	Committee on the Safety of Nuclear Installations
CV	Containment Vessel
DBA	Design Basis Accident
DEC	Design Extension Condition
DPC	Dual Purpose Cask
EAL	Emergency Action Level
ECCS	Emergency Core Cooling System
EPR	Emergency Preparedness and Response
FBR	Fast Breeder Reactor
FDMA	Fire and Disaster Management Agency
FINAS	Fuel Incident Notification and Analysis System
GCR	Gas Cooled Reactor
Human Resources Network	Nuclear Human Resource Development Network
IAEA	International Atomic Energy Agency
Implementation Plan	Implementation Plan Pertaining to Specified Nuclear Facilities at the Fukushima Daiichi Nuclear Power Station
INES	International Nuclear and Radiological Event Scale
IRRS	Integrated Regulatory Review Service
IRS	Incident Reporting System
IRSRR	Incident Reporting System for Research Reactors
ITER	International Thermonuclear Experimental Reactor

JAEA	Japan Atomic Energy Agency
JANSI	Japan Nuclear Safety Institute
JAPC	Japan Atomic Power Company
JEAC	Japan Electric Association Code
JEAG	Japan Electric Association Guide
JNES	Japan Nuclear Energy Safety Organization, an incorporated administrative agency (former TSO, merged into the NRA in March 2014)
KEPCO	Kansai Electric Power Company Holdings, Inc.
LOCA	Loss of Coolant Accident
METI	Ministry of Economy, Trade and Industry
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MOE	Ministry of the Environment
NAC	National Assistance Capability
NCA	National Competent Authority
NISA	Nuclear and Industrial Safety Agency (former nuclear regulator resolved in September 2012)
Notification on Doses	Notification to Establish Dose Limits in Accordance with the Provisions of the NRA Ordinance on Activity of Refining Nuclear Source or Nuclear Fuel Materials
NPP	Nuclear Power Plant
NPS	Nuclear Power Station
NRA	Nuclear Regulation Authority
NRA EPR Guide	NRA Guide for Emergency Preparedness and Response
NRA Ordinance on Commercial Reactors	NRA Ordinance concerning the Installation and Operation, of Commercial Power Reactors
NRA Ordinance on Standards for Installation Permit	NRA Ordinance prescribing Standards for the Location, Structure, and Equipment of Commercial Power Reactors and their Auxiliary Facilities
NRA Ordinance on Quality Control Methods	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	NRA Ordinance prescribing Technical Standards for Commercial Power Reactors and their Auxiliary Facilities

on Technical Standards	
NSC	Nuclear Safety Commission, former safety related governmental organization resolved on September 2013
NTC	Nuclear Power Training Center
NUCIA	Nuclear Information Archives
Nuclear Emergency Act	Act on Special Measures Concerning Nuclear Emergency Preparedness
NuRO	Nuclear Reprocessing Organization
NWP	National Warning Point
OECD/NEA	the Organization for Economic Co-operation and Development Nuclear Energy Agency
OJT	On-the-Job Training
OIL	Operational Intervention Level
PAZ	Precautionary Action Zone
PCCV	Pre-stressed Concrete Containment Vessel
PCV	Primary Containment Vessel
PI&M	Problem Identification and Resolution
PRA	Probabilistic Risk Assessment
PWR	Pressurized Water Reactor
QMS	Quality Management System
QST	National Institute for Quantum and Radiological Science and Technology
RANET	Response Assistance Network
R/B	Reactor Building
RCCV	Reinforced Concrete Containment Vessel
RPS	Reactor Protection System
Reactor Regulation Act	Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors
SCV	Steal Containment Vessel
SSC	Structures, Systems and Components
SSF	Specialized Safety Facility
Supervision and Evaluation Committee	Committee on Supervision and Evaluation of the Specified Nuclear Facilities
T/B	Turbine Building
TEPCO	Tokyo Electric Power Company Holdings, Inc.
TRM	Top Regulators Meeting

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 the Convention on Nuclear Safety, there are a total of 42 reactors (16 PWRs and 26 BWRs) in Japan as of March 2022. TEPCO's Fukushima Daiichi NPS units 1 thru 6 are permanently shut down for decommissioning, and decommissioning of another 20 reactors (Tohoku Electric Power Company's Onagawa NPS unit 1, Chubu Electric Power Company's Hamaoka NPS units 1 and 2, KEPCO's Mihama Power Station units 1 and 2, KEPCO's Ohi Power Station units 1 and 2, Chugoku Electric Power Company's Shimane NPS unit 1, Shikoku Electric Power Company's Ikata Power Station units 1 and 2, Kyushu Electric Power Company's Genkai NPS units 1 and 2, JAPC's Tokai Power Station and Tsuruga Power Station unit 1, JAEA's Advanced Thermal Reactor (ATR) Fugen and Prototype Fast Breeder Reactor (FBR) Monju) are currently underway.

In Japan, following the TEPCO's Fukushima Daiichi NPS accident, the Atomic Energy Basic Act, the Reactor Regulation Act, and related legislation were amended in 2012, and the nuclear regulation regime was renewed, and the NRA was established in September 2012. The new regulatory requirements for nuclear power reactors came into force in July 2013. Licensees are required to obtain authorization of the NRA through the Conformity Review which assesses on whether the reactor meets the regulatory requirements prior to resuming operation. The NRA accepted applications of the Conformity Review for 27 units in 16 sites by the end of March 2022. Commercial operation of KEPCO's Mihama Power Station unit 3, Takahama Power Station units 3 and 4, Ohi Power Station units 3 and 4, Shikoku Electric Power Company's Ikata Power Station unit 3, and Kyushu Electric Power Company's Genkai NPS units 3 and 4, and Sendai NPS units 1 and 2 have been resumed after the Conformity Review was completed. Efforts are made to ensure transparency and introduce an efficient method of overall assessment, thus the Conformity Review Meeting are made open to the public by allowing their attendance and webcasting, and materials and minutes of the meeting is disclosed. After the meeting, a list of remaining issues to be discussed are presented to licensees for the upcoming meeting efficiency.

With the amendment of the Reactor Regulation Act in June 2012, the operational period of a power reactor is limited to up to 40 years in principle. The NRA accepted applications for extension of the operational period for Mihama Power Station unit 3, Takahama Power Station units 1 and 2, and Tokai No2 Power Station so far.

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

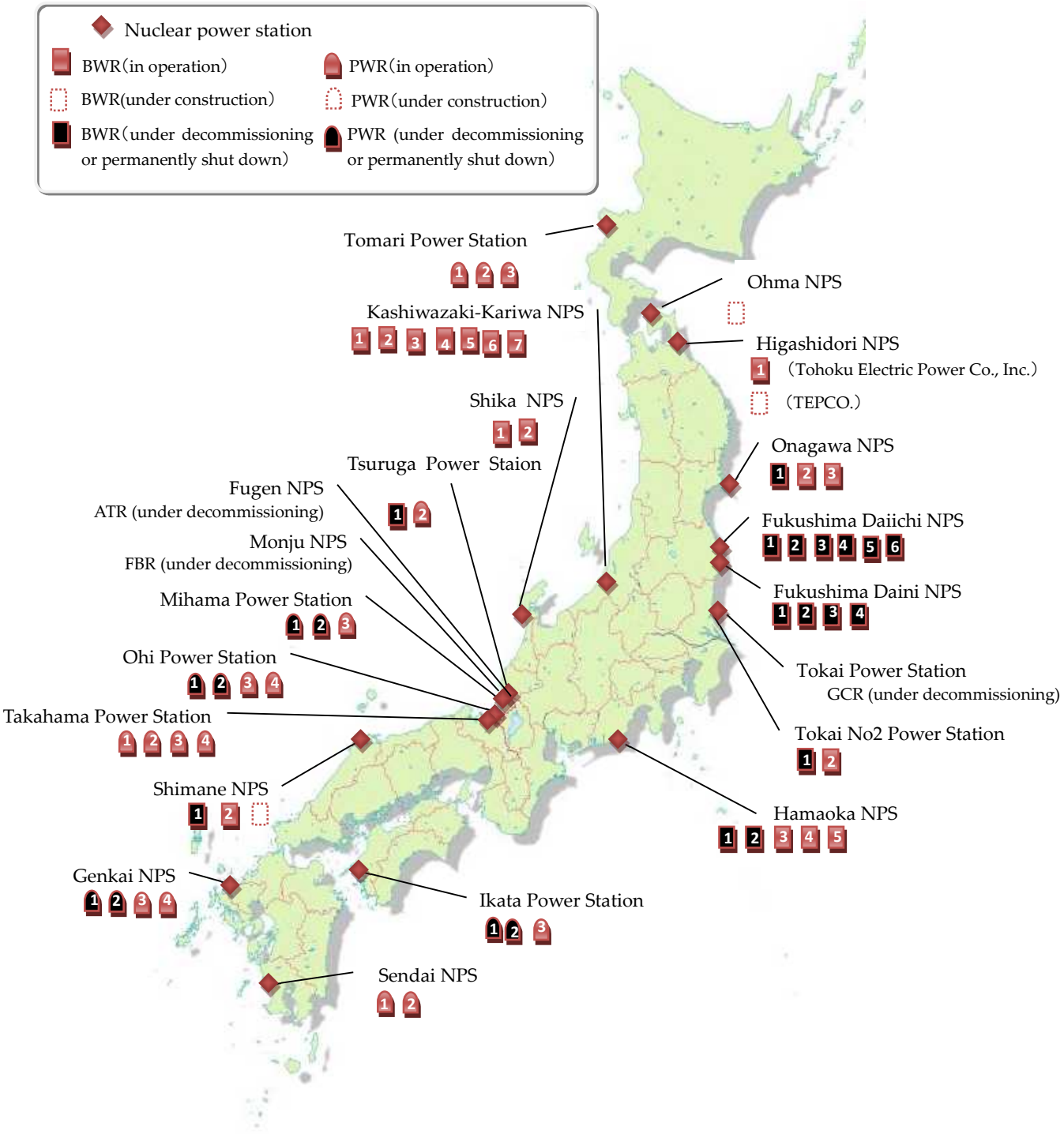

Figure A-1 Location and Status of Reactor Facilities

2 Overview of Nuclear Energy Policy in Japan

The "6th Strategic Energy Plan," which shows the path of the energy policy to realize carbon neutrality by 2050, and reduce greenhouse gas emissions by 46% in FY 2030 from its FY 2013 levels, while continuing strenuous efforts in its challenge to meet the lofty goal of cutting its emission by 50%, was formulated in October 2021. The Government expresses its unwavering resolve to deal with a variety of issues surrounding nuclear power policy keeping the experience, regrets, and lessons learned from the TEPCO's Fukushima Daiichi NPS accident uppermost in mind as the followings;

- Sincere regrets for the accident of TEPCO's Fukushima Daiichi NPS is the start point of nuclear policy.
  - On the premise that safety comes before everything else and every possible effort is made to resolve people's concerns, judgment as to whether nuclear power plants meet the new regulatory requirements will be left to the NRA and in case that the NRA confirms the conformity of nuclear power plants with the new regulatory requirements, which are of the most stringent level in the world, the government will follow NRA's judgment and will proceed with the restart of the nuclear power plants. In that case, the government will make best efforts to obtain the understanding and cooperation of the host municipalities and other relevant parties.

- Stable use of nuclear power will be promoted on the major premise that public trust in nuclear power should be gained, and that safety should be secured.
  - Restart of operation with safety as top priority: launch of restart acceleration task force; bringing human resources and knowledges together; and maintaining and improving technological capability
  - Measures for spent nuclear fuel: promotion of construction/utilization of interim storage facilities and dry storage facilities, etc. to increase storage capacity; and technology development for reducing the volume and harmfulness of radioactive waste
  - Nuclear fuel cycle: makes efforts towards the completion and operation of Rokkasho Reprocessing Plant by public and private partnership obtaining understanding of relevant municipalities involved and international society; and further promotion of plutonium-thermal (MOX fueled) power generation
  - Final disposal: steady implementation of literature surveys in two

municipalities of Hokkaido, and commencement of surveys in as many areas as possible across Japan

- Efforts for various challenges, etc. in proceeding with long-term operation with secured safety: Fulfilling conservation activities and considering of various issues depending on each role of public and private sectors
- Public understanding: interactive dialogue including regions where electricity is consumed; and easy-to-understand polite public relations/public hearing

- Building up trustful relationship with local community of the site.
  - Perception will be shared and trustful relationship will be deepened through polite dialogue with local community of the site; and support matching its reality will be provided by picturing of the region's future profile including mult-streaming of local industry and creation of new industries and employment.

- Promotion of R & D.
  - By 2030, while making the most of the private sector's ideas and wisdom, development of fast reactor will be steadily promoted by utilizing international cooperation; small modular reactor technology will be demonstrated through international cooperation; and component technologies related to hydrogen production at high temperature gas-cooled reactor will be established; as well as R&D of nuclear fusion will be promoted through international collaboration such as International Thermonuclear Experimental Reactor (ITER) Project, etc.

Japan is aiming for an energy mix of 20-22 % nuclear power by 2030 and necessary amount of nuclear power will be continuously utilized on the major premise of ensuring safety and public trust.

3 Long-Term Recovery of the Contaminated Areas After the TEPCO's Fukushima Daiichi NPS Accident

Decontamination and other measures have been implemented around TEPCO's Fukushima Daiichi NPS to quickly reduce the environmental and human health impact due to radioactive materials discharged by the accident. The Government implemented decontamination and waste disposal in "Special Decontamination Areas" and

"Contaminated Waste Management Areas" designated by Act on Special Measures concerning the Handling of Environmental Pollution by Radioactive Materials. And in "Intensive Contamination survey Areas" decontamination had been carried out by municipalities with the support of the government. The whole area decontamination was completed by the end of March 2018 except for the "Restricted Area[1]" in 100 municipalities of eight prefectures. (In the Special Decontamination Areas, completed by the end of March 2017, in the Intensive Contamination Survey Areas completed by the end of March 2018). In accordance with the fact that whole area decontamination was completed, the designation of "Intensive Contamination Survey Area" of 21 municipalities have been lifted by the end of March 2022 and in Tamura City, both designation of "Special Decontamination Area" and "Intensive Contamination Survey Area" have been lifted. And in the "Restricted Area", decontamination and demolition of houses have been implemented as a part of development of Specified Reconstruction and Revitalization Bases Area since 2017. In Fukushima Prefecture, "Interim Storage Facility" has been constructed to control and store soil and wastes, etc. containing radioactive materials generated in a large amount from the decontamination, in a safe and concentrated manner until the final disposal. And the goal to complete transportation of removed soil temporarily stored within Fukushima Prefecture has almost been achieved by FY2021 (except in "Restricted Area"). Moreover, necessary measures should be taken to complete final disposal outside of Fukushima prefecture within 30 years after starting of "Interim Storage Facility". Currently, initiatives of technical development and recycling demonstration projects for the purpose of final volume reduction are being promoted and activities to foster understanding of the necessity and safety of recycling are being implemented in Japan. As for wastes with radioactive concentration exceeding a certain level, existing managed disposal facilities in the relevant prefectures have been used and landfill disposal is being implemented on these facilities.

As it is important to carry out these efforts with obtaining understanding of wide range of general public including local residents, information is actively provided for local people and foreign visitors by activities such as hosting facility tours on two established facilities in Okuma Town and Tomioka Town in Fukushima Prefecture that serve as

[1] Areas where the annual integral dose is more than 50 mSv as of 26th December 2011 while the annual integral dose may not decrease to less than 20 mSv in the long term, specifically even after five years have passed, which was set in the "Basic Concept and Future Agenda for Review of the Restricted Zones and the Zones under Evacuation Orders where Step 2 was Completed" (Nuclear Emergency Response Headquarters, 26th December 2011).

information dissemination.

In terms of evacuation status, the number of evacuees[2] in Fukushima Prefecture was about 160,000 at the initial stage of the accident, but with progress of decontamination etc., evacuation orders have been lifted in all areas except in the "Restricted Area", and shift to reconstruction and revitalization have come into full swing. The number of evacuees is 32,000 as of March 2022. For health management of residents, the "Fukushima Health Management Survey" has been continually commenced in Fukushima Prefecture, aiming to improve and maintain the health of the residents of the prefecture into the future by means of understanding their health conditions and linking such data to the prevention, early detection, and treatment of diseases, while assessing their radiation doses.

In terms of international cooperation, an environmental remediation is promoted in a manner open to the international communities, while obtaining support from various countries and international organizations such as IAEA. As for the environmental remediation in Fukushima Prefecture, IAEA has been cooperating since 2013 and advices are given from experts' point of view in the fields of decontamination, waste disposal, and radiation monitoring that have been tackled by the Prefecture. Moreover, discussions are under way between the Ministry of the Environment (MOE), as the key party, and IAEA experts on progress, results, and future efforts in environmental recovery activities in off-site areas.

Radiation monitoring related to the TEPCO's Fukushima Daiichi NPS accident has been made by relevant government ministries and agencies, local governments, etc. in cooperation based on the "Comprehensive Radiation Monitoring Plan" set up by the government (decided in the Monitoring Coordination Meeting on 2 August 2011 and revised on 30 March 2022).

[2] Including evacuation to emergency provisional housings, houses of relatives, friends, etc. in Fukushima Prefecture and evacuation to the outside of the Prefecture.

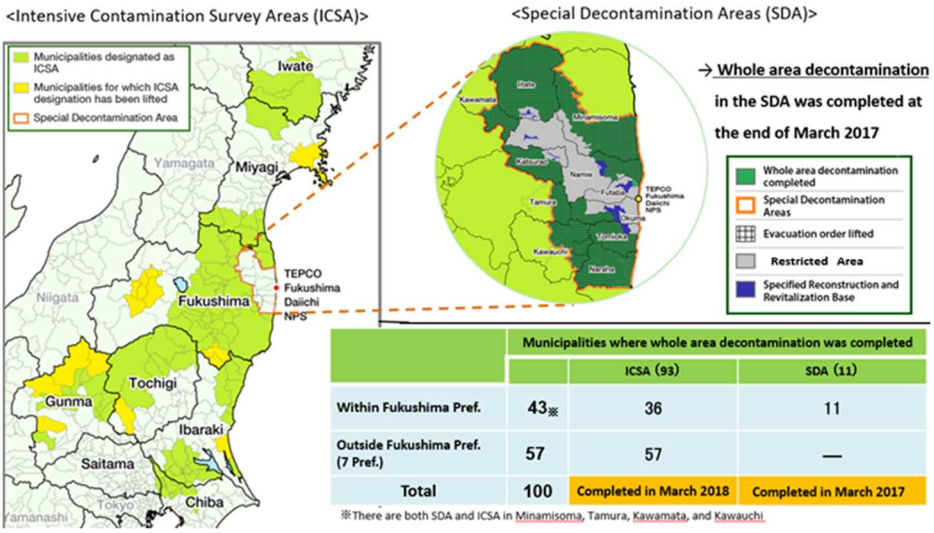

Figure A-2 Result of Whole Area Decontamination

4 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 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 the 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 and promulgation by the National Diet of Japan. In addition, with domestic legal frameworks such as the 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 the government.

5 Development of the National Report

The National Report of Japan for 9th Review Meeting is based on the guideline[3], and consists of “Introduction”, “Summary”, “Reporting article by article” and “Annexes”.

[3] INFCIRC/572/Rev.6

In principle, the reporting period is from 1 April 2019 to 31 March 2022.

For well-understandable review by the Contracting Parties, updates of measures for identified challenges and suggestions in 7th Review Meeting since the 8th Reporting Period are reported in Chapter B "Summary of Major Activities during the 9th Reporting Period". Response to COVID-19 pandemic is also included in this Chapter.

Reports for each article of the CNS are mainly intended to explain the compliance status of obligations of the CNS and provide comprehensive information on regulatory system in Japan.

B Summary of Major Activities During the 9th Reporting Period

1 Activities Related to Nuclear Regulation

1-1 Review on Compliance to New Regulatory Requirements

The licensee must submit applications on compliance to the regulatory requirements to the NRA and obtain authorization for their operation of reactors.

The NRA implements the Conformity Review by holding the Conformity Review Meeting where Commissioners participate, for which were held for 158 meetings in FY2019, 106 meetings in FY2020 and 76 meetings in FY2021.

In addition to the Conformity Review Meeting where Commissioners participate, meetings and hearings with licensees are occasionally held as appropriate by the NRA staff for the purpose of regulatory activities such as confirmation of facts related to matters included in applications. While summaries of those proceedings are made open along with related materials, the transcription result by the automatic speech-to-text software was disclosed on a trial basis from April 2019, followed by a full-scale operation which has been started since April 2020. 486 transcriptions generated by the automatic speech-to-text software were disclosed on the NRA website in FY2019, subsequently 374 in FY 2020 and 852 in FY 2021.

As of the end of March 2022, applications for amendment to Reactor Installation Permit on compliance to the regulatory requirements have been submitted by licensees for 27 units in 16 NPSs. Among them, as of the end of March2019, permit was given to total 15 units: TEPCO's Kashiwazaki-Kariwa NPS units 6 and 7, KEPCO's Mihama Power Station unit 3, Takahama Power Station units 1 thru 4, Ohi Power Station units 3 and 4, Shikoku Electric Power Company's Ikata Power Station unit 3, Kyushu Electric Power Company's Genkai NPS units 3 and 4, Sendai NPS units 1 and 2, and JAPC's Tokai No2 Power Station. During 9th Reporting Period starting from 1 April 2019 to the end of March 2022, amendment of Reactor Installation Permit was given to total 2 units: Tohoku Electric Power Company's Onagawa NPS unit 2, and Chugoku Electric Power Company's Shimane NPS unit 2.

As for the Specialized Safety Facility required by the regulatory requirements, Conformity Review is being conducted in line with the progress of the review for their own power reactors, as of the end of March 2019, amendment to Reactor Installation Permit was granted for total 7 units: KEPCO's Takahama Power Station units 1 to 4 ,

Shikoku Electric Power Company's Ikata Power Station unit 3, Kyushu Electric Power Company's Sendai NPS units 1 and 2. During 9th Reporting Period starting from 1 April 2019 to the end of March 2022, amendment of Reactor Installation Permit was given to total six units: KEPCO's Mihama Power Station unit 3, Ohi Power Station units 3 and 4, Kyushu Electric Power Company's Genkai NPS units 3 and 4, and JAPC's Tokai No2 Power Station. For the other 6 units, as of the end of March 2022, review of amendment to Reactor Installation Permit is being conducted.

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

The NRA received applications for approval of extension of operational period from KEPCO for Takahama Power Station units 1 and 2 on 30 April 2015 and Mihama Power Station unit 3 on 26 November 2015 and from JAPC for Tokai No2 Power Station on 24 November 2017.
The NRA approved operational period extension for Takahama Power Station units 1 and 2 on 20 June 2016, Mihama Power Station unit 3 on 16 November 2016, and Tokai No2 Power Station on 7 November 2018.

1-3 Decommissioning of Power Reactors

As of the end of March 2022, 18 commercial power reactors and 2 research reactors have been under decommissioning. Among them, 9 commercial power reactors were granted approval for "Decommissioning Plan" during the 9th Reporting Period. (Refer to 4, Article 6)

1-4 Full-scale Operation and Continuous Improvement of the New Inspection Program

In April 2017, the Act was amended for further enhancement of safety and security, making the inspection program flexible and covering the licensees' whole activities relevant to safety and security with a focus on issues and concerns. Concretely, the inspection program in which the NRA can oversight the overall licensees' activities relevant to safety and security any time (i.e., the NRA can keep a close check "at any time" and "to anything") has been developed, putting an obligation on licensees to inspect compliance to the regulatory requirements by themselves. In addition, the

program was designed to implement performance-based regulation by assessing the level of operational safety and security activities comprehensively for each nuclear facility and reflecting its safety and security performance to the next fiscal year inspection plan. With this program, the NRA encourages licensees to maintain and improve the level of safety and security voluntarily. Based on discussions in meetings of Study Team on Oversight Program, which consists of the NRA Commissioners, staff of the Secretariat of the NRA and experts, along with the trial operation of the program carried out from FY2018 to FY2019 with the aim of launching full-scale operation of the new inspection program in April 2020, the NRA revised relevant Cabinet Order and provisions, and prepared inspection guidelines. Then, the new inspection program, Nuclear Regulatory Inspection has started in full scale from April 2020. The results of Nuclear Regulatory Inspection are reported to the NRA Commission Meeting in each quarter. Furthermore, the NRA conducts a comprehensive assessment based on the inspection reports and status of safety and security performance indicators and makes the results public annually for each nuclear facility.

Regarding efforts to achieve continuous improvement in Nuclear Regulatory Inspection, a meeting to exchange opinions on the inspection program was established with external experts and licensees. The meeting was held five times in FY2020 and three times in FY2021, in which topics to be discussed were cross-cutting areas, expanded use of the probabilistic risk assessment (PRA) model, and the significance determination processes for nuclear cycle fuel facilities, etc. In light of these meetings, the inspection guidelines have been revised to improve the inspection program.

As initiatives to improve the competence of inspectors, the NRA provided training and education necessary for acquiring inspector qualifications, and shared information on inspection practice and results through Inspector Meetings.

In addition, to prevent spread of COVID-19 among inspectors and operators in the power station sites, initiatives involving movement of the NRA staff, such as a management observation conducted by the NRA management staff to the regional offices, were carried out within a reasonable scope.

Furthermore, as an improvement of Nuclear Regulatory Inspections in FY2020, it was decided at the NRA Commission Meeting that public meetings would be held as necessary with licensees participation, to confirm the facts of matters noticed in inspections. Specifically, public meetings on significant indications at welds of the pressurizer spray line of Ohi unit 3 were held 11 times. Regarding a process of hearing the opinions from licensees on the NRA inspection reports, it has been adopted an approach in November 2020 that the NRA Secretariat makes draft inspection reports

public before the NRA Commission Meeting and if the licensees have an intension to provide an opinion or other statement on the draft inspection reports, the NRA Secretariat hears the opinion submitted by the licensees and then reports the inspection results to the NRA Commission Meeting together with the licensee's opinion.

In addition, in order to conduct risk-informed inspections, the NRA has reviewed the appropriateness of the PRA model developed by the licensees. As of July 2022, the appropriateness of Level 1 PRA model for Ikata Power Station unit 3, Ohi Power Station units 3 and 4, and Genkai NPS units 3 and 4, as well as Level 1.5 PRA model for Ikata Power Station unit 3 has been reviewed.

Moreover, in response to a series of incidents of unauthorized use of an ID card and partial function loss of nuclear security equipment at TEPCO's Kashiwazaki-Kariwa NPS since September 2020, the NRA ordered TEPCO in April 2021 not to move nuclear fuel materials based on the Reactor Regulation Act, thereafter supplemental inspections are being conducted on the status of the licensee's corrective actions. In order to strengthen the NRA inspection program of nuclear security at nuclear facilities, the NRA has been progressively assigning nuclear security inspectors in charge of nuclear security inspections to the NRA regional offices since April 2022. In addition, the inspection guidelines have been revised so that resident inspectors assigned to oversight nuclear safety fields can also conduct inspections related to nuclear security, and trainings are provided to the inspectors to improve their abilities in the field of nuclear security as well. The NRA continues to improve the operation of Nuclear Regulatory Inspections.

Regarding the inspection at TEPCO's Fukushima Daiichi NPS, while the new inspection program (the Nuclear Regulatory Inspection) was to be implemented from FY2020, the NRA has decided to regulate the entire TEPCO's Fukushima Daiichi NPS including units 5 and 6 in a unified manner mainly with the Implementation Plan Pertaining to Specified Nuclear Facilities at the Fukushima Daiichi Nuclear Power Station (Implementation Plan), by which conventional inspection system are applied, instead of the Nuclear Regulatory Inspection. At the same time, it has been clarified the obligation of implementation of licensee checks conducted by TEPCO itself, and that flexible and appropriate regulatory inspections are made possible in accordance with the progress of the decommissioning work. Preparations such as the revision of relating laws and regulation, required for system reform were promoted. Revised regulations for TEPCO's Fukushima Daiichi NPS have been effective since FY2020.

2 Major Response to Items Identified through the Integrated Regulatory Review Service (IRRS) follow-up mission

The NRA invited an IRRS mission by the IAEA in January 2016 with a view to strengthen and enhance the effectiveness of regulatory infrastructure for nuclear safety and sorted action items based on self-developed action plans in addition to the recommendations and suggestions made by the IRRS mission, and took the actions with consideration for the evaluation and advice from the Reactor Safety Examination Committee and the Nuclear Fuel Safety Examination Committee. IRRS follow-up mission was invited from 14 to 21 January 2020, the purpose of which was to peer review the actions taken to address recommendations and suggestions made during the IRRS initial mission in 2016. The regulation of the land transport of radioactive materials was included as a mission scope in addition to that of 2016 IRRS mission.
In IRRS follow-up mission, significant progress was confirmed that the NRA accomplished 10 recommendations and 12 suggestions out of the 13 recommendations and 13 suggestions made in the 2016 IRRS mission with receiving one new recommendation in the field of occupational radiation protection. Regarding the land transport of radioactive materials, four recommendations and one suggestion were made for the assessment of the status of compliance with IAEA Safety Standards. The report of the follow-up mission is accessible in Annex 1.

The major items the NRA has addressed are as follows.

2-1 Establishment of Information Exchange Process with Authorities with Responsibilities for Safety within Regulatory Framework

In 2016 initial IRRS mission, the NRA received a 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”. The NRA has continuously working to develop a process to improve communication and coordination among authorities that play a relevant role in the field of nuclear safety, following a follow-up mission in January 2020 to the present day. Specifically, since there was no cooperation or information exchange process on

inspections with other authorities that conduct inspections at licensed facilities, a document on cooperation between the Fire and Disaster Management Agency (FDMA), which are government agencies related to fire protection, and the NRA, was issued in June 2019. As a result of this, the NRA has been conducting inspections in cooperation with the local fire department in the Nuclear Regulatory Inspection since FY2020. In addition, personnel exchanges are conducted with the aim of strengthening the common knowledge base and promoting mutual understanding of issues of common interest. One personnel from the FDMA and three personnel from the fire headquarters of the municipality where NPS is located, have been accepted to the NRA.

2-2 Improvement of Management System

In 2016 initial IRRS mission, the NRA received a recommendation, "The NRA should evaluate the effectiveness of its current organizational 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". In response to this recommendation, the NRA evaluated the organizational structure and personnel necessary to conduct regulatory activities effectively and efficiently in accordance with the NRA Management Rules. Based on this evaluation, the NRA has reconstructed the organizational structure of the departments responsible for the regulation of NPS to a task-based structure. The NRA has increased the number of nuclear inspectors to strengthen its inspection program, increased the number of radiation safety inspectors to enhance oversight of nuclear safety regulations and the implementation of radiation protection measures. As an administrative body, the NRA has implemented several government-wide cross-sectional processes, including document management and policy evaluation. The NRA has been developing and implementing further cross-sectional processes under its own management system development plan since its follow-up mission in January 2020. Specifically, the NRA management system requires each department to gather information from licensees and other stakeholders to develop annual plans. The information collected includes the schedule of application for inspections and others from licensees, and technical evaluations of industry standards.

3 Status of TEPCO's Fukushima Daiichi NPS

3-1 Effort on Risk Reduction

TEPCO decided the "Mid-and-Long-Term Roadmap Towards the Decommissioning of Fukushima Daiichi NPS Units 1-4, TEPCO," in December 2011 and has been making efforts toward implementation of decommissioning while making continuous reviews of the Roadmap.

TEPCO's Fukushima Daiichi NPS units 1 thru 4 have been designated as the Specified Nuclear Facilities on 7 November 2012 by the NRA. Thereafter, TEPCO has obtained the NRA's approval on the "Implementation Plan" on 14 August 2013, and thus special measures have been taken to secure safety based on the Implementation Plan.

As 11 years have been passed since the accident, measures such as waste management including contaminated water treatment and the decommissioning have been proceeded in a planned manner. As for the status of observance of the Implementation Plan, resident inspectors at the NRA regional office are making daily patrol activities and also monitoring TEPCO's activities based on Operational Safety Inspections.

As for the treatment of contaminated water accumulated in the buildings in TEPCO's Fukushima Daiichi NPS, decontamination by the Advanced Liquid Processing System (ALPS) has been conducted, however the treated water, including tritium that cannot be removed by this equipment, has been continuously stored in the site.

To set forth a target related to measures to be taken at TEPCO's Fukushima Daiichi NPS, the NRA formulated the "Measures for Mid-Term Risk Reduction"[4] in February 2015 and has revised it according to progress of the decommissioning. In FY2019, the NRA confirmed that TEPCO decided the method of removing spent fuel from the spent fuel pools of units 1 and 2, and the completion of prioritized treatment of remaining water in unit 1 Radioactive Waste Building and unit 4 Turbine Building. In FY2020, the NRA checked that the exposed floors were maintained in Reactor Building units 1 thru 3, a Process Main Building, and a High-temperature Incineration Building, and that removal of fuel from the spent fuel pool of unit 3 was completed. In FY2021, it was confirmed that the additional construction of dry storage casks for the removal of spent fuel from unit 6, and the completion of the closure of the Reactor Building opening.

While there are items that show steady progress for each item in the risk reduction target

[4] https://www.nsr.go.jp/data/000383432.pdf, in Japanese
https://www.nsr.go.jp/english/library/nraplans_01.html, in English

map, efforts against solid radioactive substances are behind the target schedule. In addition, as decommissioning work progresses, it is expected that the amount of rubbles generated by the demolition of buildings and that the analysis work of radioactive substances will further increase, so it is necessary to take immediate measures. For these reasons, in the "Measures for Mid-term Risk Reduction at TEPCO's Fukushima Daiichi NPS (March 2022 Edition)", the examination of appropriate storage methods for solid waste caused by the demolition of buildings and the strengthening of analytical capabilities for radioactive substances are listed as major initiatives as well as interim target dates have been set for recently identified issues and for those that have been delayed in addressing.

In April 2021, the Government of Japan announced a "Basic Policy on handling of ALPS treated water at the Tokyo Electric Power Company Holdings' Fukushima Daiichi Nuclear Power Station" (Basic Policy). In response to the above, in December 2021, TEPCO submitted application documents for approval to amend the Implementation Plan for Fukushima Daiichi NPS related to the discharge of Advanced Liquid Processing System (ALPS) treated water into the sea. This application is for the installation of ALPS treated water discharge facilities (Sea Discharge Facilities), which are necessary for the discharge of treated water to meet the regulatory requirements (ALPS treated water) as well as the method of operation and management of facilities. The NRA has conducted 13 review meetings to examine and review the application, and has compiled the results as a draft review results document in May 2022. In July 2022, the Implementation Plan has been approved after soliciting public comments of the draft review results document. In addition to the examination based on the Reactor Regulation Act, the application has been also reviewed in light of the Basic policy.

Based on the Reactor Regulation Act, the examination was conducted and confirmed the following: overall process and risk assessment; treatment, storage and management of radioactive liquid waste; treatment, storage and management of radioactive solid waste; radiation dose management of workers; radiation protection around the site by discharge control of radioactive substances; emergency measures; design considerations, such as prevention of malfunction and reliability; confirmation of the appropriateness of operational safety including nuclide selection policy; design of discharge facilities and equipment; and promotion of public understanding regarding the implementation of discharge. It has been confirmed that the NRA concludes that application satisfies the relevant items of the Regulatory Requirements and thus is sufficient for preventing disasters to be caused by nuclear fuel materials, materials contaminated by nuclear fuel materials or nuclear reactors.

In order to confirm whether the application is in accordance with the Basic Policy, the NRA has confirmed that the radiological impact assessment of the discharge into the sea on humans in normal operation and in case of potential exposure is sufficiently small and is smaller than the criteria, respectively. It also has been confirmed that the evaluation result of radiological impact on animals and plants in the sea by the discharge of ALPS treated water under normal operations is sufficiently small.
The IAEA published a progress report in June 2022 on the regulatory aspects of the discharge of ALPS treated water into the sea after conducting a review mission in Japan in March 2022 by international experts from various countries and IAEA Secretariat. The report is accessible in Annex 2.

3-2 Accident Analysis of TEPCO's Fukushima Daiichi NPS

The analysis of the TEPCO's Fukushima Daiichi NPS accident is one of the important activities of the NRA, and thus the NRA has conducted verification from the technical aspect. In the NRA Commission Meeting in March 2013, it was decided that technical issues to be clarified would be discussed in the Committee on Accident Analysis of Fukushima Daiichi NPS (Accident Analysis Committee Meeting) which was started in May 2013. The Fukushima Nuclear Accident Independent Investigation Commission, set up by the National Diet, requested the regulatory body to investigate seven unresolved issues. The NRA analyzed these issues from a technical viewpoint based on the plant data, computer analysis and site investigation, and developed the "Analysis of the TEPCO's Fukushima Daiichi NPS Accident (Interim Report)" which was then decided in the NRA Commission Meeting in October 2014. Under the circumstances where on-site investigations necessary for accident analysis became possible due to the improvement of environmental condition at the site and progress of decommissioning work, the NRA decided to reorganize the policy and system for accident analysis implementation in FY2019. Accordingly, the Accident Analysis Study Committee established at the NRA has conducted investigation and analysis using the results of on-site investigations and records from the time of the accident at TEPCO's Fukushima Daiichi NPS. In FY2019, a total of 18 on-site investigations followed by 11 in FY2020 and 10 in FY2021. Their meeting of the Accident Analysis Committee Meetings were held several times with information obtained in the investigations, the NRA examined routes and points of release or leakage of radioactive materials from the reactor containment vessel, detailed analysis of hydrogen explosions in reactor buildings, and status of equipment which should cool the reactor. The study results were compiled at the Accident Analysis

Committee Meetings as the "Interim Summary of Investigation and Analysis of TEPCO's Fukushima Daiichi NPS Accident" (Interim Report), and approved at NRA Commission Meeting in March 2021. Subsequently, in FY2021, the Accident Analysis Committee Meetings proceeded with the investigation of perforation on the unit 2 shield plug, and of the inside of the piping of the units 1 and 2 emergency gas treatment system. In addition, after receiving a report at the NRA in May 2021 on the views submitted by TEPCO regarding the Interim Report, the results of confirmation including the views of TEPCO as well as additional questions and answers as well as the exchange of opinions with TEPCO at the Accident Analysis Committee Meetings, were reported to NRA Commission Meeting in January 2022.

The NRA required active cooperation to ATENA, such as participation in the Accident Analysis Committee Meetings and providing information required for accident analysis. Furthermore, the NRA held the "Fukushima Daiichi NPS Decommissioning and Accident Investigation Liaison and Coordination Meeting" for 3 times in both FY2019 and FY2020, and twice in FY2021, with the participation of the Agency for Natural Resources and Energy, Nuclear Damage Compensation and Decommissioning Facilitation Corporation, TEPCO, and the NRA, and carried out the necessary coordinating tasks relating to accident analysis and decommissioning work.

The NRA disseminates information on the accident analysis at home and abroad.

The English version of the Interim Report was sent to the IAEA, OECD / NEA and other organizations, and disseminated to the international community.

In FY2019, a video of the internal investigation of unit 3 reactor building, conducted on in December 2019, was released on YouTube and attracted a large number of audiences as pertaining to the recorded number of viewers. During FY2020, on 30 January and 8 October 2020, on-site investigation on the contamination of unit 2 reactor building was carried out in a format open to the press to release the actual activities of investigation to various media outlets. In addition to videos from the above investigation, videos of an on-site investigation of unit 4 reactor building in January 2020, of unit 3 reactor building in September 2020 and of unit 1 turbine building in October 2020 were released on YouTube. During FY2021, on-site investigation (photograph) of unit 2 emergency gas treatment system filter train in June 2021, of units 1 and 3 reactor buildings in November 2021, on-site investigation (photograph) of radiation dose using the remotely operated robot on the operating floor of unit 2 reactor building in August and September 2021, and a video of on-site investigation related to the fire in unit 4 reactor building was released on YouTube. These videos released were used for discussions in the Accident Analysis Committee Meetings.

The NRA participated in workshops and projects held by the Atomic Energy Society of Japan, the NRC, the DOE-NE Fukushima Expert Panel Meeting, and the IAEA-INSAG[5] Forum. Also, the NRA participated in international projects for research and investigation of the accident, in particular, the research project (ARC-F) of OECD / NEA / Committee on the Safety of Nuclear Installations (CSNI), which started in January 2019 for the purpose of analyzing the accident in more detail based on the results of internal surveys of the reactor buildings and accident progression analysis. Information on the current status of analysis for accident scenarios and associated transportation, and dispersion of fission products were shared with the participants (12 nations and 22 organizations).

4 Response to COVID-19 Pandemic

On March 2020, the NRA established the NRA Secretariat's task force to cope with COVID-19 pandemic headed by the Deputy Secretary General of the NRA. The task force meeting held 33 times during FY2020 and 12 times during FY2021, formulated infection prevention measures based on the situation such as the declaration of a state of emergency. Alternative measures were also taken for regulatory activity continuity. Specifically, it took infection prevention measures such as holding regular meetings fortnightly including limiting the number of public observers at regular session of Commission Meetings, and limiting the number of employees of the NRA who come to work by teleworking.

For reviews based on the Reactor Regulation Act, steps were taken to minimize the impact on review work while implementing measures to prevent COVID-19. In particular, it was decided to steadily proceed with the review by holding review meetings using online meeting system, and to ensure transparency by disclosing the video and minutes of the meeting. Regarding Nuclear Regulatory Inspections, base line inspections conducted by the NRA inspectors in the NRA regional offices were performed as originally planned, however in order to maintain the NRA's inspection function in the pandemic situation, special measures were taken such as dividing the inspectors into two separate groups to avoid close contact to each group and working from home. In addition, upon a written request from a licensee, the NRA allowed the licensee to make it possible to flexibly handle the requirement of timing and the reduced

[5] International Nuclear Safety Group

number of personnel for the licensee's inspections after considering the safety impact on the nuclear facility. In response to this, when the state of emergency was declared at the beginning of FY2020, the NRA received three written requests from licensees of nuclear facilities. The change of the frequency of patrols was approved. After the declaration was lifted, normal operational safety activities were resumed promptly. Furthermore, in response to the declaration of a state of emergency again in January 2021, one written request was received and approved for a licensee of test reactor to conduct operational safety activities in flexible manner.
The team inspection, which is mainly carried out by inspectors dispatched from the NRA headquarters, was performed after changing the inspection plan due to refraining from the inspection travels under the declaration of a state of emergency.

In light of the COVID-19 pandemic, protective measures against a nuclear disaster under infectious disease epidemic conditions must be given the highest priority to protect the lives and health of the public from the dual risks of radiation exposure and infection. Therefore, on 2 June 2020, the Cabinet Office announced the "Basic Concept of Protective Measures in Case of Nuclear Disasters during an Epidemic of Infectious Diseases Due to the Spread of the Novel Coronavirus" In a nuclear disaster, it was decided that protective measures under local emergency response and infection prevention measures stemming from the action plan from the "Act on Special Measures for Pandemic Influenza and New Infectious Diseases Preparedness and Response" will be employed to the extents possible to provide the best nuclear disaster risk management measures possible in case of concurrent infectious disease outbreak. In addition, on 2 November 2020, the "Guidelines for the Implementation of Protective Measures in Case of Nuclear Disasters during an Epidemic of Infectious Diseases Due to the Spread of the Novel Coronavirus" was specified to protect life and health reasonably, taking into consideration various risks, including the possibility of COVID-19 aggravation among the elderly. Here are some of the points listed in the guidelines:

- At shelters and in evacuation vehicles, infection control measures, such as maintaining adequate physical distance, wearing masks, and thoroughly disinfecting hands, must be implemented
- Efforts must be made to prevent infection by trying to separate and isolate close contacts with positive patients, symptomatic people with fevers, coughs, etc., and other asymptomatic people.
- In the cases of sheltering-in-place in avoidance of exposure to radioactive materials, shared ventilation should be avoided. However, from the viewpoint of

countermeasures against infectious diseases, efforts should be made to ventilate the area for a few minutes every 30 minutes or so, while paying close attention to the release of radioactive materials.

In addition, local governments were instructed to take appropriate measures in consideration of the situation at the site, and to prepare nuclear disaster countermeasures in accordance with the specific situation of each region.

5 Vienna Declaration

The Vienna Declaration[6] was adopted at the Diplomatic Conference to consider a proposal to amend the CNS on 9th February 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 offsite contamination and avoiding early radioactive releases or 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, it had been required to take preventive measures on disaster caused by nuclear power reactors up to the Design Basis Accidents as a regulatory requirement, and as a result of the amendment of the Reactor Regulation Act in 2012, measures against severe accidents were stipulated as regulatory requirements, resulting in enhancement of regulations. The new regulatory requirements require to take measures such as prevention of core damage and prevention of containment vessel (CV) failure and to

[6] INFCIRC/872

minimize the total amount of radioactive releases, as well as to evaluate effectiveness of the measures taken by using a combination of PRAs and deterministic analyses. It is stated in its review guide that release amount of Cs-137 be less than 100 TBq for the postulated CV failure mode (refer to 2-5, Article 18).

Additionally, this amendment made it newly mandatory 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 implementation of Licensee's Periodic Inspections and Nuclear Regulatory Inspections. Evaluation to enhance safety is reported in Article 14, and Licensee's Periodic Inspections, and Nuclear Regulatory Inspections are reported in Article 19.

Furthermore, with the amendment of the Atomic Energy Basic Act in 2012, provision to refer to the established international standards was added to its basic policy, and back-fitting rule was introduced in the Reactor Regulation Act. With this rule, in the case that regulatory requirements are revised, licensees have obligation to meet their existing power reactors to the revised regulatory requirements. The NRA has enhanced the process to feedback operating experience and state-of-the-art knowledge based in the lessons learned from the TEPCO's Fukushima Daiichi NPS accident through discussions in the Technical Information Committee. The NRA Ordinances where back-fitting is applied are the NRA Ordinance on Standards for Installation Permit and the NRA Ordinance on Technical Standards, etc., which are reported in Articles 17, 18, and 19. The back-fitting rule corresponds to measures taken to prevent operation of power reactors where safety is not ensured, reported in Article 6.

The NRA developed regulatory requirements incorporating measures against severe accidents and put them into force in July 2013, and in developing regulatory requirements, the IAEA Safety Standards and other international standards have been taken into account. Besides, the NRA participates in the IAEA's Commission on Safety Standards and its five Committees and is actively contributing to the Safety Standards developing activities of the IAEA.

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

6 Activities by Licensees

In response to the regulatory requirements in July 2013 entered into force, licensees have

taken measures based on lessons learned from the TEPCO's Fukushima Daiichi NPS accident in order to conform to the requirements, such as measures to improve fragility of protection against tsunamis, including installation of seawalls, installing watertight doors to important areas, enhancing the pressure resistance and the waterproof property of outside walls of buildings. As for preparation of measures to be taken for water injection at the time of station black out, alternative power sources such as air-cooled gas turbine generator vehicles to be located at high ground level, increasing the number of batteries stored, and constructing water reservoirs have been completed. In addition, as measures to mitigate influences of core damage, measures such as installation of top-vent facilities on R/Bs, top-head flange cooling lines to fill water into the top part of CV, filtered vent facilities have been taken. As for measures on the software side, emergency-response organizations have been reorganized so that they can respond to accidents when severe accidents occur simultaneously in two or more units. A necessary number of personnel for immediate response are ensured to enable initial response on emergency.

The regulatory requirements enforced in July 2013 require that preparation of necessary functions (of facilities or procedures) should be completed based on the lessons learned from the accident, and in addition require that preparation of backup facilities (the 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 Construction Plan related to measures to deal with severe accidents. For example, the Specialized Safety Facility is a facility for measures against acts of terrorism such as large-aircraft crash into a R/B. It is required that this facility is to be installed at a location about 100 meters or more apart from a R/B or to be housed in a robust building against aircraft crash with equipment necessary to prevent CV failure.

In April 2021, the staff interpretation of the NRA Ordinance on Standards for Installation Permit was partially revised in order that the standard response spectrum compiled as " seismic ground motion which is formulated without specifying the epicenter (common nationwide)" by "the study team on seismic ground motion formulated without a hypocenter" was incorporated into the regulations.

Prior to the aforementioned revision , licensees requested for a certain period of time needed to modify their license conditions at the "Opinion hearing meeting on Transitional Measures for the Introduction of Regulations on seismic ground motion formulated without a epicenter (Spectrum)" held in October and December 2019. The NRA reflected licensees' opinions to the revised interpretation, and currently the licensing process is underway.

7 Update of Efforts to Address the Challenges Identified in Country Group Discussions of the 7th Review Meeting

The update progress of items reported in the 8th national report, during the 9th reporting period are reported in this section including those considered closed since 8th review cycle.

7-1 To attract competent and experienced staff, and develop competencies relevant to nuclear and radiation safety through education, training, research and effective international cooperation

Based on the "Basic Policy for Human Resource Development of the NRA Personnel" established in FY 2021, the NRA considers the attractive working condition is essential to secure competent and experienced personnel, and therefore, the NRA implements several measures to conduct personnel exchange programs between other governmental organizations, to formulate a special retirement program which extend retirement age for unreplaceable experienced experts, to send staff to foreign universities, national research institutes or international organizations, to provide internship programs, to improve welfare programs and so on. As for the human resource development, the NRA installed plant simulators which were developed to simulate the behavior of power reactor facilities (BWRs and PWRs). By use of these simulators, practical trainings such as oversights of operator actions at startup and shutdown of reactors, and response to severe accidents, are carried out for NRA staff to enhance capability of dealing with accidents and events at the scene. As for the human resource development, the NRA installed plant simulators which were developed to simulate the behavior of power reactor facilities (BWRs and PWRs). By use of these simulators, practical trainings such as oversights of operator actions at startup and shutdown of reactors, and response to severe accidents, are carried out for NRA staff to enhance–capability of responding accidents and events at the scene. As for the training programs for specific fields, the qualification system composed of five fields (nuclear inspection, nuclear safety review, safeguards inspection, emergency preparedness and regulation for radiation) was introduced in 2017. Through associated training courses and on- the-job trainings provided by the NRA, 242 personnel in FY2019 and 117 personnel in FY2020 were qualified for one of the five fields. Starting from FY2018, the NRA has been providing education and training courses for basic qualifications to NRA staff in 5 job fields, to

continually secure and develop human resources capable of handling regulatory work. For the full-scope operation of the nuclear regulatory inspection program started in April 2020, 198 personnel were qualified for nuclear inspection. In FY2019, seven personnel were selected for and started an “intensive course” intended for them to concentrate on the course without involvement in their daily jobs. And six personnel were selected for and took a “part-time course” intended for them to complete training while performing their normal business in parallel. Several personnel who had been taking the intensive course since FY2018, completed the education and training course in FY2019 as planned and qualified for their selected job field.

Seven personnel started the intensive course since FY2019, completed the education and training course in August 2020. To cope with increasing numbers of staff taking these education and training courses, in FY2020, the NRA has improved and modified courses by reviewing curricula and instructional methods.

In FY2020, 17 personnel were selected for "intensive course", eight personnel in "part-time course". In FY2021, 15 personnel were selected for "intensive course", and 10 personnel were selected for "part-time course". In addition, 17 personnel who have taken the intensive course since FY2020 completed the education and training course in April 2021. In addition, to contribute to the curriculum of the education and training course, and to review the training methods, it was started to examine the optimization for training method from the results of the questionnaire. A continuous education and training course has been launched to keep a given qualification. To improve the quality of training, the training that incorporated active learning has been in trial, and introduced e-learning for train the trainer. Also, reviewing teaching methods and training evaluation methods to improve the quality of training are continuous activity in respect to the human resource development in the NRA. For staffs who have little opportunity to learn technical expertise, a new training is now provided to study the outline of the reactor facilities by using the training plant simulator to visualize the behavior of the reactor.

For development of human resources for research, the NRA had 37staff members engaged in joint research in FY2019, followed by 50 and 58 staff members in FY2020 and FY2021 respectively. 3 NRA staff members were dispatched to the JAEA for them to exclusively engage in testing and research activities in FY2019 followed by two staff members in FY2020 and 2021. The NRA also accepted staff members dispatched from the JAEA. One of them worked in research-related jobs.

The NRA actively makes presentations at academic conferences based on safety research results and works to improve the research capabilities of research staff through

discussions with experts at academic conferences.

7-2 To improve the effectiveness of inspections based on new regulation

In April 2017, the Reactor Regulation Act was amended to introduce a risk-informed and performance-based inspection program. Trial operation of the new inspection program began in the autumn of 2018, after that, it was conducted for a total of 3 phases of 6 months each. The new inspection program has been implemented in full scope since April 2020. (See B1-4 for details.)

7-3 To continue and strengthen the promotion of safety culture including a questioning attitude, to achieve a high level of safety in the NRA

In the amendment of Reactor Regulation Act in April 2017, it became newly required to establish the QMS for the installation permit of nuclear facilities. In line with this amendment, relevant NRA Ordinances has been revised to require the licensee to foster and maintain safety culture, incorporating requirements of GSR Part 2. The guide is set in force in December 2019 after thorough discussion and public comments.
Implementation status in Japan is described in Article 10.

7-4 Continuous Improvement of Ordinances and Guides by the NRA

The NRA has been conducting improvement of regulatory requirements and/or guides to incorporate latest information positively gained through national and foreign regulatory activities, operational information relating to incidents and troubles occurred at national or overseas nuclear facilities, results of safety research conducted by the NRA, surveys of academic research and state-of-the-art technical and scientific knowledge obtained from activities of international organizations such as the IAEA and the OECD/NEA. As for improved ordinances and/or guides reported on the 8th National Report, there listed are toxic gas intake protection for staff in a control room etc., protection against fire caused by high energy arcing faults (HEAF), evaluation on impact of volcanic ashes, and containment vessel alternate circulation cooling system (ACCS). During the 9th reporting period, improvements are made to ordinances and/or guides on the seismic ground motion which is formulated without specifying the epicenter, and the seismic isolation structure of buildings and structures.
See details in Article 6.

7-5 To Continue to Make Progress towards Decommissioning of TEPCO's Fukushima Daiichi NPS

Refer to B3-1 for efforts on risk reduction at TEPCO's Fukushima Daiichi NPS.

8 Efforts to Address Challenges Stated in the Summary Report of the 7th Review Meeting

The items identified as the "major common issues", in paragraphs 26 through 34 of the Summary Report of the 7th Review Meeting, are described in the applicable articles of Chapter B and C, however those not listed in Chapter B and C are reported below.

8-1 Safety Culture

Refer to B 7-3 and Article 10.

8-2 International Peer Reviews

Refer to B-2.

8-3 Legal Framework and Independence of Regulatory Body

Refer to Article 8.

8-4 Financial and Human Resources

The budget for FY2022 of the NRA is 58.9 billion yen. The number of staff is 1103 as of the end of March 2022, increased by 14 from the previous year.

8-5 Knowledge Management

The NRA developed the "Nuclear Regulation Authority Management Rules" in 2014 (revised in 2022) which describes that the knowledge to be managed is what is necessary to conduct duties and the head of each division or department is required to identify such

knowledge and to establish and maintain a system for identifying, collecting, organizing and utilizing the said knowledge.
The NRA issued the "Basic Policy for Human Resource Development of the NRA Personnel". Recognizing it needs a plenty of time to regain the highly expertized knowledge once it was lost, it states that technical expertise on regulation and administrative experiences such as those of accident responses, should be transferred from senior experts to younger staff in a planned manner, considering the work load change in the future as well as the importance of maintaining the organizational capability. It also mentions to proceed with the establishment of information infrastructure in addition to identification of such knowledge as early as possible and the implementation of training programs, in order to share those knowledge within the whole organization.
The head of each division designates a staff to deal with knowledge management and elaborates on establishment of knowledge management system, exchanging information on good practices, good ideas or improvements and so on.

8-6 Supply Chain

The licensees are provided from vendors with information on potential difficulties of procurement of components due to discontinued production and share those information among them. As such information is disclosed prior to discontinued production, the licensee starts to survey availability of alternative ones or replacement of the system which uses the said components as soon as the information is provided. The licensees stock components or equipment for replacement to take measures against failures or troubles which may happen during operation, including the stock of components which would be expected unavailable in the future.
As for the non-conforming or quality problem issues, issues of carbon segregation in reactor vessel were revealed. This was reported from France in 2014 that carbon segregation may exist in reactor vessels. The NRA ordered the licensees to report the possibility that the same problem might exist for the forged iron used for reactor vessels and so on. After receiving the reports from licensees, the NRA concluded that there were no possibilities that the portion exceeding the limit of carbon content specified in the industrial standards does exist in the forged iron for the NPPs operating in Japan.
After the data falsification cases at Kobe Steel, Ltd. and its affiliated companies in October 2017, the similar falsification cases were disclosed intermittently by the companies that supply materials or components used for nuclear facilities. The NRA has been interviewing the licensees on the status of usage of such products and continuing

to focus on the survey done by the licensees and confirms that the material with falsified data is not utilized or, if it's not confirmed, it has been replaced by the legitimate one.

8-7 Ageing Management and Extension of Operational Period

Refer to Article 14.

8-8 Emergency Preparedness

Refer to Article 16.

8-9 Stakeholder Consultation and Communication

Refer to 1-3 in Article 8.

C Outline of the Report for Each Article

This Chapter reports Japan's implementation status of each Article of the Convention on Nuclear Safety.

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

Nuclear reactor facilities in Japan are required to comply with the regulatory requirements set forth in the NRA Ordinances in accordance with the provisions of Reactor Regulation Act. When the regulatory requirements have been revised, existing nuclear facilities are also obliged to comply with the revised regulatory requirements. In the event that they are deemed not to conform with the revised regulatory requirements, the NRA may order the suspension of the use of the facilities. All ten nuclear reactors for power generation in commercial operation in Japan have been confirmed to be comply with the regulatory requirements established by the NRA and have been granted the amendment to Reactor Installation Permit.

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.

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.

1 Reactor Facilities in Japan

The Annex 3 provides a list of reactors for nuclear installation in Japan as of the end of March 2022.

2 Accidents or Failures that Occurred During the Reporting Period

During the three-year period FY2019 -FY2021, 11 incidents were reported to the NRA by licensees in accordance with the Reactor Regulation Act. Five among above mentioned 11 incidents were occurred in TEPCO's Fukushima Daiichi NPS. The list of accidents or failures that occurred during the reporting period is shown in the Annex 2.

3 Efforts to Secure Safety

3-1 Conformity Review

Based on the lessons learned from the accident at TEPCO's Fukushima Daiichi NPS, the revised Reactor Regulation Act, which were put into effect in July 2013, the NRA Ordinances and other relevant documents stipulate that commercial power reactor facilities are required to conform to them. The Conformity Review is a regulatory framework needed for operation of existing power reactors in Japan, which consists of review procedures for grant of amendment to Reactor Installation Permit, approval of Design and Construction Plan, and approval of amendment to Operational Safety Programs. The NRA checks the conformity to the regulatory requirements through these procedures.

Measures against severe accidents were added as regulatory requirements, as well as those against earthquakes, tsunamis and so on were reinforced based on lessons learned from the TEPCO's Fukushima Daiichi NPS accident. Accordingly, existing reactors need to be back-fit to them. In case of accidents or natural disasters that exceed postulated level in the regulatory requirements, it is required to take measures for prevention of core damage, CV failure, and dispersion of radioactive materials. The review of amendment to Reactor Installation Permit focuses on whether the reactor location, structure, equipment of the power reactor facilities as well as technical capability of the licensees of power reactor meet these requirements.

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

The review on amendment to Operational Safety Programs focuses on whether measures needed for safety of power reactor facilities specified in the Operational Safety Programs are "consistent with Reactor Installation Permit and not insufficient for prevention of disasters caused by nuclear fuel material, items contaminated by nuclear fuel material, or the power reactor".

By the end of March 2022, applications for granting amendment to Reactor Installation Permit concerning conformity to the regulatory requirements were submitted for 27 nuclear power reactors, and 17 of which were granted amendment to Reactor Installation Permit. 15 among the above mentioned 17 reactors obtained the approval of Design and Construction Plan, and 13 of which obtained approval of amendment to Operational Safety Programs.

As for the Specialized Safety Facility (SSF), the NRA requires licensees to complete its construction within five years from the date of the approval of Design and Construction Plan, and applications for granting amendment to Reactor Installation Permit were submitted for 18 power reactors by the end of March 2022. The review on the SSF focuses on whether measures are taken to confirm that there is no risk that the functions necessary for dealing with a severe accident etc. will be lost by the terrorism such as intentional aircraft crashes. 18 reactors were granted Reactor Installation Permit so far. Applications of the approval of Design and Construction Plan were submitted for 13 nuclear power reactors, and 12 of which obtained the approval by the end of March 2022.

3-2 Review on Approval of Extension of Operational Period

The Reactor Regulation Act amended in June 2012, after the TEPCO's Fukushima Daiichi NPS accident, prescribes an operational period of 40 years, and it is possible to extend this once, for a period of no more than 20 years, if approval is obtained from the NRA. In September 2017, the NRA revised the NRA Ordinance on Commercial Reactors and the "Guide for Extension of Operational Period on Commercial Power Reactors," etc., and deleted the provision (one year and three months) related to the commencement of the application period for approval of extension of the operational period where "one year or more but within one year and three months before expiration of the operational period" had been specified. So far, applications for extension were approved for 4

reactors.

As ageing measures, commercial power reactors that have been operated for 30 years after commencement of operation are obliged to make evaluations of ageing degradation of structures, systems and components (SSC) and formulate long-term Maintenance Management Program in every 10 years and are requested to reflect them to the Operational Safety Programs. In terms of each attached document describing an evaluation of the ageing degradation in both the application for approval of amendment of the Operational Safety Programs related to technical evaluation of ageing degradation and the application for approval of extension of the operational period, it would be possible to make confirmation with only one of them if these evaluations were made in a unified manner. Therefore, the regulatory process was simplified by amending provisions of the NRA Ordinance to avoid duplication in July 2017.

3-3 Improvement of Regulatory Requirements Reflecting the State-of-the-Art Technical and Scientific Knowledge

The NRA has been conducting improvement of regulatory requirements and/or guides to incorporate latest information positively gained through national and foreign regulatory activities, operational information relating to incidents and troubles occurred at national or overseas nuclear facilities, results of safety research conducted by the NRA, surveys of academic research and state-of-the-art technical and scientific knowledge obtained from activities of international organizations such as the IAEA and the OECD/NEA.

In the implementing process, the NRA collects information of incidents and troubles that occurred at domestic or foreign nuclear facilities, studies them and selects important items. The NRA decides whether to take regulatory actions or not on these selected important items after the discussion at the Technical Information Committee and advices from the Reactor Safety Examination Committee or the Nuclear Fuel Safety Examination Committee.

Improvements of regulatory requirements and/ or guides since the last review meeting are as follows.

- Dual Purpose Cask for Transportation and Storage (DPC)

As for dry storage of spent fuel at site by DPC which could be used both for transportation and storage, the NRA established the reasonable regulation and procedure based on stringent specifications for transportation. It requires that the DPC

is to be designed to cope with the seismic design conditions applicable to any candidate site with sufficient margin. The NRA specified DPC as Type Certification for Design and Type Designation. As far as the certified and designated DPC is applied, reviews on Installation Permit and the approval of Construction Plan are carried out only for site specific conditions such as site boundary radiation dose or separation distance from a fire source. The NRA revised/established the NRA Ordinance on Standards for Installation Permit, the NRA Ordinance on Technical Standards, and relevant guides, and promulgated and enforced them in April 2019.

- Tsunami without Tsunami Warning

As for tsunamis caused by landslide for which Tsunami Warning might not be issued such as tsunami caused by volcanic phenomenon in Sunda Strait in Indonesia, in January 2019, the NRA decided to hear about assessments of Takahama Power Station by KEPCO at the meeting open to the public where the NRA Commissioners and staff participate. It is to confirm the assessments of tsunami run-up while the anti-tide gates of inlet channels are open and the influences on essential equipment such as sea water pumps in the case of “Submarine Landslide of Iki Trough”, for which Tsunami Warning might not be issued. This is due to the necessity of evaluating the safety of Tsunami being pushed to the power stations without tsunami warnings, as the power stations were operated to close the tide gate in response to tsunami warnings.
The NRA reviewed the report from Kansai Electric Power and, based on the knowledge of the tsunami that occurred in the Sunda Strait in Indonesia, concluded that the tsunami assessed by KEPCO had to be incorporated into the regulations as a new knowledge, and that it was necessary to select it as a standard tsunami considered in the Installation Permit. The NRA expressed the view that it was necessary to apply for permission to change the installation of the Takahama Power Station within an appropriate period of time, as it was necessary to change the basic design or the basic design policy for the permission to change the installation Permit of the Takahama Power Station.

- Ground Motions without Specifying the Epicenter

Regarding "ground motions formulated without specifying an epicenter" that are commonly applied at nuclear power stations nationwide among the standard ground motions, it was determined that it was appropriate to formulate such ground motions in light of the base ground motions estimated for the 2004 Hokkaido Rumoi Sub-Prefecture Earthquake with consideration to the uncertainty, from among the 14 earthquakes below Mw6.5 previously exemplified in the "Review Guide for Standard Earthquake Motion

and Seismic Design Policies". The licensee considered that it was difficult to estimate the ground motions with high accuracy for other earthquakes due to lack of data, and that it took time to evaluate them, while the NRA considered that it was necessary to clarify at an early stage to formulate seismic ground motions for which were less than Mw6.5 level and commonly applied nationwide as "seismic ground motions formulated without specifying seismic centers". Considering the situation, the NRA decided to establish a study team, including earthquake experts, which statistically processed 89 earthquakes to formulate a "standard response spectrum". In August 2019, the NRA decided to incorporate this "standard response spectrum" into regulations in addition to the previous Rumoi Earthquake.

Subsequently, the NRA discussed the revision policy of regulatory requirement for incorporation of standard response spectrum and decided to revise the interpretation of the Ordinance in April 2021. As an administrative procedure, it was decided that an application for permission should be filed within nine months after the revision issued, however, in the case of a nuclear facility for which the licensee believed that there was no need to change the standard ground motions, a document explaining it could be submitted within three months. Only if the NRA found the change unnecessary, an application should not be required. As a result, it was confirmed that changes to the standard ground motions were not necessary except for Kyushu Electric Power's Genkai NPS units 3 and 4. After that, an application for the change to the Installation Permit was submitted by Kyushu Electric Power. As of July 2022, a new standard ground motion based on the standard response spectrum has been establishing at multiple facilities with the applications filed by the licensees.

Besides, the NRA accumulated the findings from their experiences of the reviewers through the Conformity Review, and complied "Review Process for Regulatory Documents Based on Experiences Through the Conformity Review" and reported the items to be reviewed at the NRA Commission Meeting.

In connection with amending ordinances and/or relevant guides, the certain moratorium period would be basically provided for the licensees to accommodate them. The licensees have applied again to adopt them and the NRA has been deliberating on their applications equitably and appropriately.

3-4 Assessment to Enhance Safety

The Reactor Regulation Act amended in 2012 newly introduced a safety assessment system named "Periodic Safety Assessment of Continuous Improvement of Commercial Power Reactors" which incorporated the former system of "Periodical Safety Review (PSR)". In this system, in order to enhance the safety of power reactor facilities, licensees of power reactor are requested to make an assessment by themselves in a period within six months of the date when the Licensee's Periodic Inspections of the said facilities is completed, and after the assessment, they are requested to submit reports of the assessment ("Safety Assessment Reports") to the NRA without delay and make them open to the public. For practical operation of the system, the "Operational Guide for Periodic Safety Assessment of Continuous Improvement of Commercial Power Reactors" was formulated in November 2013. Originally, the reassessment for earthquake and tsunami, as the site characteristic which might influence the risk for nuclear facilities, were requested by the Operational Guide. The Operational Guide was revised in February 2017, reflecting the result of IRRS etc., and the requirement of reassessment for some site characteristics such as risk of volcano and external fire, etc. were added. Moreover, the consistency with the IAEA Specific Safety Guide, "Periodic Safety Review for Nuclear Power Plants (SSG-25)" was confirmed. Matters concerning the Operational Guide are reported in Article 17(3).

Periodic Safety Assessment of Continuous Improvement of Commercial Power Reactors is the first activity for both the NRA and licensees, and the common understanding for the actual operation of the system, and the continuous improvement is necessary. For that purpose, the NRA held the meeting on the continuous improvement of the said Assessment five times since July 2017, and the discussion about the contents of the Safety Assessment Reports of Sendai NPS units 1 and 2 was conducted. The NRA summarized the items to be improved and reported at the NRA Commission Meeting. Then the items to be improved were approved:

- For depth of description of the Safety Assessment Reports, not only the result of assessment etc., but also details of the method and process of investigation and assessment should be described as easily understandable.
- As for the description of Chapter 1 of the Safety Assessment Reports, unified document composed of contents of existing authorized documents is not satisfactory, and licensees should describe the Safety Assessment Report so as to explain the latest status of the plant, namely "as is" referring to USNRC's UFSAR or IAEA Safety Guides.

- As for the result of PRAs, licensees should disclose not only the results of the PRAs but also the results of analysis of PRAs including the differences between current and past PRAs results. And licensees should evaluate appropriateness of the assessment methods in the light of the purpose of PRAs, in the case that methods are not in line with the purpose, licensees should modify them to meet the purpose and disclose them.

The NRA requests licensees to reflect the items to be improved into the Safety Assessment Reports.

The NRA holds "Exchange of opinions with chief executive officers (CEOs) of major nuclear utilities," open to the public, to promote efforts fostering safety culture and enhancing safety, and to hear licensees' basic policy for safety improvement activities and perspectives on current regulatory system. In this Exchange, CEOs report their voluntary efforts to enhance safety, and the NRA and CEOs discuss licensees' idea for improving regulatory system, and licensees' view on organization and framework of voluntary safety improvements based on the recommendations provided by the Japan Nuclear Safety Institute (JANSI).
Also, the NRA holds "Exchange of opinions with chief nuclear officers (CNOs) of major nuclear utilities," open to the public, to contribute to smooth improvement and clarification of regulatory requirements and safety reviews for smooth introduction of new regulation and enhancement of predictability. Furthermore, in response to the needs of both regulatory body and licensees in Exchange of opinions with CNOs, the NRA also holds a dialog where to exchange specific technical matters at a staff level between licensees and regulatory body. Through these activities, the NRA encourages licensees' efforts on safety improvement.

3-5 Specified Nuclear Facilities

The NRA designated TEPCO's Fukushima Daiichi NPS as the Specified Nuclear Facilities in accordance with the Reactor Regulation Act. The NRA further gave TEPCO a list entitled "Matters for Which Measures Should Be Taken" and ordered TEPCO to submit an implementation plan to ensure operational safety and the protection of specified nuclear fuel materials. The Implementation Plan was submitted on 7th December 2012, and accordingly, the NRA approved it on 14th August 2013. Afterwards, amendments were made in the Implementation Plan in accordance with progress of work in Fukushima Daiichi NPS.

4 Nuclear Installations Under Decommissioning

In order to ensure a smoother transition from shutdown to decommissioning of aging nuclear facilities, nuclear licensees are obliged to formulate and publicize a policy on decommissioning from the start-up stage of projects as regulatory developments in response to the decommissioning of nuclear facilities. In response to the enforcement of relevant laws in October 2018, each nuclear licensee formulated and publicized a policy on decommissioning by the end of the same year.

As of March 2022, 20 power reactors obtained approval of Decommissioning Plan, and are under decommissioning. Reactors below obtained approval of Decommissioning Plan during the reporting period.

NPS	Reactor Type	Shutdown	Applied for Decommissioning	Approved
Ohi Power Station unit 1 and 2 (KEPCO)	PWR	1/3/2018	22/11/2018	11/12/2019
Onagawa NPS units 1 (Tohoku Electric Power Company)	BWR	21/12/2018	29/7/2019	18/3/2020
Genkai NPS unit 2 (Kyushu Electric Power Company)	PWR	9/4/2019	3/9/2019	18/3/2020
Ikata Power Station unit 2 (Shikoku Electric Power Company)	PWR	23/5/2018	10/10/2018	7/10/2020
Fukushima Daini NPS unit 1~4 (TEPCO)	BWR	30/9/2019	29/5/2020	28/4/2021

5 Nuclear Installations Decided to Be Decommissioned

Licensees decided to decommission the following power reactor facilities, which are in permanent shutdown status. In this report, the decision of decommissioning by licensees is defined as giving the notification of changes of electric facilities to the Minister of Economy, Trade and Industry according to the provision of Article 9, the Electricity Business Act.

NPS	Reactor Type	Commissioned	Shutdown	Applied for Decommissioning
Fukushima Daiichi NPS unit 1 (TEPCO)	BWR	26/3/1971	19/4/2012	-
Fukushima Daiichi NPS unit 2 (TEPCO)	BWR	18/7/1974	19/4/2012	-
Fukushima Daiichi NPS unit 3 (TEPCO)	BWR	27/3/1976	19/4/2012	-
Fukushima Daiichi NPS unit 4 (TEPCO)	BWR	12/10/1978	19/4/2012	-
Fukushima Daiichi NPS unit 5 (TEPCO)	BWR	18/4/1978	31/1/2014	-
Fukushima Daiichi NPS unit 6 (TEPCO)	BWR	24/10/1979	31/1/2014	-

The conditions of TEPCO's Fukushima Daiichi NPS units 1 thru 6 are as follows.
In the wake of the Great East Japan Earthquake occurred on 11 March 2011 and the following nuclear accidents such as core damage, TEPCO concluded that it was impossible to further use units 1 thru 4 of the Fukushima Daiichi NPS as electric facilities for business purposes, and submitted a plan on 30 March 2012, for their decommissioning as a commercial source of power on 19 April of that year, pursuant to the provisions of the Electricity Business Act. In addition, TEPCO submitted a plan on 18 December 2013, for decommissioning units 5 and 6 of the Fukushima Daiichi NPS as a commercial source of power on 31 January 2014.

6 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 requirements set forth in the NRA Ordinances, the NRA can suspend the use of the reactor facility in question, or require 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."

When regulatory requirements are revised, the NRA can order the licensees to meet revised regulatory requirements even for existing nuclear installations. In the case of applying revised regulatory requirements, basically, the date of enforcement is set on a day certain time after the revision of the regulatory requirements, or certain moratorium period is set to meet the revised regulatory requirements. This period is decided on a case-by-case basis by the NRA considering the safety importance of revised regulatory requirements, and the time period required for licensees to implement necessary measures. However, it is possible to apply revised regulatory requirements at the same time as the revision if necessary measures need to be taken immediately for ensuring safety.

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 details regulations stipulated in the Reactor Regulation Act and defines regulatory requirements. To install a nuclear power plant, Reactor Installation Permit shall be obtained based on the Reactor Regulation Act. The approval of Design and Construction Plan, Pre-service Inspections, and the approval of Operational Safety Programs are procedures to check compliance to regulations and approval conditions.

The Reactor Regulation Act includes provisions to revoke permits and the order suspension of facility use in exercise of the NRA's authority; it also provides implementation methods for 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 the provisions of 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, the development and the use of nuclear energy shall be strictly limited to peaceful purposes, be dedicated to securing safety democratically and voluntarily, 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 the security of Japan.
The Atomic Energy Basic Act stipulates the establishment of the NRA and the Nuclear Emergency Preparedness Commission, and it also provides the basis for the establishment of the NRA as a government supervisory body for enforcement and democratic control of nuclear energy policies for the use of nuclear energy.

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

The Act for Establishment of the NRA which was enacted on 19 September 2012 stipulates the foundation of the NRA as the nuclear regulatory body of Japan, its authorities and responsibilities.
The object of the Act is to emphasize the importance for its powers to be exercised in a neutral, fair and independent manner.
The 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 authorities and responsibilities needed for the NRA to carry out its mission. A report on the authorities and responsibilities which 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.

In accordance with the spirit of the Atomic Energy Basic Act, this Act is enacted for the purpose of providing necessary regulations on refining activities, fabricating and enrichment activities, interim storage activities, reprocessing activities and waste disposal activities, as well as on the installation and operation of reactors while taking into consideration the possibility of large scale natural disasters, terrorist attacks, or other criminal acts, in order to ensure that the usage of nuclear source material, nuclear fuel material and reactors are limited to peaceful purposes, and to ensure public safety by preventing hazards in the event that a severe accident at a nuclear facility causes discharge of an abnormal level of radioactive materials outside the factory or place of activity where the nuclear facility is installed, and by protecting nuclear fuel material. And it is also enacted for the purpose of providing necessary regulations on the usage of international controlled material in accordance with treaties or other international agreements concerning the research, the development and the usage of nuclear energy

The Reactor Regulation Act establishes safety regulations and standards for granting permits and approval, including Reactor Installation Permit, the approval of Design and Construction Plan, Pre-service Inspections, Licensee's Periodic Inspections, the approval of Operational Safety Programs, and approval of Decommissioning Plan. The regulations also establish administrative procedures such as the suspension of operation (back-fitting) 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.

The Act also regulates the assessment to enhance safety, the type certification, operational periods, and responsibilities of nuclear licensees (obligation of developing necessary measures such as the installation of facility or equipment contributing to safety improvement and fulfillment of safety education, based on the latest knowledge). Furthermore, the Act specifies that when the NRA determines it especially necessary for nuclear licensees to manage the facility in an appropriate manner according to the facility situation, the NRA can designate the facility as the Specified Nuclear Facility. In this case, it is stipulated that the licensees of the Specified Nuclear Facility have to submit an implementation plan to the NRA for approval and that they have to receive an

additional approval every time a change is made.

In addition, it stipulates a system for an employee feedback system (whistle blowers) whereby they can report any violation of the Reactor Regulation Act to the NRA without fear of penalty. It also prohibits employers to fire employees or treat them disadvantageously because of reporting violations.

Cabinet Orders, the NRA Ordinances, and other related ordinances are stipulated based on the provision of the Reactor Regulation Act and to implement the provisions.

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)
  - Applies to the installation and the 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 Installation Permit)
  - Standards relating to the location, the structure, and the equipment of reactor facilities, which form one of the criteria for obtaining an approval for Design and Construction Plan on power reactors.
- NRA Ordinance Prescribing Technical Standards for Commercial Power Reactors and their Auxiliary Facilities (NRA Ordinance on Technical Standards)
  - Technical standards relating to an approval of Design and Construction Plan 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 and systems for their inspection relating to the design and the construction for power reactors, which are one of the criteria for approval of Design and Construction Plan.
- NRA Ordinance Prescribing Technical Standards for Nuclear Fuel Material Being Used as a Fuel in Commercial Power Reactors
  - Technical standards relating to the design of fuel assemblies.

For facilities designated as Specified Nuclear Facilities, the Reactor Regulation Act stipulates that those regulatory requirements may be only partially applied if proper implementation of measures to achieve operational safety is ensured based on an

implementation plan. The following ordinances have been enacted for the TEPCO's Fukushima Daiichi NPS designated as Specified Nuclear Facilities to stipulate the measures to be taken to ensure safety, as the situation there differs from that of 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

In response to the TEPCO's Fukushima Daiichi NPS accident, the Reactor Regulation Act was amended in 2012. In order to strengthen safety measures in the use of nuclear power, part of the Reactor Regulation Act was amended in April 2017.
Under this Act, from the perspective of reinforcing measures taken by both licensees and the NRA, with the aim of ensuring higher safety, licensees are obliged to confirm the nuclear facility's compliance to the regulatory requirements as well as to ensure the primary responsibility for securing safety.
The Act also requires consistent quality assurance management from design and construction to use.
This amendment to the Act came into force in April 2020

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 to protect lives health and property of citizens. Combined with the Reactor Regulation Act, the Basic Act on Disaster Management, and other laws concerning nuclear disasters, this Act has been designed to strengthen measures against nuclear disasters by prescribing the responsibilities of licensees, the declaration of a nuclear emergency situation, the establishment of the 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 actions to prevent nuclear disasters, and take necessary actions faithfully for preventing the spread of the effects of a crisis and repairing any damage caused by such an incident.
This law also stipulates that the government must take all necessary actions to implement emergency response measures, precautionary protective measures and restorative measures for nuclear disasters.

Following the TEPCO's Fukushima Daiichi NPS accident, the Nuclear Emergency Act was amended on 19 September 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) Regulatory Requirements and Safety Regulations

1 Regulatory Requirements

Considering lessons learned from the TEPCO's Fukushima Daiichi NPS accident, the NRA put into effect the new regulatory requirements in July 2013.
The regulatory requirements are based on the concepts of defense-in-depth, which are to prepare multiple (or multi- layered) and effective countermeasures and do not rely on other levels of defense when preparing certain countermeasures. These requirements reinforce the estimations and the countermeasures against natural phenomena and other events such as fire disasters that trigger common-caused failures. Moreover, they require measures to prevent core damages and CV failures in case of a severe accident, measures for suppression of dispersion of radioactive material, and protection measures against intentional aircraft crashes. The basic policies for measures against severe accidents and acts of terrorism are as follows:

- Protective measures through multiple stages such as "prevention of core damage ", "securing of the containment function", "controlled discharge through vents", and "suppression of dispersion of radioactive material."

- Further enhancement of reliability in combination with permanent facilities, while primarily based on the use of portable facilities.
- Reinforcement of preventive and protective measures in spent fuel storage pools.
- Enhancement of durability of Emergency Response Center, reliability and durability of communication systems, and reliability and persistence of measurement systems including those in spent fuel storage pools (reinforcement of command communications and measurement systems).
- Development of procedures, securement of personnel, and implementation of trainings are required since it is important for hardware (facilities) and software (on-site work) to function integrally.
- As countermeasures against deliberate airplane crashes, distributed storage and connection of portable facilities are required. The Specialized Safety Facility is introduced as a backup measure for reliability enhancement.

2 Regulatory System

2-1 Licensing Systems

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

The Act stipulates the reasons of disqualification from obtaining a permit, such as that anyone who has had Reactor Installation Permit revoked within the previous two years may not obtain a new permit.

If a licensee wishes to change an already obtained permit he must obtain permit for any amendment or, if the change is prescribed as a minor change in the 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 by the authorization of the NRA only once for a maximum of 20 additional years.

The Conformity Review for obtaining Reactor Installation Permit is carried out by the NRA. In granting Reactor Installation Permit, the NRA must seek the opinion of the Atomic Energy Commission (AEC) 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 Reactor Installation Permit will be

subject to a penalty of imprisonment with labor for no more than three years, or a fine of no more than three million yen, or both, pursuant to the provisions of the Reactor Regulation Act.

Licensees shall submit the application for the approval of Design and Construction Plan to the NRA before commencing construction, and obtain NRA's approval.

In the case of constructing new nuclear reactor facilities, the applicant shall describe all matters required by the NRA Ordinances concerning detailed equipment design and attach explanatory documents as required for reactor units, nuclear fuel material handling systems and storage systems, reactor cooling systems, instrumentations and control systems, radioactive waste disposal systems, radiation controlled systems, reactor containment systems, and so forth, on the application for the approval of Design and Construction Plan.

When an existing nuclear reactor facility is modified, a licensee shall obtain the approval of Design and Construction Plan or notify the NRA in accordance with the contents of the modifying.

When the NRA acknowledges that the applied Design and Construction Plan complies with the approved Reactor Installation Permit and the NRA Ordinance on Technical Standards, and that the design and quality assurance method of the applicant complies with the regulatory requirements, it shall approve the Design and Construction Plan.

The type certification was newly introduced by the revision of the Reactor Regulation Act in 2012, and it is given by the NRA when the specified equipment regulated by the NRA Ordinance Concerning the Installation and Operation of Commercial Power Reactors, is applied and confirmed to be in compliance with the NRA Ordinance on Standards for Installation Permit. The equipment for which the certificate is given has no need to prove compliance for every application because it has already been regarded as compliant with the NRA Ordinance on Standards for Installation Permit. This certification is expected to contribute to a 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 NRA Ordinance on Technical Standards, the type can be designated. The specified equipment for which the type designation is given has no need to prove compliance for every application for the approval of Design and Construction Plan because it has already been regarded as compliant with the NRA Ordinance on Technical Standards. This also is expected to contribute to a more efficient licensing process of the approval of Design and Construction Plan.

And the approval shall be obtained for the Operational Safety Programs of the fuel

assembly before its operation.

In the amendment of the Reactor Regulation Act in April 2017, the approval of Construction Plan and the approval of Fuel Assembly Design for both the domestically produced fuel assembly and imported fuel assembly were integrated, and the licensee is required to apply for the approval of Construction Plan of design and construction, and to obtain NRA's approval.

In addition, the licensee is required to carry out the activities based on the QMS from the Reactor Installation Permit stage, and it is recognized as a subject for the review for the Reactor Installation Permit. The licensee is also required to set the Operational Safety Programs before the start of construction, and to conduct activities based on the Operational Safety Programs from the design and construction stages consistently. The Act was amended in April 2020.

2-2 Inspection Systems

A licensee of reactor shall conduct a Pre-service Inspection on reactor facilities for which a construction project for installation or modification is carried out in accordance with the Design and Construction Plan approved by the NRA, and shall confirm that the reactor facilities conform with the technical requirement established by the NRA. Also, unless the NRA confirms that the reactor facilities meets the regulatory requirement, the licensee may not use the reactor facilities.

After the commencement of a reactor facility operation, the licensee shall periodically conduct an operator inspection to confirm that the reactor facility conforms to the technical requirement established by the NRA. Upon completion of the Pre-service Inspection, the licensee shall report the result to the NRA.

While the licensee carries out the above-mentioned inspection on licensee's own responsibility, the NRA performs oversight on the licensee's activities through Nuclear Regulatory Inspection, the inspection program that enables the NRA to inspect the licensee's safety activities at any time (i.e., the NRA's inspections are carried out "at any time" and " to anything"). When there are issues of concerns about a licensee's safety activities, the NRA points out them as an inspection finding, and conducts supplemental inspections depending on its safety significance and severity level.

It should be noted that Nuclear Regulatory Inspections shall not apply to Specified Nuclear Facilities, and that they shall be inspected by the NRA as to whether safety measures are being taken in accordance with the Implementation Plan.

When a nuclear reactor facility is used without confirmation of the NRA, or when a

licensee refuses, obstructs or evades an entry through the Nuclear Regulatory Inspection, or refuses to make a statement or makes a false statement in response to a question in processes of the Nuclear Regulatory Inspection, the licensee shall be penalized by imprisonment for not more than one year or a fine of not more than 1 million yen, or the both, pursuant to the provisions of the Reactor Regulation Act.

2-3 Law Enforcement Measures

The Reactor Regulation Act stipulates law-enforcement measures for the NRA execution.
The NRA can revoke 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 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 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 labor 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 permit and approval, implement of inspections, and issue necessary orders. The NRA is financed by the national budget and its staffs are 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 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 the 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 for the NRA.

The NRA is established as an external bureau of the MOE. 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 National Government Organization Act and the Act for Establishment of the NRA. It exercises 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 staff of the NRA 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 years 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 permit 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. 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.

In July 2017, the NRA has strengthened its organization in order to improve the inspection system, the strengthening of regulation for radiation source and radiation protection, and the development and securing of human resources, those were identified as Recommendation items in the IRRS mission by the IAEA. Specifically, the number of NRA staff increased as well as Radiation Protection Department to strengthen regulation of radiation source, and the Oversight Planning and Coordination Division to operate a new oversight program for nuclear facilities, were newly established.

The Secretariat of the NRA consists of the 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, physical protection of nuclear material, radiation monitoring, regulation for radiation sources, and safeguards based on international commitments, and the Nuclear Regulation Department consisting of the Nuclear Regulation Policy Planning Division, the Group of Licensing for the nuclear facilities, and the Group of Oversight for the nuclear facilities including Oversight Planning and Coordination Division, in addition to the Policy Planning and coordination Division, the Personnel Division, the Division of Budget and Accounting, the Division of Legal Affairs.

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 Regional 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; usage facilities
Onagawa Nuclear Regulation Office	Power plant (BWR)
Fukushima Daiichi Nuclear Regulation Office	Power plant (BWR); Specified Nuclear Facilities
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	fuel fabrication, usage facilities
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 national government funds the NRA which compiles a proposed annual budget and submits it to the appropriate financial authorities via the MOE.

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

The NRA budget in FY2019 is 54.7 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 Nuclear and Industrial Safety Agency (NISA), the Nuclear Safety Commission (NSC), and the AEC of Japan in September 2012. In order to integrate functions of safeguards and radiation protection in April 2013, the NRA accepted staff from the Ministry of Education, Culture, Sports, Science and Technology (MEXT). The NRA integrated JNES a technical and scientific support organization, in March 2014, and 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 Basic Policy for Human Resource Development of the NRA Personnel 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) to properly distribute resources needed for learning, training, (2) to connect future challenges and strategies of the organization with human resource development, and (3) to encourage staff to promote their voluntary learning. Furthermore, in order to show the direction of human resource development, career paths were set as a career improvement models, and "the Basic Policy on Human Resource Development for NRA Staff" was revised in June 2021, adding the statement related to the involvement of central government human resource agency in career paths.

In addition, based on the recognition that it is important for the NRA to develop and secure not only NRA staff members but also human resources who have the knowledge necessary for nuclear safety and nuclear regulation widely in order to conduct nuclear regulatory steadily, the NRA has been implementing a nuclear regulatory human resource development project in collaboration with universities etc. since FY2016.

The NRA reviewed the contents of the project proposed by the applicants by documents and interviews, and adopted 13 projects in 2016 and five projects in 2017. In the continuous implementation of the business adopted in the previous year, the NRA evaluates the progress of the business and the plans for the next fiscal year, and strive for the effective implementation of the business.

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 publicized, 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 reference materials used.

In addition, the NRA has been working to improve the transparency of the review. Based on discussions at the 38th the NRA Commission Meeting in 2018 (31 October 2018) and the 45th the NRA Commission Meeting in 2018 (5 December 2018) on the basic concept of disclosure of nuclear operator interviews, the minutes made by the automatic speech-to-text software have been posted on the NRA's website since April 2019. 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.

Since 2020, as response to COVID-19 pandemic situation, review meetings, and study team meetings have been implemented using the online conference system. The NRA Commission Meeting also held using the online conference system depending on the situation.

Meeting materials are posted on the NRA's website so that they can be obtained at the same time as the meeting begins, in order to facilitate the convenience of viewers.

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

In addition, Technical Information Committee, in which examines whether the latest findings require regulatory response, frequently used materials obtained from overseas regulatory agencies on the premise of non-disclosure, so these meetings itself conducted as closed. The transparency of such meetings has been ensured by publishing materials as far as possible and summary of the meeting minutes. However, based on the importance of this meeting and further transparency, the NRA decided to make this meeting disclosed to the public in principle, and the meetings may be treated as closed meeting only if it handles non-disclosure information or if the meeting is deemed appropriate not to be disclosed. The NRA started the policy from June 2018.

The NRA Chairman conducts weekly press conference. The Director of Policy Planning and Coordination Division of the Secretariat of the NRA, in his capacity as spokesman, also conducts press conference twice a week. If necessary, extraordinary press conferences are held.

Press conferences are also made available as live broadcasts, and their recordings are disclosed to the public. The minutes are posted on the NRA's website within the next day as the target.

When the chairman and commissioners of the NRA conduct site visits, photographs of site visits and interviews with the chairman or commissioners after achieving the purpose of the visit are provided (15 cases in FY2021).

(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.

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 started Visits of nuclear facilities by NRA Commissioners and Exchange of opinions with local parties based on the discussion in the NRA Commission Meeting in November 2017.

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 and Scientific Support

(1) Technical and scientific support organizations

As Technical and Scientific Support Organizations, the NRA has joint jurisdiction over JAEA and National Institute for Quantum and Radiological Science and Technology (QST) 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 FBRs 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 the MEXT and the NRA.
QST's mission is to raise the level of quantum and radiological sciences and technologies through its commitment to research and development into quantum science and technology, the effect of radiation on humans, the prevention of human radiation hazards, diagnosis and treatment, and the medical use of radiation.
Activities by QST in the fields of radiation effects on the humans, the prevention of radiation hazards for humans, and diagnosis and treatment fall under the joint jurisdiction of the MEXT and the NRA.

(2) Input from external experts

The NRA has an 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 requirements, measures against nuclear disasters, etc. For the Conformity Review, the Conformity Review Meeting is

held to hear opinions from external experts. In addition, the NRA has an opportunity to get advice from international advisers consisting of experts overseas, in order to capture a wide range of international knowledge on general issues including the NRA's organizational approach and safety regulatory activities, etc.

(3) Safety research

For the NRA to adequately implement its activities, it is necessary to pursue safety research to continue improving nuclear safety and to accumulate scientific/technical knowledge. The NRA decided to review research fields to tackle in light of past progress of safety research. In July 2016, the NRA formulated the "Basic Policy of the Safety Research in the NRA" and decided to formulate the "Safety Research Areas to Be Promoted and the Implementing Policy" every year after FY2017.

As for evaluation of the safety research, 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 "Basic policy of 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 research in efforts to address imminent challenges immediately. For this reason, the NRA promptly discloses results of the safety research as NRA technical report.

Collaborative research is pursued in international agencies, because nuclear safety is a global issue. 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 collaborative research operated by international agencies such as the OECD/NEA and the IAEA or under the frameworks of bilateral/multilateral cooperation.

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. Based on that rules, the NRA established the "Mid-Term Goal for the First Term of the NRA" in February, 2015, and full operation of

this management system started in April 2015. The Mid-Term Goal for the Second Term has been implemented since April 2020.

The NRA Management Rules stipulates that the PDCA cycle (Plan ⇒ Do ⇒ Check ⇒ Act ⇒ make improvements and formulate another Plan) should be implemented as a management system in a unified manner where the cycle consists of periodical formulation of a fiscal-year plan with items on special emphasis, 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.

The following five goals have been set for the second mid-term target period, from 1 April, 2020 to 31 March, 2025.

I. Secure independence, neutrality, and transparency, and enhance the organizational structure

II. Strict and appropriate implementation of nuclear regulation and strengthening of technical foundation

III. Promotion of nuclear security measures and steady implementation of safeguards

IV. Secure safety of Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station and investigate the cause of the accident

V. Appropriate implementation of radiation protection measures and emergency preparedness measures

Article 8 (2) Status of the Regulatory Body

The NRA carry out its regulatory 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 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 via the MOE.

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, approval, and inspections, including approval of nuclear reactor construction plan, 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, the NRA staff 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 NRA staff 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 have 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 Prime 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 prime 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.
To establish Operation Safety Programs and obtain NRA's approval, licensees must also undergo NRA's inspections.
In addition, 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 to 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 permit or order it to suspend operations for a specified period not exceeding one year.

If an operator establishes a power reactor without permit, 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 the QMSquality 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's approval of Operational Safety Programs before commencing reactor operations, in accordance with the Reactor Regulation Act.

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

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 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.
In addition, as part of such activities, the licensees are making voluntary efforts to improve safety, and reports to the NRA in a timely manner. For example, as the lessons learned from the TEPCO's Fukushima Daiichi NPS accident, TEPCO has established the nuclear safety advisory board of nuclear experts from abroad for seeking their advises on the relationship with partner companies and strengthening risk management. Moreover, the senior management directly visits the sites, receives voices from the field workers who are responsible for safety, and correctly grasps the actual situation at the site, resulting in effective support for nuclear safety reform and improvement. From the perspective of defense in depth, TEPCO holds the contest aims to enhance the competence of proposing a cost-effective safety measure through multilateral studies, and to acquire the competence of substantialize such ideas quickly. Since the accident, TEPCO has selected 119 good proposals out of 1761 proposals applied. And among good proposals, 94 safety measures are already substantialized such as expansion of equipment for field inspection after tsunami, improvement of indication of external water injection port in order to improve the reliability of reactor water injection in emergencies.

3 Efforts by the Regulatory Authority to Prioritize Safety

At its Commission Meeting 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 TEPCO's Fukushima Daiichi nuclear accident on 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 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 27th May 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 Daiichi 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 the review of financial basis in the examination stage of Reactor Installation Permits, a mechanism of ensuring 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 even from the stage that the reactors are still in operation exists. e for.

The deployment of competent personnel is a regulatory requirement, and licensees secure enough personnel who have sufficient competent.

Therefore, the regulations are ensuring financial and human resources for securing safety of nuclear installation, 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 permit.
In addition to a request for Reactor Installation Permit, anyone who installs nuclear facilities 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 costs (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 with consent of the Minister of Economy, Trade and Industry.
This is a system that reserves the total estimated costs necessary for dismantling a nuclear power plant according to the proportion of actual power generation amount in the assumed total power generation amount from start-up to shut-down. In this system, the required costs are fully accumulated when the actual accumulated power generation amount reaches the assumed total power generation amount.

Reserve amount = (total estimated costs × 90% × (actual accumulated power generation amount/ assumed total power generation amount) – amount of previous year reserve)

* assumed total power generated amount = authorized output × 40 years × 365 days × 24 hours × capacity factor (76%)
* The reason of multiplying 90% to total estimated costs is that for normal thermal power generation facilities, the dismantling costs will be funded at the time of dismantling, so the amount excluding the dismantling costs equivalent of the thermal power generating facility because it will be accumulated as costs specific to

dismantling nuclear power facilities.

As to the costs of disposal and reprocessing of spent fuel, it was funded by licensees to a deposit management company which designated by the Minister of Economy, Trade and Industry, pursuant to the Spent Nuclear Fuel Reprocessing Fund Act.

After that, the Act was amended in September 2016 in order to continue to secure the necessary funds for disposal and reprocessing business and the deposit system was abolished, then new contribution system was formulated.

Before the amendment, the fund amount had to 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. And the Act stated that the Minister of Economy, Trade and Industry could notify each licensee of change of the amount of needed reserves if there are significant changes in the status of generation of spent fuel.

However, the spent fuel reprocessing is not completed unless the process at the reprocessing plant and its related businesses which include MOX fuel processing are properly implemented, so that the deposit system has been changed to a scheme in which the electricity utility contributes at the time of power generation. From the viewpoints of financial benefits and securing a sustainable company to complete the business in the future, the council of the Ministry of Economy, Trade and Industry (METI) has resulted in its arguments that establishment of authorized corporation that private sector mainly conduct with government proper involvement is appropriate due to remain competitively neutral and ensure that reprocessing projects will be implemented in the future without failure even under the circumstances where competition has progressed. In September 2016, as the authorized corporation, Nuclear Reprocessing Organization (NuRO) was approved by the Minister of Economy, Trade and Industry, and in October same year, it was established at the same time of the Act amendment. With this amendment, the electricity utility contributes fund to the NuRO at the time it generates electricity so that it become possible to secure necessary funds stable no matter how the electricity utility financial health is worse.

With regard to the final disposal of high-level radioactive waste and radioactive waste with low heat generation 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-the-spot inspections of electric utilities and Deposit Management Entities.

Article 11 (2) Human Resources

1 Regulatory Requirements

In applying for Reactor Installation Permit, licensee is required to submit the attachment of certification for technical capability of installing and operating nuclear reactor properly and of preventing and mitigating severe accident.
Licensee must take adequate measures for operational safety; such as operation shall be assigned to proper staff with adequate knowledge, operation shall be implemented with necessary number of staff, responsible staff shall be with adequate knowledge and experiments and be certificated according to the standard that the NRA had approved. Proper deployment and accreditation of technical staff are regulatory requirements.
Licensee must set checks to be carried out before the reactor operation starts, during its operation and after its shutdown, and make operators to ensure it.
Licensee should develop Operational Safety Programs and obtain its approval by the NRA. It includes the content of operational safety education and its implementation for personnel operating and managing reactor facilities.
It is required to develop a quality assurance plan in Operational Safety Programs, and matters regarding human resources should be included in it. A quality assurance plan outlines requirements on staff competence for operational safety and any supplemental education or training to be implemented for staff to be deficient in such competency.
Licensee must appoint a Chief Reactor Engineer from among qualified applications, including the provisions of the NRA Ordinance, to supervise the operational safety of reactor.
When implementing decommissioning, licensees must establish appropriate Operational Safety Programs and obtain NRA's 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 Acquisition and Check by Licensees on Knowledge and Technical Competence

To secure safety of nuclear power plant, securing high awareness of nuclear safety and excellent knowledge and technical competence 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 failure and troubles. There are specialized facilities for different reactor types outside their companies: the BWR Operator 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 for operators of nuclear facilities of the licensees. In training in these Training Centers, curriculums designed according to the level of competence of operators. The licensees periodically dispatch operators to the facilities for re-training.

Persons responsible for operation are required to have not only knowledge and technical competence 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 certain 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.
- Have position state at a management or supervisory level in the nuclear power station, and
- Have knowledge and technical competence concerning reactors.

In response to designation by licensees in April 2009, JANSI 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 (Japan Electric Association Code (JEAC) 4804). The determination is made based on operation

[7] http://www.btc.co.jp/e_training.html

[8] https://www.mhi.com/group/ntc/

skill tests using a simulator, training sessions, and an oral examination. When conformance to standards is confirmed with a person, a certificate is granted. This certificate 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 industry. There are also various types of training courses on equipment produced by manufacturers, and engineers are dispatched to these manufacturers for training.

In addition, with regard to human resource development, licensees are participating "Nuclear Human Resource Development Network (Human Resources Network)" aiming to promote efficient and effective encouragement of nuclear human resources securing and development by industry-government-academia collaborating.

Human Resources Network has five working groups (elementary to high school education, universities and colleges education, human resource development for working engineers, overseas human resource development, and internationalization of national human resources). Moreover, with the Strategy Working Group established in April 2019, Overseeing both domestic and foreign activities, and formulating strategies for securing and fostering nuclear human resources while making overall coordination, strengthen the functions and structure of the Human Resources Network.

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

In Japan, licensees deal with both human and organizational factors in anticipating problems and managing any noncompliance with rules and regulations.

In a quality assurance plan set in the Operational Safety Programs, licensees set force guidelines dealing with noncompliance. These include programs for the analysis, prevention, detection, and correction of human errors, and for self-assessment of management and organizational problems.

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

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

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

1 Regulatory Requirements

In the NRA Ordinance on Standards for Installation Permit it is required in designing nuclear reactors to take necessary measures to prevent operational error. In the NRA Ordinance on Technical Standards, 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 errors, and to take measures to prevent recurrence of human errors.

In the operation phase of a nuclear reactor, a licensee shall establish QMS in the licensee's Operational Safety Program and nonconformance caused by human error should be handled in the QMS. A licensee shall analyze and assess a cause of human errors, and implement corrective actions to prevent the recurrence. The NRA oversights such licensee's QMS activities in Nuclear Regulatory Inspection. There are the NRA Ordinance for Licensee's QMS (hereinafter "the QMS Ordinance") as a criterion for the installation permit and the NRA's inspection guideline of the implementation of the QMS. The NRA's inspection guideline presents the following inspection viewpoints for daily, semi-annual, and annual basis. The NRA inspectors conduct the oversight of licensee's Plan-Do-Check-Action activities relevant to safety based on its QMS.

(1) Effectiveness of licensee's Corrective Action Program (CAP) including capturing problems by observation, data analysis and categorization of nonconformance, prioritization, cause analysis, corrective action and measures to prevent recurrence as a part of a licensee's Problem Identification and Resolution (PI&R) activities
(2) A licensee's accomplishment of expected result by implementing safety related activities following the licensee's rule based on the QMS Ordinance
(3) Status of conducting proper measures to prevent recurrence by gathering information from orders and suggestions from the NRA and operating experiences from domestic facilities, international nuclear facilities and Nuclear Information Archives (NUCIA) database etc.
(4) Effectiveness of self-assessment such as a licensee's internal audit (including external audit is acceptable) and management review
(5) Status of implementing a licensee's activities of fostering and maintaining safety culture, and weak points or points to be strengthened identified by CAP programs based on the QMS Ordinance and a licensee's rules

(6) Status of corrective actions against past violation of regulatory requirements or a licensee's self-imposed rules (green inspection finding and severity level Ⅳ violation)
(7) Status of implementing proper procurement management, especially investigating nonconformance happened at suppliers and assessing the potential effects to the licensee

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 board have been improved for prevention of mis-operations, and interlock systems have been introduced to prevent equipment or components from wrong operation. In addition, a fail-safe system has been introduced which is designed to ensure operation of equipment or components on the safe side in case that failure occurs in a part of the system.
For example, the Japan Electric Association formulated the "Rule on Equipment Design for Preventing Mis-Operation in Reactor Control Rooms of Nuclear Power Stations" (Japan Electric Association Guide (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 requirements related to prevent mis-operation, such methods of preventing mis-operation are adopted as use of display devices on the control board; arrangement of alarm system and operating devices; identification by color for each type of liquid flowing inside the piping in local; locking control of control panels of equipment and manual valves.
In terms of operation and control, licensees are required to set up the provisions related to a system to foster safety culture and QMS, 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 requirements 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 Programs. 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

The Reactor Regulation Act requires that the quality control methods and inspection systems comply with regulatory requirement of the NRA Ordinance[9]. 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.

In the former system, the quality methods and inspection systems had been reviewed to be technically appropriate through the licensing process of the approval of Construction Plan. In accordance with the amendment of the Reactor Regulation Act in April 2017, the licensing process of the quality assurance is under revision in order to be included in the earlier stage, i. e. that of Reactor Installation Permit, aiming to be enforced in April 2020.

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

Quality assurance plans shall be dealt with an organizational unit managed by licensee's senior management; clearly identify responsibilities, authority, and duties; and settle mechanisms for the formulation, implementation, evaluation, and continuous improvement of the plans.

Operational safety plans shall establish appropriate management methods covering 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 shall 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.

[9] the NRA Ordinance on Quality Control Methods

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 recurrence. Preventive measures acquired at both their own plants and other nuclear facilities should be evaluated and, where appropriate, incorporated by licensees in their operations.

Matters concerning the quality assurance in the licensing process are reported in Article 7 and 19.

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 in the section above.

The technical adequacy of the JEAC 4111-2009 standard was endorsed 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 the QMS, as well as making continuous improvements. These regulations establish specific requirements for the QMS including "responsibility of senior management," "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 based on judgment in areas of education, training, skills and experience.

Licensees shall identify necessary competences and, if necessary, provide further education and training to ensure the designated personnel to reach the required level.

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

As for the operation of reactor facilities, reactor quality assurance programs are audited.

To guarantee its impartiality the audit should be conducted by an appropriate department at the licensee's head office which has no direct involvement with the department running the nuclear facility. In general, the auditing department is directly under control of the president in the company's organizational structure so that the president 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 requirements written in the specification.

The specification is provided to the supplier at the time of ordering and the products are then checked upon delivery.

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

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

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

The provider shall submit to the licensee a quality assurance plan to guarantee all requirements are met.

Thus, this prevents sub-standard outsourcing to providers with inappropriate quality assurance systems.

As described above, licensees in Japan recognize steadily 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

During the period of obtaining the Reactor Installation Permit, licensees must conduct an evaluation to confirm that the basic reactor facility design does not interfere with prevention measures against disasters during the construction, licensees must evaluate safety measures for facilities through the approval process of the construction plan. In addition, licensees must obtain the approval of Operational Safety Programs which clarify limitations and conditions for the operation of the reactor facility before the start of the operation, and the NRA needs to confirm that the operation is continuously conducted under these limitations and conditions based on the Operational Safety Programs. In the case of changing the safety programs, the licensees are to obtain an approval of modification of equipment, as needed, after the evaluation on the correspondence of the safety programs.

After starting the operation of the nuclear power reactor facility, licensees are 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 licensees must conduct aging evaluation every 10 years after 30 years of the operation, and in the case of extending the operational period, conduct an evaluation for a license application before 40 years of the operation.

The Reactor Regulation Act stipulates the NRA to validate the evaluation conducted by licensees in the licensing process of safety reviews, and to conduct Pre-service Inspection at the construction stage, Licensee's Periodic Inspections and Operational Safety Inspections during the operational stage, in order to check the safety of reactor facilities from both hardware and software aspects.

Therefore, evaluations are conducted throughout the installation phase and the operational period of the nuclear power facility under the supervision of the regulatory body, and the provision of Article 14 of the Convention is conformed.

Article 14 (1) Safety Assessments

1 Overview of regulatory requirements

1-1 Safety Assessments on Reactor Installation

Those who seek to construct reactor facilities, must provide the description that the basic design and design principles of the reactor do not interfere with the disaster prevention, in addition to an installation permit application. Such documentation must be submitted to the NRA, pursuant to the provisions of the Reactor Regulation Act.

To obtain Reactor Installation Permit, applicants are required to show the equipment necessary for the response to abnormal transients during operation, design-basis accidents, and severe accidents, conditions set to evaluate the scales and the impacts of accidents assumed to occur and to explain, and based on the results of these evaluation, they are required to explain that the safety of these nuclear facilities is ensured.

After obtaining Reactor Installation Permit, licensees must obtain the approval of Design and Construction Plan from the NRA before the commencement of the construction, as well as an approval of the design of the fuel assembly to be loaded in the reactor, except for imported fuel assemblies.

When applying for the approval of Design and Construction Plan, licensees must conduct an evaluation to confirm that the detailed design meets the conditions approved in the Reactor Installation Permit. Licensees are required to append descriptions on the durability, the earthquake resistance, safety-related design features specific to the applied equipment and so forth, as the result of a safety evaluation conducted by licensees, based on the detailed design for the reactor facilities.

When seeking an approval for the design of the fuel assembly, applicants must attach a document covering features of the fuel assembly such as its resistance of the heat, radiation and corrosion, 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 fabrication, and a document concerning quality assurance.

In addition, licensees must conduct welding inspections focusing specifically on parts such as pressure boundaries and containment vessel, and licensee's organizational structure for these inspections must be reviewed by the NRA.
Before beginning reactor operation, licensees must also obtain the approval of Operational Safety Programs, which must comply to assure the operational safety.
Descriptions concerning Reactor Installation Permit, the approval of Design and Construction Plan, Pre-service Inspections, the approval of Fuel Assembly Design, the approval of Operational Safety Programs are detailed in Article 7, 17 and 19.

1-2 Safety Evaluation on Reactor Operation

The safety evaluation during the operational phase of power reactors consists of (1) Periodic Safety Assessment of Continuous Improvement, (2) Technical Aging Evaluation, and (3) the approval of extending operational period. Their relations in technical evaluations and application documents are as follows.

(1) Periodic Safety Assessment of Continuous Improvement
Periodic Safety Assessment of Continuous Improvement has been newly introduced by the amendment of the Reactor Regulation Act in 2012, based on the TEPCO's Fukushima Daiichi NPS accident. With the former system of Periodical Safety Review (PSR) incorporated, this system requires the licensee to conduct an evaluation of the safety of the power reactor facility by themselves no later than six months after the day when Licensee's Periodic Inspection of the facility is finished. The licensee must report the results of the evaluation to the NRA and disclose the results to the public.
According to the Operational Guide, the licensee is required to make mid to long-term evaluations on the aging of components and structures with safety functions of the nuclear power reactor. In mid to long-term evaluations of the aging (to be implemented every 10 years in principle) among evaluations of Periodic Safety Assessment of Continuous Improvement of nuclear facilities, it is possible to use the results of the most recent technical aging evaluation (see (2)).
See Article 17 (3) for the Operational Guide for Periodic Safety Assessment of Continuous Improvement.

(2) Technical Aging Evaluation
Technical Aging Evaluation system is to evaluate the integrity of components and structures with safety functions of a nuclear reactor in every 10 years after 30 years of its

operation. The licensee is required to extract aging events worth noting in terms of aging measures against the components and the structures, make technical evaluation in terms of integrity, and then develop a long-term maintenance policy for the coming 10 years. The long-term maintenance policy is to be included in the Operational Safety Programs and must be approved by the NRA.

(3) Approval of Extending Operational Period

The system of approval of extending operational period was introduced in the amended Reactor Regulation Act of 2012. Nuclear power reactors can be operated for 40 years after the start of their operation, but this system allows an extension of operational period once, up to 20 years if approved by the NRA before the expiration of the operating period of 40 years. Licensees must conduct Special Inspection indicated in Tables 14-1 and -2 to assess the condition of degradation caused by the operation of reactors and other equipment, carry out a technical evaluation of any degradation while referring requirements shown in Table 14-3, set out the Maintenance Management Program during the extended period, and receive approvals from the NRA. If the evaluation of degradation is conducted integrally with the Technical Evaluation of Aging, it is allowed to use those results for the approval of extending operational period.

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 (RV)	- Base metal and welded parts (100% of the reactor core area)	- Check for defects using ultrasonic inspection
	- Primary coolant nozzle corner (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 (CV)	- Steel plates for the Steal containment vessel (SCV) (all areas which are possible to get close enough to inspect) - Pre-stressed concrete containment vessel (PCCV)	- 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
Concrete structures	- Concrete structures designed to ensure the safety of reactor[11] (primary shield wall)	- Checks of strength, concrete carbonation, and salt penetration by means of core sampling

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

Equipment Targeted	Areas Targeted	Inspection Method
Reactor pressure vessel (RPV)	- Base metal and welded parts (reactor core area and all areas which are possible to get close enough to inspect)	- Check for defects using ultrasonic inspection
	- Feed water nozzle corner (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, 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
Primary containment vessel (PCV)	- 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
	- Steel plates for the SCV (all areas which are possible to get close enough to inspect) - Reinforced concrete containment vessel (RCCV)	- 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 (reactor pressure vessel pedestal or equivalent part, etc.)	- Checks of strength, concrete carbonation, and salt penetration by means of core sampling

For the approval of operational extension period, all Design and Construction Plans required to comply with the technical standards need to already be approved or submitted by the time the operational extension period is approved, and the results of technical aging evaluation must comply with the requirements[12] in Table 14-3 during the extended

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

[12] Examination criteria for the extension of the operational period of commercial power reactors

operational period. If the results of the technical evaluation do not comply with these requirements shown in Table 14-3, the implementation of the Maintenance Management Program 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 shall be less than one (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 shall exceed the value of the stress intensity factor. • The following requirements shall 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 evaluation results above, it is determined that it is possible to set the limits of the temperature and the 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 operation from the reactor coolant pressure boundary, or the minimum temperature of the reactor coolant in a hydraulic test.

Events/issues to be evaluated			Requirements
Irradiation-assisted stress corrosion cracking			If, as a result of evaluation of integrity, it is determined that irradiation-assisted stress corrosion cracking may occur in the area to be evaluated, the criteria set forth in the Technical Standards shall 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 penetrated parts and 650°C for other parts), a strength evaluation shall be conducted and the strength of materials or structures comprising the area shall 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 shall be conducted and the strength of materials or structures comprising the area shall 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 shall be conducted and the strength of materials or structures comprising the area shall 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,

Events/issues to be evaluated			Requirements
			a strength evaluation shall be conducted and the strength of materials or structures comprising the area shall exceed the design load.
		Alkali-silica reaction	If significant cracking due to alkali-silica reaction has occurred in the area to be evaluated, a strength evaluation shall be conducted and the strength of materials or structures comprising the area shall 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 shall be conducted and the strength of materials or structures comprising the area shall 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 shall be conducted and the strength of materials or structures comprising the area shall 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 shall be conducted and the shielding performance of materials or structures comprising the area shall 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 shall be conducted and the strength of materials or structures comprising the area shall 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 shall be conducted and the strength of materials or structures comprising the area shall 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, an evaluation of integrity shall be conducted based on the assumption that it occurs and progresses in case of the actual or the potential occurrence or progress, and the results shall meet

Events/issues to be evaluated	Requirements
	the criteria set forth in the Technical Standards.
Evaluation of seismic safety	• For the components or the structure considering aging events, the stress and the usage factor caused by seismic forces shall be below the allowable seismic design limit. • For the components or the structure considering aging events, the stress, the crack-driving force and the stress intensity factor caused by seismic forces shall be below the allowable fracture mechanics evaluation limit on postulated cracks. • For the components or the structure considering aging events, that are required to function dynamically in an earthquake the response acceleration at the time of an earthquake shall be less than the level at which the components and the structure have been confirmed to function. • For the fuel assembly considering aging events, the displacement in an earthquake 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 the safety evaluation.
Evaluation of tsunami safety	For the components or the structure considering aging events, the stress caused by a tsunami shall be below the allowable limit.

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

Licensees must submit the Maintenance Management Program covering all relevant maintenance measures identified as a result of technical evaluation of degradation for an extended period.

For the maintenance during an extended operational period, a system for aging management is used, thereby ensuring appropriate implementations such as making the Maintenance Management Program focused on the end of the extended operational period effective for 10 years. Under this system, licensees are required to include in their Operational Safety Programs a degradation evaluation for the equipment which is to be done in every 10 years and the Maintenance Management Program, both for the reactors being in operation for 30 years or more, and they must ensure their compliance.

The content of maintenance implemented in each operational cycle according the Maintenance Management Program is reflected in the inspections and the maintenance plan of the individual equipment, taking into account past inspection performances and the status of degradation, and these details are checked by the NRA.
Under this system, an NRA Operational Safety Inspector checks the implementation of the maintenance plan by such means as an Operational Safety Inspection. Figure 14-1 provides an outline.

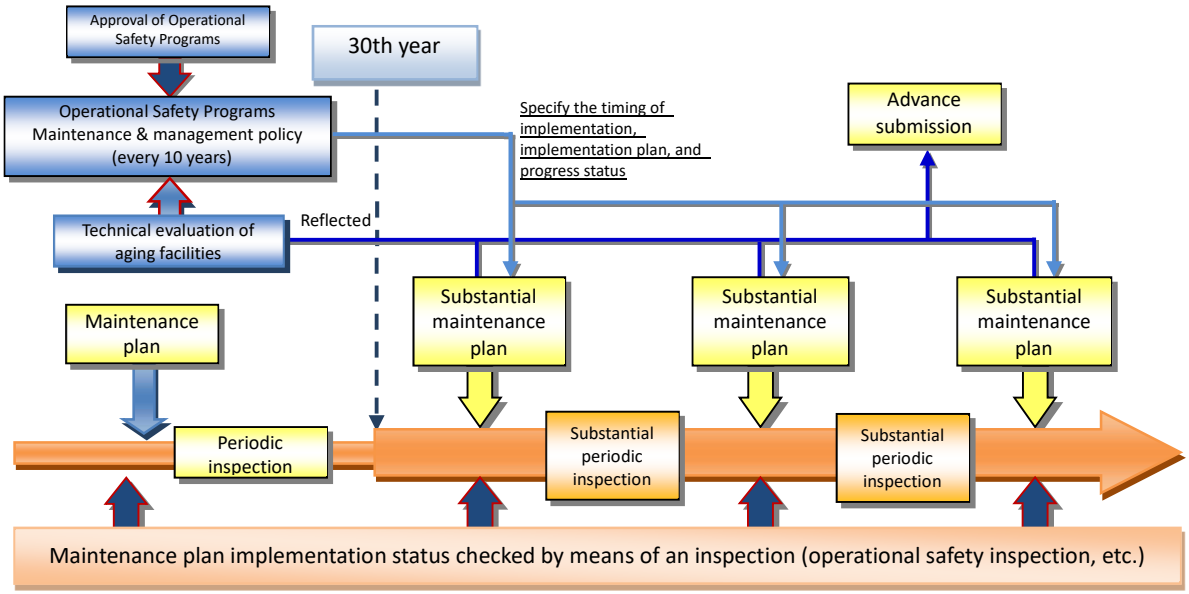

Figure 14-1 Maintenance Activities at Reactor Facilities

Article 14 (2) Verification of Safety

Even though receiving the approval of Design and Construction Plan, licensees shall perform Pre-service Inspection and confirm the facility to meet the technical requirements of the NRA. Licensees shall not use the facility unless the NRA conform the facility meets the technical requirements of the NRA.
In addition, throughout the operating period of a nuclear facility, licensees are obliged to undergo Nuclear Regulatory Inspections conducted by the NRA. A report on details of this inspection program 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 NRA Ordinance on Commercial Reactors under the Reactor Regulation Act. Baseline levels for dose limits etc. are specified in the Notification to Establish Dose Limits in Accordance with the Provisions of the NRA Ordinance Concerning the Installation, Operation of Commercial Power Reactors (Notification on Doses).

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 (1mSv/y＊[13]) 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.

[13] In the "Guideline of dose target around light power reactor facilities" (decided by the Atomic Energy Commission on 13 May 1975), the target dose is set at 50μSv/y.

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 an 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 it 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 on Doses 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 Reactor Regulation 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 five years or longer, the Radiation Effect Association is designated as the specified organization.

The Figure 15-1 shows the ten-year total and average dose of radiation workers in nuclear power plants, excluding the Fukushima Daiichi NPS.

3 Dose Reduction Efforts in the Fukushima Daiichi Nuclear Power Station

In the early stages of the earthquake disaster in the Fukushima Daiichi NPS, 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 NPS, 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.

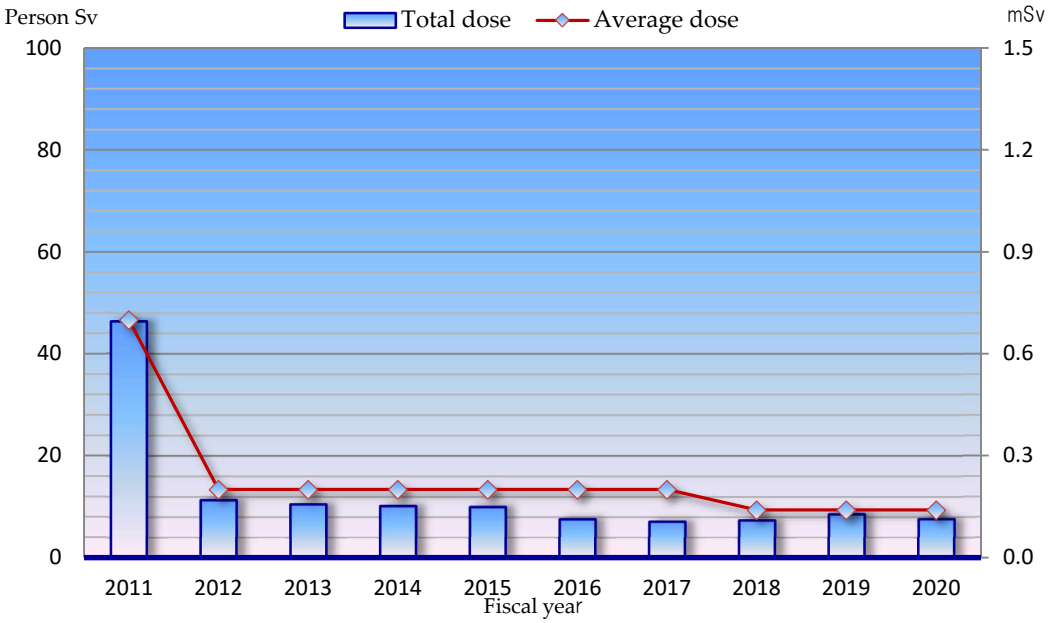

Figure 15-1 Total Dose and Average Dose

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 supervised area, licensees decide the control targets based on the annual release quantity evaluated in the process of application for Reactor Installation Permit. 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 10 years reported by licensees in accordance with the Reactor Regulation Act.

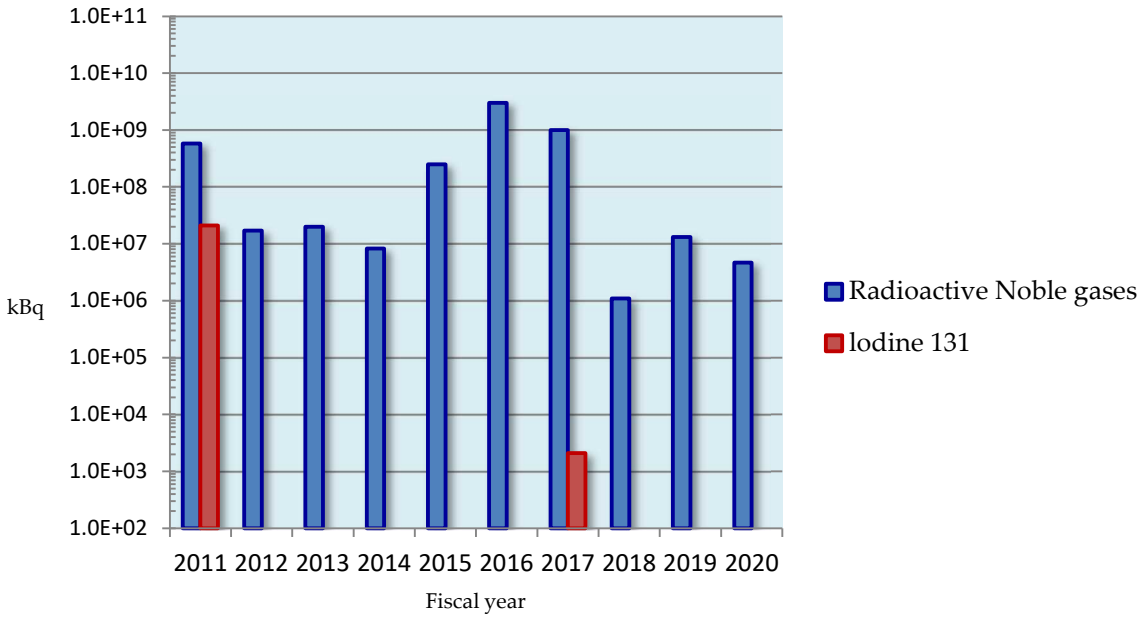

Figure15-2 The Quantity of Gaseous Waste Released

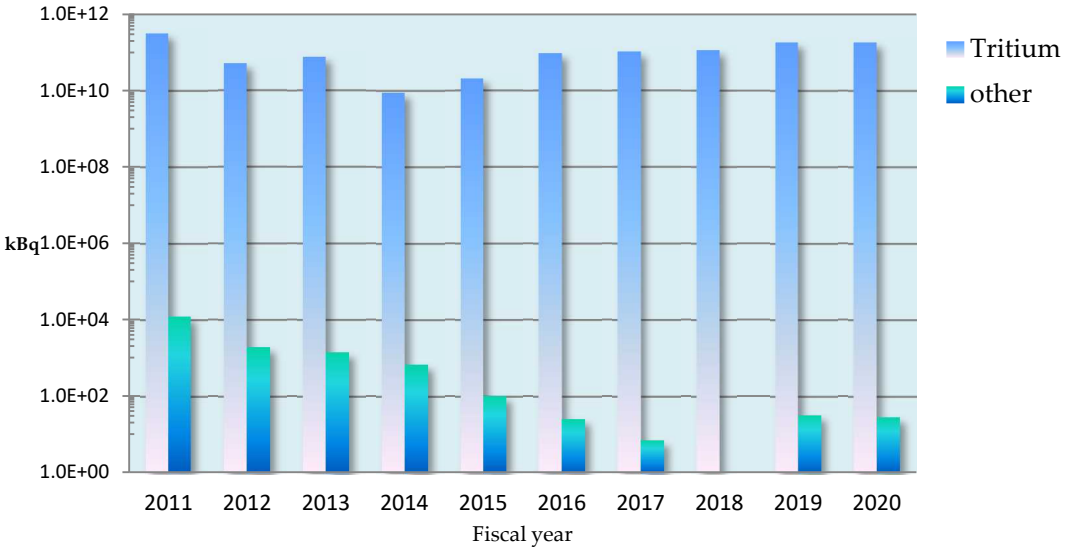

Figure15-3 The Quantity of Liquid Waste Released

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.

As for the radiation monitoring related to the TEPCO's Fukushima Daiichi NPS accident, the Government conduct radiation monitoring in partnership with the relevant ministries and local governments based on "Comprehensive Radiation Monitoring Plan (decided in the Monitoring Coordination Meeting on 2 August 2011 and revised on 30 March 2022)"

Measurement results of the environmental radiation monitoring are uploaded on the website of the "Disaster Prevention and Nuclear Safety Network for the Nuclear Environment "(https://www.bousai.ne.jp/eng/), which is run by the NRA, enabling the general public to see it in real time. Measurement results of air dose rates are released on the aforementioned Japanese-version website 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

In accordance with the Basic Act on Disaster Management and the Nuclear Emergency Act, the Basic Disaster Management Plan includes sections on countermeasures related to nuclear emergencies. The Plan defines basic issues about emergency responses and assigned roles of the national government, local governments, and nuclear operators (licensees) under emergencies. The Nuclear Emergency Act requires licensees to develop the Nuclear Operator's Emergency Preparedness and Response (EPR) Plan. Relevant local governments develop their own local disaster management plan and evacuation plan. Drills and exercises are conducted complying with these plans at licensee, local governments, and the national government levels.

For the purpose to improve and reinforce governmental organizations for the nuclear emergencies preparedness and response, Nuclear Disaster Management Bureau was established in the Cabinet Office on 14th October 2014. Nuclear Disaster Management Bureau, Cabinet Office (CAO), is in charge to improve and reinforce off-site preparedness and response under nuclear emergencies. It supports the relevant local government organizations to develop their local disaster management plans and evacuation plans, supports their emergency response during emergencies, and conducts drills at the national level etc.

In terms of the relationship with the neighboring countries, Japan's domestic radiological emergencies are not expected to impact other countries because of its

geographic situation that Japan is separated by the ocean from neighboring countries. 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, emergency drills and exercises are conducted, and additionally an information sharing mechanism exists among neighboring countries, which means that it conforms to the provision of Article 16 of the Convention.

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

Licensees are responsible to take actions to prevent, mitigate, and recover from nuclear emergencies. They must develop EPR plans for their nuclear power stations respectively. Prior to development or amendment, these plans must be consulted with governors of prefectures and mayors of the municipalities which the nuclear facility is located at, and which are facing to them. After developing or amending 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 of the prefecture and the mayor of the municipalities 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 of the prefecture and the mayor of the municipalities 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 the 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 or requirements of an order in accordance this 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 of the prefecture and the mayor of the municipalities where the nuclear facility is located, as well as to the governors of the neighboring prefectures involved. 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 the 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 based on Cabinet Office Order. Before developing the plan, the Prime Minister must hear opinions of the NRA.

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 exercise 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 if emergency response actions are required in a nuclear site of other licensees by sending nuclear emergency preparedness personnel and lending nuclear emergency response equipment.

(2) Emergency response actions

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 necessary 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 evacuation and sheltering-in-place. Following this, the Prime Minister will immediately declare a nuclear emergency situation.

If a nuclear emergency 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 a facility that will be used as the center for emergency response actions, local nuclear emergency response headquarters to perform some of the administrative work of the Nuclear Emergency Response Headquarters will be set up within the off-site center for emergency response actions.

Following the declaration of a state of nuclear emergency, the emergency response headquarters of the local government (prefecture, municipalities) will be set up by the governor of the prefecture and the mayor of the municipalities in charge of the areas where emergency actions will be implemented. 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 mutual 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 necessary 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 of the prefecture and the mayor of the municipalities 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 the head of local governments to be performed precisely and smoothly, licensees must take actions such as sending nuclear emergency preparedness personnel and lending nuclear emergency response equipment.

1-2 Basic Disaster Management Plan

The Central Disaster Management Council formulated the Basic Disaster Management Plan based on the Basic Act on Disaster Management and the Nuclear Emergency Act.
The Basic Disaster Management Plan is a fundamental plan for the national government's disaster prevention measures to respond to various disasters in a comprehensive manner. The Basic Disaster Management Plan that describes nuclear emergency preparedness defines basic issues on the nuclear emergency preparedness of the national 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 Disaster Management Plan:

- 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 nuclear accident sufferers in reviewing their life; abolition of the Nuclear Emergency Response Headquarters

A local disaster management plan is developed by the related local governments within the radius approximately 30 km range from a nuclear power plant, based on the Basic Disaster Management Plan and the NRA Guide for Emergency Preparedness and Response (NRA EPR Guide). For a local disaster management plan, materialization of the contents and the system performance are important, and it is determined that the national government provides an aggressive support 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 plans developed by local governments such as prefectures, municipalities, based on the decision of the Nuclear Emergency Preparedness Council in September, 2013, the Nuclear Disaster Management Bureau, CAO established Regional Nuclear Emergency Preparedness Committees (Hereinafter it's called "Regional 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 national government are studied, and the national 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 Regional Committees are required to confirm that their “emergency response” including evacuation plans are concrete and reasonable, considering the NRA EPR Guide. In addition, the Nuclear Disaster Management Bureau reports to Nuclear Emergency Preparedness Council results of examination and consultation for the plans by the Regional Committees, and then, will ask to the Council for their approval.

In the area where the “emergency response” has been confirmed, in addition to the support of materialization and improvement of the “emergency measures”, and confirmation(Plan) of the “emergency response”, the exercise(Do) based on the “emergency response” confirmed by the Regional Committees is conducted, items to be improved from the exercise results (Check) are extracted, and the “emergency response” at the area are improved (Action), considering the items, so the PDCA cycle was introduced and the regional disaster prevention system is improved and enhanced

continuously.

1-3 NRA Guide for Emergency Preparedness and Response

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

The purpose of the NRA EPR Guide is to ask 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 NRA EPR Guide went into effect on October 31, 2012 and, since then, they have been revised as necessary. The ultimate goal of the NRA EPR Guide is to ensure that in the event of an emergency, protective actions will be taken to avoid or minimize the serious deterministic effects, and reduce the stochastic effects of the radiation on residents etc. in the surrounding area of a nuclear facility.

Described below are the main provisions of the NRA EPR Guide

(1) Measures in Advance for Nuclear Emergency Preparedness and Response

- Establishment of the Nuclear Emergency Planning 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 power reactor facilities, a precautionary action zone (PAZ) is defined as an area where precautionary protective actions, such as immediate evacuation depending on the

emergency action level (EAL), should be prepared in the stage before radioactive material is released into the environment in order to avoid or minimize the serious 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 (UPZ) is defined as an area where emergency protective actions should be prepared based on the EAL and operational intervention level (OIL) to reduce the risk of the deterministic effect of radiation exposure. The rough target of the UPZ is approximately within a radius of 30 km from the power reactor facility.

The designation of these nuclear emergency planning zones is based on the international standards and the lessons learned from the TEPCO's Fukushima Daiichi NPS accident.

In addition, the range of the nuclear emergency planning zones for the nuclear fuel facilities was established through the revision of the NRA EPR Guide in March, 2017.

- Nuclear emergency category and Emergency Action Level (CCS)

In Japan, emergencies phases are divided into three categories: an alert (AL), a site area emergency (SE) and a general emergency (GE).

An alert level condition (AL) 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 national government. The national government must confirm the occurrence of the alert level event based on the information from licensee and provide it to the local governments and the public and other stakeholders without delay. The national 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 condition (SE) 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 national government and the local governments. The national 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 national 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 implement evacuation those who need to evacuate in a site area emergency.

A general emergency condition (GE) 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 or minimize the serious deterministic effect of radiation exposure and reduce the risk of the stochastic 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 national government and the local governments. In addition, licensee must take emergency actions necessary to prevent occurrence or development of a nuclear emergency, and report the outline of such actions. The national government must confirm the occurrence of the general emergency and provide information to the local governments, the public and other stakeholders without delay. The national 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 tablets. As in the PAZ, precautionary preventive actions, such as evacuation, need to be taken in the UPZ as well as sheltering-in-place being implemented, depending on the scale of the event as well as on how much time has passed.

In the NRA EPR Guide, the EAL used to determine the category of an emergency is defined for each of the three emergency categories for each reactor type (BWR and PWR), as well as for the nuclear fuel facility, for Fukushima Daiichi NPS units 1 thru 4, and for different conditions in the reactor, such as the condition that no nuclear fuel material exists in the reactor vessel.

As for the SE and GE generation for the power reactor, the criteria of system unavailability which is based on that of Design Basis Event Facility (DB Facility), and that of Beyond Design Basis Event or Severe Accident Facility (SA Facility) for reactors which conform to the new regulatory regulations, is consistent to the actual availability of facility. While in the plant not to be applied to the new regulatory requirements, the applicable criteria is such as the radiation level or radioactive material concentration or the water level of spent fuel pool and etc.

- Operational Intervention Level

In a general emergency, after release of radioactive material, due to the spread of the radioactive material, there are likely to become points arisen with a high air dose rate in

a relatively wide area. To prepare for such an event, the national 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 to avoid unnecessary exposure.

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

	Classification	Description	Initial Values	Outline of Protective actions
Urgent protective actions	OIL1	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	500μSv/h (air radiation dose rate when measured 1m above the ground)	Identification of zones and evacuation within a few hours (including ordering those who cannot easily move to shelter indoors temporarily)
	OIL4	Criteria for conducting decontamination to prevent inadvertent ingestion and external exposure via skin contamination	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)	Contamination screening of those who are ordered evacuation or relocation and prompt primary decontamination when the results exceed the criteria
Early protective actions	OIL2	Criteria for restricting ingestion of local product 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	20μSv/h (Air radiation dose rate measured at 1m from ground)	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
Restriction on intake	Food and drink screening standards	Criteria for identifying areas where measurement of radionuclide concentrations in food and drink should be	0.5μSv/h (Air radiation dose rate measured at 1m from ground)	Identification of zones where radionuclide concentrations in food and drink should be

<table>
<tr><th></th><th>Classification</th><th>Description</th><th colspan="3">Initial Values</th><th>Outline of Protective actions</th></tr>
<tr><td rowspan="6">of food and drink</td><td>(corresponding to OIL3)</td><td>carried out in preparation for possible food and drink restrictions at OIL6</td><td colspan="3"></td><td>measured</td></tr>
<tr><td rowspan="5">OIL6</td><td rowspan="5">Criteria when restricting food and drink intake in order to prevent radiation exposure via ingestion</td><td>Nuclide</td><td>Drinking water, milk, dairy products</td><td>Vegetables, cereals, meat, eggs, fish, other</td><td rowspan="5">Measurement and 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>
<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>

- 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 national 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 the SE, the national 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 national government, the local governments and licensee can work together to conduct emergency monitoring. The emergency monitoring center consists of the national

government, the local governments, licensees, and the designated public organizations[15], 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 medical care system in a nuclear emergency

Medical care to allow 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 national government designates "Advanced Radiation Emergency Medical Support Center" (when some organizations are designated as the Advanced Radiation Emergency Medical Support Center, one of them is designated as the Core Advanced Radiation Emergency Medical Support Center which plays leading roles.) and "Nuclear Emergency Medical Support Centers", and reviews them for compliance with the requirements every three years roughly. The prefecture in the nuclear emergency planning zone designates and registers "Nuclear Emergency Core Hospitals" and "Nuclear Emergency Medical Cooperative Institutions", and review them for compliance with the requirements every three years roughly.

Besides, the government shall confirm that each organization meets the requirements every three years roughly and should consider reviewing the requirements. The review in FY2021 clarified the roles of each organization in charge of nuclear disaster medical care, including strengthening the leading roles of the Core Advanced Radiation Emergency Medical Support Centers.

- Distribution and intake of the Stable Iodine

For the purpose of intake of Stable Iodine in a nuclear emergency, at ordinary times, the local governments will provide Stable Iodine to residents in the PAZ in preparation for an emergency. When the Stable Iodine are provided in preparation, a physician will explain the efficacy or effect of the Stable Iodine, the time to take it and its side effects. In the event of the GE, 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 will be put in place.

[15] Japan Atomic Energy Agency and the National Institutes for Quantum and Radiological Science and Technology

- Setting-up of an Off-site center

While the Local Nuclear Emergency Response Headquarters of the national 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, an off-site center serves as a center for implementing nuclear emergency response actions in a coordinated manner. It is required that 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 national 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 the GE by a nuclear operator, residents in the PAZ will be required to evacuate and those in the UPZ will be required to take preventive actions, such as sheltering-in-place. Residents are required to evacuate who are in the UPZ and to shelter themselves even out of UPZ depending on the condition of the facility and the progress of the accident. In addition, additional protective actions are implemented, such as evacuation, temporary relocation and restrictions on eating and drinking after release of radioactive materials, based on the results of emergency monitoring.

- Emergency monitoring

In the event of the AL, the national government, the local governments, licensee, and the relevant designated public organizations will prepare for emergency monitoring. In the event of the SE, the national government will set up an emergency monitoring center, make a request for the necessary mobilization of 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 or radiation is or may be released into the surrounding area of the nuclear facility, 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 the GE. 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 the GE, 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.

- Thyroid Dose Monitoring

When evacuation or temporary relocation is implemented as a protective measure based on the OIL, thyroid dose monitoring will be implemented for persons under 19 years of age, pregnant women and lactating women among the residents living in the areas covered by the protective measures, in order to quantitatively understand the degree of accumulation of radioactive iodine in the thyroid gland by inhalation and to estimate the exposure dose. Although the implementation of thyroid dose monitoring has been indicated, the government revised the NRA EPR Guide in April 2022 to clarify these specific matters.

2 Nuclear Emergency Exercises

Previously, nuclear emergency exercises had 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 TEPCO's Fukushima Daiichi NPS accident these exercises have been under review. Future exercises must now incorporate 'lessons learned' from the TEPCO's Fukushima Daiichi NPS accident including the possibility of a complex earthquake- nuclear accident disaster which had never been experienced before 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 National 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 had planned and implemented exercises, taking the initiative.
The TEPCO's Fukushima Daiichi NPS accident marked the first accident when a nuclear emergency situation had been declared in Japan. Based on this experience, the emergency management system, as well as nuclear emergency exercises were improved.
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 2018 Nuclear Energy Disaster Prevention Drill was conducted for KEPCO's Ohi Power Station and Takahama Power Station in Fukui Prefecture for the following purposes:

- Confirmation of performance of emergency response system of national government, local governments and nuclear operator, and cooperation system among relevant organizations.
- Confirmation of systems and procedures set as manuals in the central organization and the site organizations in a nuclear emergency situation.
- Verification of the evacuation plan set in the "Emergency measures in Onagawa Area"
- Extraction of lesson-learned from the exercise results and improvement of emergency measures etc.
- Acquirement of personnels' skill for nuclear emergency preparedness and response and promotion of resident understanding for the nuclear disaster prevention.

The Nuclear Energy Disaster Prevention Drill itself other drills as well, methods and items of exercise should be further improved and enhanced to review them 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; nuclear emergency 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; 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; and connection training to confirm the communication channels in the event of emergency.

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 Disaster Management Plan states that the NRA will evaluate the results of exercises for severe accidents. The NRA developed performance indicator of nuclear operator emergency exercises (including nuclear fuel facilities etc.) and evaluates the exercises by taking opportunities such as general exercises and by holding a debriefing session of emergency exercises by nuclear operators since 2013.

In the working group for development of training scenarios set under the debriefing session of emergency exercises by nuclear operators since 2018, trainings have been

conducted to enhance the judgment ability of commanders in an Emergency Response Center or the main control room in a power station and also to improve the ability of staff on site to respond to emergency.

2-3 The Exercise Planned by the Local Governments

Local governments which have jurisdiction over the area where the relevant nuclear site is located and the neighboring local governments should put the drills and exercises into effect based on the Basic Act on Disaster Management. In the drills and exercises conducted by the relevant prefectures, the local governments (including the governor), the actual working units, such as police, fire services, the Japan Coast Guard and Japan Self-Defense Forces, and nuclear operator should participate. And, exercises on evacuation of residents and contamination screening for evacuation from emergency zones are carried out, with residents' cooperation and the actual working units' participation.

More concretely describing, exercises of 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, the Regional 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, with the support of the government, the aforementioned local governments are proactively planning and implementing trainings to personnel belonging to local government's organs for nuclear emergency preparedness including several trainings.

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 Convention Exercise (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 central 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, the former nuclear regulator, launched its emergency information mailing service in July 2008. People who registered their mobile phone e-mail addresses in advance promptly receive emergency information. This system was inherited by the NRA in September 2012 as N-alert.

Information provided through the website and official Twitter of the NRA is also being used as a means of providing emergency information.

During a nuclear emergency, the mass media will also provide information to local residents. Press briefings, highlighted by television and radio broadcasts, will be held as required at the local off-site centers which are for disaster prevention and at the Emergency Response Center in the government (the NRA), and these will provide local residents with relevant 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 the Republic of Korea – also have reactor facilities. Considering the experience of the TEPCO's Fukushima Daiichi NPS accident, sharing information in case of nuclear emergency is an issue of mutual importance. In August 2009, Japan, China and the Republic of Korea established Top Regulators Meeting (TRM) for the purpose of information exchange in the fields of nuclear safety regulation. At the TRM in November 2011, the three countries agreed on Cooperative Nuclear Safety Initiative among Japan, 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. In addition, the three countries organized a working group for emergency response in 2015 to establish a system for prompt sharing of emergency information within the framework, and have

discussed to achieve smooth information sharing during emergency. The three countries also perform communication exercises using opportunities of emergency exercises in their own countries. The three countries verified the communication means available during emergency (such as effectiveness of dispatch of liaison) with Japan serving as a host country in 2018.

Besides the aforementioned trilateral cooperation mechanism, Japan proactively uses the Unified System for Information Exchange in Incidents and Emergencies (USIE) web portal run by the IAEA's Incident and Emergency Centre (IEC). As of 2019, Japan is preparing to provide monitoring data to the International Radiation Monitoring Information System (IRMIS) operated by the IAEA's IEC, and is trying to disseminate information by proactively utilizing these systems.

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

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 it 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, Japan registers its assistance capabilities (NAC: National Assistance Capability) to the IAEA Response Assistance and Network (RANET), and thus recognizes that Japan meets the Article 2, paragraph 4 of the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

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

In installing a nuclear facility, the majority of "Evaluation of Site-Related Factors" and "Evaluation of Safety Impacts on Individuals, Society, and the Environment Resulting from Reactor Facilities" is reviewed as part of the review process of application for Reactor Installation Permit. Under the NRA Ordinance on Standards for Installation Permit, the regulatory requirements for external events (natural phenomena and human induced events) were significantly reinforced. Furthermore, based on the amendment of the Reactor Regulation Act in 2012, measures against severe accidents became subject to legal requirements, and thus it was required to take measures for prevention and mitigation of the consequences of severe accidents and to evaluate the effectiveness of such measures. As part of it, it has been evaluated not to give rise to significant radiation risks to the public in the surrounding area.

Regarding "Re-Evaluation of Site-Related Factors," the back-fitting system was introduced due to the amendment of the Reactor Regulation Act, and the re-evaluation is required in the case where the NRA Ordinance is amended based on new knowledge etc. Additionally, Periodic Safety Assessment of Continuous Improvement was introduced, and licensees are required to conduct evaluation consistent with the IAEA Safety Guide SSG-25, "Periodic Safety Review for Nuclear Power Plants," including evaluation related to external events every five years in principle.

In terms of evacuation of residents etc., as prescribed in Article 16 (1), a framework for development of local disaster management plans by local governments such as

prefectures, cities, towns and villages, based on the Basic Act on Disaster Management, has been established.

As for a nuclear facility in Japan, 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 the framework for information sharing with the neighboring countries has been established as described in Article 16 (2).

Therefore, the measures of the government are in compliance with the provisions of Article 17 of the Convention.

Article 17 (1) Evaluation of Site-Related Factors

Site-related factors that may affect the safety of reactor facilities are evaluated as part of the review process of application for the reactor installation permit. Applicants are required to conduct adequate review and analysis of external events that could occur around the site and to take these into account in the designs of such facilities. It is required to conduct evaluation to show the adequacy of basic designs in terms of each of normal operation, anticipated operational occurrences, design-basis accidents, and severe accidents (design extension conditions: those without significant fuel degradation and those with core melting), and as part of it, evaluation is to be made on "safety impacts on individuals, society, and the environment resulting from the reactor facilities" that is described in (2).

In order to apply for the reactor installation permit, the applicants 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
- Types, thermal powers and number of the nuclear power reactors
- The name and location of the site for the nuclear power reactors
- Locations, and structures, systems and components of the nuclear power reactors and affiliated facilities.
- The construction plans of the nuclear power reactor facilities
- The types and planned consumption amounts per annum of nuclear fuel materials
- Method for disposal of spent fuel
- Radiation control management in the nuclear reactor facilities
- Implementation of facilities and organizations to cope with an accident
- Matters concerning the establishment of a system necessary for quality control

And, the following instructions are required as attachments:

- The purpose to use nuclear power reactors
- Thermal powers of the nuclear power reactors
- Funds required for the construction and the procurement plan.
- Procurement plan of a nuclear fuel materials
- Technical capability of the installation and operation of nuclear reactor facilities
- Status of the weather, ground, hydrology, earthquakes and social environment of the site where the nuclear reactor facilities are installed (social environment

includes population distribution, transportation, industry, and public facilities such as hospitals etc.)
- Map around the site of nuclear reactor facilities
- Safety designs of the nuclear reactor facilities
- Radiation control in the nuclear reactor facilities
- Implementation of facilities and organizations to cope with an accident
- Applicant's articles of incorporation, certificate of registered matters, inventory of property, 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 technical competence and financial basis; the applicant has the necessary technical competence to implement the necessary measures to prevent and mitigate the consequences of severe accidents; and the locations, structures and equipment of the reactor facilities are in compliance with the NRA Ordinance on Standards for Installation Permit, which provides for the regulatory requirements of the NRA. The NRA grants the reactor installation permit if the power reactor facilities conform to the NRA's regulatory requirements.

Under the NRA Ordinance on Standards for Installation Permit, the regulatory requirements for external events (natural phenomena and human induced events) were significantly reinforced in response to the lessons learned from the TEPCO's Fukushima Daiichi NPS accident, as follows:

- To cope with displacement and deformation of the grounds, in addition to tremors of earthquakes, buildings, structures, etc. with importance in terms of a seismic design are required to be installed on the ground surface without an outcrop of a capable fault, because buildings and internal equipment, etc. may be damaged when a capable fault moves. Additionally, the standards for determining capable faults (faults having a possibility of becoming capable in the future) were clarified as follows. The faults are identified as capable if it is not possible to deny fault activities after the Late Pleistocene (about 120,000 to 130,000 years ago). If necessary, evaluation of fault activities shall be made by going back to the Middle Pleistocene (about 400,000 years ago).
- For prevention of damage caused by earthquakes, it is required that safety functions of the buildings, structures, etc. with importance in terms of aseismic design are not lost against the seismic force and potential slope collapses generated by the design basis ground motion. The design basis ground motion is to be expected in light of the latest scientific and technical knowledge from a

seismological and earthquake engineering point of view such as geology, geological structure, soil structure, earthquake activities, etc. on and around the site, and it is required to formulate each of "seismic ground motions to be formulated by identifying seismic sources in each site" and "seismic ground motions to be formulated without identifying seismic sources." For the former type, formulation is to be made by selecting several earthquakes, out of continental-crust earthquakes, inter-plate earthquakes, and oceanic intraplate earthquakes, that are expected to have large influence on the site, taking into account the uncertainties and reflecting the propagation characteristics of earthquake waves. For the latter type, formulation is to be made by collecting the observation records from the past earthquakes that occurred in the continental crust with seismic sources difficult to be related to capable faults and by taking into account the ground characteristics of the site. In terms of propagation characteristics of earthquake waves, it is required to evaluate the subsurface structure under a site three-dimensionally in light of a possibility that a seismic ground motion is amplified due to the subsurface structure under the site. For the design basis ground motion, it is required to assess what level of exceedance probability the design basis ground motion corresponds to.

- For prevention of damage caused by tsunamis, it is required to formulate a tsunami of a level exceeding the past maximum value as the design-basis tsunami and to install tsunami protective facilities such as protective seawalls to prevent water inundation into sites or tide gates to prevent water inundation into buildings as measures against the design-basis tsunami. Tsunami protective facilities shall be of the S class, the highest class in the aseismic design classification, so that the flooding prevention functions etc. are not lost due to earthquakes. For the design-basis tsunami, formulation should be made, in light of the latest scientific and technical knowledge, of tsunamis that should be postulated from a seismological perspective such as ocean floor topography, geological structure, seismic activities, etc. from the sea area with wave sources to that around the site. As for the mechanisms that may cause Tsunamis, in addition to the earthquakes (inter-plate earthquakes, oceanic intraplate earthquakes, and continental-crustal earthquakes due to capable faults in a relevant sea area), landslide, slope collapse, and other mechanisms and a combination of these should be selected, and formulation should be made by making numerical analyses while taking into account the uncertainties. It is also required to identify what level of exceedance probability the formulated design-basis tsunami corresponds to.

- It is required not to lose the safety functions in case of occurrence of natural phenomena other than earthquakes and tsunamis such as floods, winds (typhoons), tornados, freeze, precipitation, accumulation of snow, lightning, landslides, influences of volcanos, biological events or forest fires, or a combination of them. For human induced events (except intentional ones), it is also required not to lose the safety functions in case of occurrence of missiles (airplane crash etc.), collapse of dams, explosions, fires of nearby factories and the like, toxic gas, collision of ships, electromagnetic interferences, etc., based on situations on and around a site.
- Specialized Safety Facility must be built to suppress the unusual releases of radioactive materials in the event of an intentional large airplane crash or the other terrorism. The Specialized Safety Facility is a facility that can be used until external support becomes available in the events such as intentional air crash, having necessary equipment for preventing damages to the containment vessel, and must ensure that it does not lose its function even in the event of an air crash into the R/B. Moreover, robustness must be enhanced against motions exceeding the design basis ground motion to a certain degree.

The NRA has developed guides and the like such as Guide for Review on Geological and Geological Structural Investigations on and around the Site, the Guide for Review on Design-Basis Earthquake and Seismic-resistance Design, the Guide for Review on Design-Basis Tsunami and Tsunami-resistance Design, the Guide for Review on Foundation Grounds and Slope Stability Assessment, the Guide for Assessment of Volcanic Hazards, the Guide for Assessment of Tornado Hazards, and the Guide for Assessment of External Fires, etc.

For example, in the Guide for Evaluation on Volcanic Hazards, the volcanos, among those within a 160 km radius from a nuclear power station and active in the Quaternary period[16]* , which had been active in the Holocene epoch[17]* were certified as the volcanos with a possibility of whose activity in the future cannot be denied (capable volcanos), and it is required to evaluate the possibility of impacts on the site from the capable volcanos during a period of facility operation, in particular impacts of the five volcanic phenomena (pyroclastic density currents, lava flow, debris avalanche/landslide/slope collapse, opening of new vents, and ground deformation) against which design measures cannot be taken. It is clearly stated that if the possibility is evaluated to be small enough, it is required to conduct monitoring of the volcanic activities and to

[16] A period from about 2.58 million years ago to the present

[17] A period from about 11,700 years ago to the present

formulate a policy for the case of finding the volcanic unrest; if it is not evaluated to be small, it should be judged to be unsuitable for siting.

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

The evaluation of safety impacts on residents and the environment around nuclear facilities has been done separately for during normal operation and for at the accident. At the accident, measures against severe accidents have become subject to legal requirements due to the amendment of the Reactor Regulation Act in 2012, and the NRA Ordinance on Standards for Installation Permit requires to take measures for prevention and mitigation of the consequences of severe accidents and to conduct an evaluation (effectiveness evaluation) through combined use of the probabilistic risk assessment method and deterministic safety assessment method to confirm the effectiveness of the measures to be taken (see 2-4 and 2-5 of Article 18). During normal operation, the NRA Ordinance on Standards for Installation Permit shows the basic regulatory requirements. Hereinafter, the summary of the safety impact evaluation is shown for each of at the accident and during normal operation.

2-1 Evaluation of Safety Impacts of Nuclear Facilities

2-1-1 At the accident

The NRA Ordinance on Standards for Installation Permit requires to take necessary measures to prevent significant core damage when an accident which may lead to a severe accident occurs, and furthermore to take necessary measures to prevent failure of the containment vessel and an abnormal level of discharge of radioactive materials to the outside of the facilities when a severe accident occurs. The effectiveness evaluation is also required to confirm that the measures taken are effective for each and its regulatory guide shows the acceptable examples. For example, confirmation shall be made that the following evaluation items are basically satisfied by measures against containment vessel failure and an abnormal level of discharge of radioactive materials to the outside of the facilities.

(a) The pressure to the containment vessel boundary is below the maximum design pressure or the limiting pressure.

(b) The temperature of the containment vessel boundary is below the maximum design temperature or the limiting temperature.
(c) The total amount of discharged radioactive materials is such that it would keep influence on the environment as small as possible, including a point of view of contamination of the environment by radioactive materials.

The NRA implemented the guide for reviewing the results of the above-stated effectiveness evaluation, and the guide specifies that it is confirmed that the amount of discharged Cs-137 is less than 100 TBq for the postulated containment vessel failure mode (see 2-5 of Article 18), in order to confirm the above item (c). The guide also stipulates that the effectiveness evaluation of the measures to prevent core damage in the accident sequence group using the containment vessel pressure relief system (filtered venting system) evaluates the effective dose at the site boundary and thus confirms that a risk of significant radiation exposure is not given to the nearby public (approximately five (5) mSv or less per accident occurred).
Additionally, the NRA Ordinance on Standards for Installation Permit requests not only the effectiveness evaluation of the above-stated measures to prevent core damage and containment vessel failure but also the effectiveness evaluation of the measures to prevent fuel damage in the spent fuel storage pool/pit and fuel damage during shutdown of a reactor.
Although the above-stated items are requirements for facility design etc., the organizational structure etc. of applicants for installation permits are also important for prevention and mitigation of the consequences of severe accidents. In the amendment of the Reactor Regulation Act in 2012, it was added as criteria for installation permits that applicants shall have the necessary technical capability to implement necessary measures for prevention and mitigation of the consequences of severe accidents. Its review standards show securement of access routes, securement of spare articles, etc., securement of storage areas in consideration of positional distribution etc., and items to be confirmed in relation to support from the outside of the site etc. in addition to development of procedures, implementation of trainings, and development of the organizational structures. As for the support, it is specified to confirm that it is a policy to receive support within six days after the occurrence of an event. In terms of development of procedures, implementation of trainings, and development of the organizational structures, the NRA confirms through inspection of trainings their effectiveness and also adequacy of the conditions, etc. related to operator actions etc. adopted by applicants for installation permits in their effectiveness evaluations.

2-1-2 During normal operation

The NRA Ordinance on Standards for Installation Permit requires for the facility to dispose of radioactive waste during normal operation to have the ability to dispose of radioactive waste generated in commercial power reactor facilities so as to fully reduce radioactive material concentration in air outside the supervised area and in water at the boundary to the supervised area, and for the facility to dispose of liquid radioactive waste to prevent leakage of liquid radioactive waste from facilities to dispose of radioactive materials. According to the regulatory guide on this requirement, the above expression "to fully reduce" is to mean that the dose objective (50 μSv/year) stipulated in the guide developed by the former NSC can be achieved, under ALARA (as low as reasonably achievable) concept.

2-2 Development and Continuous Improvement of Local Disaster Management Plans

As shown in Article 16 (1), each prefecture and each municipality have developed the local disaster management plan for the prefecture and that for the municipality, respectively, based on the Basic Disaster Management Plan and the NRA EPR Guide.
Trainings are periodically implemented at each level of the national government, licensees, local governments while promoting continual improvement of the NRA EPR Guide, development of an emergency monitoring system, development of a medical system to be operated during a nuclear disaster, development of systems for distribution and intake of stable iodine tablets, development of the off-site centers, etc. Through trainings etc., improvement of local disaster management plans developed by local governments such as prefectures, cities, towns and villages are continually promoted.

Article 17 (3) Re-Evaluation of Site-Related Factors

As the back-fitting system was introduced due to the amendment of the Reactor Regulation Act in 2012, for example, if new knowledge on evaluation of capable faults is obtained and the regulatory requirements are revised, it is necessary for licensees to make re-evaluation and show conformance to the revised regulatory requirements.
Additionally, as Periodic Safety Assessment of Continuous Improvement was introduced due to the amendment of the said Act, it was stipulated that licensees should

periodically evaluate safety of the facilities by themselves, notify its results to the NRA and make them public.

In the Operational Guide for Periodic Safety Assessment of Continuous Improvement, it is stipulated that the timing for evaluation should be at the time of completion of a Licensee's Periodic Inspection and evaluation should be made within six months after completion of the inspection. The contents of evaluation to be conducted are largely divided into two, and one of them is for development of documents describing the latest (as is) status of a plant. The Operational Guide requests explanation on the following items.

- Summary of power reactor facilities
- Site characteristics: Description should be made on facility location and characteristics such as meteorological phenomena, ground, hydrology, earthquakes, tsunamis, volcanos, external fires, social environment, etc.
- Structures, systems, and components: Description should be made on their latest states, using descriptions of permitted contents and contents of the approved or submitted construction plan as the bases.
- Management systems and items for safety: Description should be made on their latest states, using operation management described in the Operational Safety Program as the bases.
- Results of safety assessment to confirm conformance to laws and regulations: Description should be made on their latest status, using as bases the safety assessments (including the exposure assessment during normal operation) for normal operation, anticipated operational occurrences, design basis accidents, and severe accidents.

In development of these documents, reference should be made to the Updated Final Safety Analysis Report (UFSAR) of the U.S. Nuclear Regulatory Commission and the IAEA Safety Guide GS-G-4.1, “Format and Content of the Safety Analysis Report for Nuclear Power Plants,” etc.

The other content of evaluation is corresponding to a periodic safety review (PSR). The Guide was revised in light of findings by the IRRS in February 2017, and in terms of re-evaluation of site characteristics, volcanos, external fires, etc. were added, and at the same time, consistency with the IAEA Safety Guide SSG-25, “Periodic safety review for nuclear power plants,” was clarified. According to the Operational Guide, licensees shall take measures for safety improvement and conduct the following evaluation in every five years in principle to evaluate effectiveness for their safety improvement. However, when evaluation results are expected to be changed, such as in the case of large-scale

construction, re-evaluation shall also be conducted.

- Evaluation related to internal and external events (re-evaluation of external and internal hazards): Internal and external events should be re-evaluated as premises for safety assessment, based on the latest scientific and technical knowledge at the timing of evaluation. If a need for change arises in terms of installation (amendment) permits as a result of confirmation of the adequacy of protection measures in light of the necessity for review from previous evaluation results (those related to the latest notification or those related to installation (amendment) permits, whichever the later) and the evaluation results, the procedures for application for amendments to Reactor Installation Permit, etc. should be promptly implemented.
- Deterministic safety assessment: The assessment method (analysis codes etc.) should be applied in light of the latest knowledge.
- Probabilistic risk assessment (PRA) related to internal and external events: Level 1 PRA and level 2 PRA should be implemented for both internal and external events. The scope of PRAs shall be expanded step by step according to the maturity of each PRA method, and internal flooding and internal fires are written as examples of internal events to be developed in the future, and a combined event with an earthquake and a tsunami, external events other than earthquakes and tsunamis, events that occur in the spent-fuel storage pool/pit, events that occur simultaneously in multi units are also written as examples of external events to be developed in the future.
- Safety margin assessment: It is written that EU "Stress tests" specifications etc. shall be referred to.

In addition, evaluation of effectiveness from a medium- to long-term point of view is to be made every 10 years in principle on the following 11 safety factors out of the 14 safety factors shown in the IAEA Safety Guide SSG-25, except for three safety factors to be targeted in the above assessments.

- Plant design
- Actual condition of structures, systems and components
- Equipment qualification
- Aging degradation
- Safety performance
- Use of experience from other plants and research findings
- Organizations, the management systems and safety cultures

- Procedures
- Human factors
- Emergency planning
- Radiological impact on the environment

Article 17 (4) Discussion with Other Countries Likely to 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 the Republic of 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, suppression of dispersion of radioactive material, and loss of large area of nuclear facilities in the Design Extension Condition (DEC) 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 sure operability are required for 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 the NRA's regulatory requirements were developed, Defense in Depth concept was stated in the Reactor Regulation Act and Regulatory Guides issued by the NSC, and requested as follows; for the first layer, to ensure high reliability sufficient to meet importance of the SSC to prevent occurrence of abnormality; for the second layer, to take necessary measures for early finding of abnormality and shut-down nuclear reactor to prevent expansion of abnormality; for the theid layer, to get core not severely damaged and be sufficiently cooled in case of Design Basis Accident (DBA) occurred to mitigate its consequence.

In the new regulatory requirements issued by the NRA, measures to eliminate common cause failure are significantly strengthened, based on the lessons from the TEPCO's 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 DBA, and measures to prevent CV failure in case of severe core damage, are required. Further, new regulatory requirements require measures against CV failure because Japan experienced the TEPCO's 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 requirements 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 to ensure high reliability sufficient to meet importance of the SSC to prevent occurrence of abnormality, to design sufficient safety margin, to have core stability characteristics, and to prevent mis-operation. Failsafe design and interlock function, etc. are designed to deal with mis-operation or a failure.

In the new regulatory requirements, measures for seismic safety, tsunami safety, reliability of power supply, and fire protection are strengthened and introducing measures for internal flooding, volcano, tornado, forest fire, etc. are newly required. Requirements for external events are reported in Article17.

2-2 Prevention of Expanding Abnormality

In order to detect deviation from normal operation state and make it under control, measures to prevent anticipated transient, i.e., an anticipated event in the nuclear power plant during operation, from expanding to an accident such as preparing specific system and mechanism in the design, and establishing operational 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 postulated initiating event which cannot be under control in the previous layer and allow to progress to DBA, it is required that the core is not severely damaged and be able to maintain sufficient cooling by the Engineered Safety Features and core stability characteristics.

2-4 Prevention of 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 the DEC without severe core damage.
The DEC without severe core damage is identified as “Postulated Accident Sequence Groups”. The Guide for the NRA Ordinance on Standards for Installation Permit, taking research results into account, stipulates accident sequence groups which cover most of accident sequences with significant core damage as “Designated Accident Sequence Groups” as is shown in Table 18-1.

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 component cooling function
Loss of decay heat removal function	Loss of CV heat removal function
Loss of reactor shutdown function	Loss of Reactor shutdown function
Loss of water injection during Loss of Coolant Accident (LOCA)	Loss of Emergency Core Cooling System (ECCS) water injection function
CV bypass (Interface system LOCA)	Loss of ECCS recirculation function
	CV 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 it 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 the DEC have to meet following regulatory requirements; the equipment do not lose its function simultaneously with safety function of equipment to address the DBA caused by common cause; the equipment be furnished with 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 (water injection, power source, etc.) are required.

2-5 Prevention of Containment Vessel Failure in the Design Extension Condition with Core Melt

Licensees are required to confirm effectiveness of measures to prevent CV failure in the case of the DEC with core melt.

The DEC with core melt is identified as "CV failure mode". The Regulatory Guide of the NRA Ordinance on Standards for Installation Permit, 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 atmospheric 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 it into "Postulated CV failure mode".

In the first step, for every Postulated CV failure mode, a severe accident sequence from the point of load etc., against CV is identified as an evaluated accident sequence 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, fuel, etc., from the view point of whether equipment required as severe accident measures can prevent CV damage. The NRA Guide for Evaluating Effectiveness requires to confirm the release amount of Cs-137 be less than 100 TBq.

Equipment required to address the DEC with core mel have to meet following regulatory requirements; the equipment perform its function under the accident conditions; redundancy or diversity, independence and dispersion 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.; 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 (water injection, power source, etc.) are required.

2-6 Measures to Suppress Dispersion of Radioactive Material

As stated in 2-4 and 2-5, the NRA Ordinance on Standards for Installation Permit requires measures to prevent severe core damage and CV failure, as measures to address the DEC. The NRA Ordinance requires equipment to suppress dispersion of radioactive material to outside of the 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 DEC. For example, water cannon is required to suppress dispersion of radioactive material in aerosol form leaking from the R/B.

2-7 Measures to Address Loss of Large area of Nuclear Facilities

Loss of large area of nuclear facilities 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 the NRA Ordinance on Standards for Installation Permit.
In the NRA Ordinance, measures with mobile equipment and Specialized Safety Facility (SSF), as installed facility, are required.

(1) Measures with Mobile Equipment

Airplane crash etc., leads to severe destruction of certain area of nuclear installation, i.e. loss of large area of nuclear facilities. 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, provided the destruction occurred.
In case of natural disaster extremely beyond design basis or large airplane crash, it is required mobile equipment does 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 the R/B, are required.

(2) Measures with Specialized Safety Facility

SSF "shall be equipped with adequate measures for preventing the loss of necessary function due to the intentional crashing of a large airplane into the R/B". Practical requirements are; to ensure enough distance, e.g., more than 100m, between the SSF and the R/B to prevent simultaneous failure of both facilities; or the SSF have to be 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 the SSF. 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 into the reactor; function for cooling molten core that has fallen outside 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., filtered vent; 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 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 processes for Reactor Installation Permit, the approval of Design and Construction Plan, Pre-service Inspections, Fuel Assembly Inspections, etc. and these processes are explained in Article 7.

3-2 Regulatory Requirements

The NRA Ordinance on Standards for Installation Permit and the NRA Ordinance on Technical Standards stipulate the requirements reported in Article17 and 18.
Table 18-2 is a list of facilities (facilities subject to the design standards) to prevent occurrence or propagation of a design basis accident are classified into classes, and structures and strength are stipulated for each operating condition as shown in Table 18-3 by the NRA Ordinance on Technical Standards.

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 CV 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 CV, 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 CV support structures		Structures to support the reactor CV

Table 18-3 Classification of operating conditions

Operating Condition I	Normal operating condition of a power reactor facility
Operating Condition II	Under an environmental condition anticipated at a design basis accident or during a situation develops into it, a condition other than Operating Condition I, Operating Condition III, Operating Condition IV and Testing Condition
Operating Condition III	Under an environmental condition anticipated at a design basis accident or during a situation develops into it, a condition that requires an emergency shutdown of the power reactor due to an unusual event, such as a failure or malfunction etc. of the power reactor facility
Operating Condition IV	Under an environmental condition anticipated at a design basis accident or during a situation develops into it, a condition in which an emergency anticipated in the safety design of the power reactor facility occurs
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 the above, method of quality assurance and the organization for its inspection in the licensee of power reactor operation are reviewed to be technically appropriate through the licensing process of the approval of Design and Construction Plan 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 Requirements

The licensee is conducting modification such as addition of necessary facility in order to comply with regulatory requirements set forth by the 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 said area.
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 is installed to increase the capacity of more than 7 days for continuous 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 actuation panel is newly installed to enable to close Main Steam Isolation Valve and inject emergency boric acid water to place a reactor in a subcritical condition even if control rods 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 CV.
In order to prevent the hydrogen explosion, measures to prevent failure of the CV are taken such as additional installation of equipment to enable to ignite hydrogen or recombine it 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 for the Reactor Installation Permit or the approval of Construction Plan, and if licensees adopt a new technology, they shall prove that the technology complies with the technical standards endorsed by the NRA by conducting verification test, or they shall explain that they can secure safety in using the technology without not mentioning to the technical standards .
Measures that Licensees should take in the Application of Proven Technologies, the NRA Ordinance on Standards for Installation Permit requires the highest standards of reliability for safety SSC with safety functions, and that their design is such that this can be maintained.
This should not impede the application of new technologies, but licensees are required to ensure the reliability of these technologies when designing reactor facilities.
In the licensing process of the approval of Design and Construction Plan, licensees are required to secure quality and to apply the proven technology.

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 can be tested or inspected while the reactor facility is operating or shut down.

More specifically, in obtaining Reactor Installation Permit and the approval of Design and Construction Plan, it is necessary for licensees to verify the technologies used in the design of reactor facilities.

When using the digital Reactor Protection System (RPS), for example, licensees are taking the following measures.

- The hardware of RPS is physically and functionally separated, by measures that signals from the RPS are only transmitted from the RPS, and any signal from the outside is not received by the RPS, and any hardware is not allowed to connect the RPS directly. And access from the outside is protected by the measure that signal from the RPS is limited only to transmit.
- 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 RPS, a specific software of which verification and validation have been done in every phase of design, fabrication, test and design change control in accordance with the industrial standards[18][19], so that a general computer virus can't activate.
- As measures to protect the RPS from the disturbance by thunder, induction surge and electromagnetic waves etc., isolation circuits etc. are installed at the point of connection of power or signals to RPS panels.
- A licensee requires the vendor to take the protective measure for virus, security measures to prevent sabotage to the RPS design. The vendor takes measures such as to prohibit connection with the internet directly, and use only the limited tools for connection for the maintenance.

[18] Standard for adopting RPS on digital calculator（JEAC4620）
[19] Guide for digital RPS on verification and validation（JEAG4609）

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

Safety facilities should be 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 to concentrate to monitor and control the plant. Considering good monitoring capability and surveillance to prevent mis-operation and mis-judgement and to operate easily, the control panel is so designed that the display, alarm and central equipment are properly located from the view point of human engineering.

For the local operation, identification managements such as color classification and locking management are adopted to prevent mis-operation.

In order to improve operability, proper tools for a local manual operated valve or a platform for local operation is provided near the main control room or 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 Design and Construction Plan and that the nuclear facilities conform to the technical standards set forth in the NRA Ordinance on Technical Standards.

Moreover, the licensee shall obtain the approval for the Operational Safety Programs which specifies rules concerning in–service safety preservation activities. The Operational Safety Programs specifies the limiting conditions for operation and measures to cope with accidents, in addition to the operation and the maintenance.

The licensee obtains technical supports from the plant vendors and its sub-vendors for inspections or construction works throughout the operational period.

The licensee is obliged to report to the NRA about accidents based on the Reactor

Regulation Act.
The licensee manages the NUCIA, database for nuclear facilities' information which is disclosed to the public, for the purpose of sharing operating experiences.
The NRA utilizes the nuclear information notification system for sharing operating information internationally.
Spent nuclear fuels and radioactive waste are stored inside the nuclear site temporally. Necessary treatments and volume reductions will be made for radioactive waste, and these wastes will be 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 waste contributing to the volume reduction of radioactive waste.
Therefore, Japan conforms to the provision of Article19 of the Convention.

Article 19 (1) Initial Authorization

In Japan, the Reactor Installation Permit, a license, followed by the approval of the NRA with regard to Design and Construction Plan, shall be obtained to construct a reactor facility. Thereafter, the licensee shall conduct Pre-service Inspections in order to confirm that the reactor facility is installed in accordance with Design and Construction Plan and conforms to the regulatory requirement. Licensees shall get confirmation from the NRA as to whether Pre-service Inspections have been carried out appropriately.
The NRA shall, when it has received an application for confirmation of Pre-service Inspection from licensees, conduct confirmation, and when it has been confirmed that the reactor is in conformity with Design and Construction Plan and the technical standards, issue a certificate of verification of Pre-service Inspections to the licensees. Licensees may not use the reactor facilities until after the NRA's confirmation.

Licensees shall, in an application for confirmation of Pre-service Inspections, submit to the NRA a written application containing necessary information such as the process, date and place of the construction pertaining to Pre-service Inspections. Licensees shall conduct Pre-service Inspection by sufficient means to confirm that the installation or alteration work related to structure, strength and leakage, function and performance, and other matters has been carried out in accordance with Design and Construction Plan. Licensees shall preserve the records of the results of Pre-service Inspections for the duration in which the power reactors remain.
The licensee shall specify Operational Safety Programs and obtain the approval of the NRA. With the amendment of the Reactor Regulation Act in 2017, licensees must specify their Operational Safety Programs before construction of the power reactors, and licensees must carry out activities consistently from the design and construction stage. 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 the operation.
The 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:

- Systems for compliance with relevant legislation and Operational Safety Programs
- Systems for quality management

- Duties and the organization of those who operate and manage reactor facilities
- Scope and contents of the duties of Chief Reactor Engineers, their accredited authority in supervising operational safety, and their organizational positioning
- Scope and contents of the duties of Chief Electrical Engineers, their accredited authority in supervising operational safety, and their organizational positioning
- Scope and contents of the duties of Chief Engineers of Boilers and Turbines, their accredited authority in supervising operational safety, and their organizational positioning
- Operational safety education among those who operate and manage reactor facilities:
- Operation of reactor facilities
- Establishment of controlled areas, conservation areas, and supervised areas, and restrictions on entry to these areas
- Venting and effluent monitoring equipment
- Monitoring of dose, dose equivalent, radioactive material concentrations, and the surface contamination density as well as matters concerning decontamination
- Management of radiation detectors and methods of radiation measurement
- Receiving, sending, transporting, and storing of nuclear fuel material, and other matters relating to them
- Disposal of radioactive waste
- Measures that should be taken in an emergency
- Measures to maintain the integrity of reactor facilities in the event of design basis accidents, severe accident and large-scale of damage
- Appropriate recording and reporting of operational safety at reactor facilities
- Facility Management of reactor sites
- Sharing of information with other licensees, focused on technical information concerning operational safety obtained from contractors who have carried out maintenance checks
- Disclosure of information concerning noncompliance, in the event that such noncompliance occurs
- Other necessary matters 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 organizational change of the licensee or modification of the reactor facilities.

If licensees intend to change their Operational Safety Programs, they 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 the nuclear fuel material, the material contaminated by nuclear fuel material, or reactors.
The Operational Safety Programs are the most important documents in the operation of a reactor facility. Licensees must specify their Operational Safety Programs before construction of the power reactor is commenced, and must carry out activities consistently from the design and construction stage. Licensees put together various operating procedure manuals and test manuals that set forth the procedures for the actual operation and maintenance of reactor facilities.
These provisions subordinate to the Operational Safety Programs are managed appropriately under the QMS of licensees, while keeping consistency with their Operational Safety Programs. Approval of Design and Construction Plan was incorporated with approval of fuel assembly design, and licensees submit to the NRA for approval.

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, licensees must set forth their Operational Safety Programs and obtain the NRA's approval before commencing operation of a reactor facility.
The limiting value for operating reactor facilities includes such values as the shutdown margin and thermal and hydraulic limiting value of the reactor which are all prescribed in the Operational Safety Programs.
If a licensee fails to comply with the limiting conditions for the operation, the NRA may order the licensee to take such action as shutting down the reactor, in accordance with the provisions of the Reactor Regulation Act.
In the event that a reactor facility deviates from its limiting conditions for the operation, a licensee is required to immediately declare a deviation from the limiting conditions for operation and report this to the NRA.
A licensee must take measures to revert from a state of the deviation within the allowed time of the operation permitted during the deviation. However, if the licensee cannot

resolve the deviation within the time allowed, they must return the reactor to such a state as the limiting conditions for operation is not applied. This state includes shutting down the reactor.
If the NRA receives a report of a deviation from a licensee, it examines the root cause and provides other licensees with its 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 a 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 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 it is necessary to obtain the approval from the NRA for the revision. To be more precise, 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 Establishment, Implementation, and Revision of Operation Manuals

Licensees shall regulate matters relating to the operation, the maintenance, and the testing of reactor facilities in their Operational Safety Programs as written in Article 19(1). Licensees shall set forth general procedures, procedural manuals, and other documentation relating to the operational safety, based on their Operational Safety Programs, and comply with these documents.

As for the maintenance, in accordance with the provisions of the Reactor Regulation Act, licensees shall conduct the Licensee's Periodic Inspections which are regulated in their Operational Safety Programs.

Procedural manuals are required to be documented, following an approval procedure within the nuclear power station, and applied to the operation and the maintenance of each reactor facility.

Moreover, in the event that the procedure is altered due to such reasons as the modification of the equipment, licensees are required to ensure that those carrying out tasks do not follow the incorrect procedure.

Procedural manuals are made available to ensure that all staff involved in the operation and the maintenance of a reactor facility can make appropriate use of them, in the way 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 the QMS.

Procedural manuals are reviewed regularly and revised if necessary.

The Reactor Regulation Act requires licensees to make and keep operational records, and these records to include those concerning fuel assemblies, reactor inspections, the operation, the radiation control, the maintenance, anomalies or accidents..

Moreover, the Reactor Regulation Act stipulates the results of Licensee's Periodic Inspections to be recorded and saved, covering such matters as the subjects, the methods and the results of inspections.

Among the items prescribed in the Operational Safety Programs, Chief Reactor Engineers, Operation Supervisors, the maintenance management of reactor facilities, and Licensee's Periodic Inspections that are stipulated in the NRA Ordinances are detailed as follows;

(1) Chief Reactor Engineers and Operation Supervisor

Chief Reactor Engineers, who are deployed at each reactor by the licensee, are selected from those who have qualifications certified through a national examination, and have the practical experience[20] stipulated in the NRA Ordinances. It is necessary to formally

[20] 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

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 general manager of the station, provide staff at all levels with advices and recommendations, and participate in the formulation of plans for the operational safety.
Operation Supervisors are appointed by the licensee and deployed for each shift.

(2) Maintenance management of reactor facilities

The licensee shall take the following measures in relation to checks, tests, inspections, repairs, replacements, modifications, and any other measures deemed necessary to the maintenance of reactor facilities (the maintenance management), both while the reactor is operating and 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 the maintenance management that should be achieved in accordance with the maintenance management policy.
- Formulate a plan for the implementation of the maintenance management that sets out the following matters, in order to achieve the maintenance management targets, and implement the 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 the maintenance management
  - Matters relating to methods used for conducting checks, tests, inspections, repairs, replacements, and modifications, other measures of reactor facilities, and the frequency and the timing thereof
  - Matters relating to measures to ensure operational safety taken when conducting inspections and other measures of reactor facilities
  - Matters relating to checks of the results of inspections and other measures of reactor facilities and methods of evaluating them
  - Matters relating to corrective and preventive measures concerning methods of conducting the inspections and other measures that should be carried out

(iv) Period of involvement in duties relating to the design or management of power reactor fuel assemblies

at reactor facilities, based on checks of the results of such reactor facility inspections and the results of the evaluation thereof, as well as the frequency and the timing thereof

- Matters relating to records of the maintenance management at reactor facilities

- Periodically evaluate the reactor facility maintenance management policy, the maintenance management targets, and plans for the implementation of the 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 the 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 extraordinary situations from the perspective of the maintenance management of a reactor facility.

In addition, if a licensee has formulated or amended the Long-Term Maintenance Management Program based on technical aging evaluation, these revisions shall be reflected in the Maintenance Management Program.

(3) Licensee's Periodic Inspections

A licensee is obligated to conduct the Licensee's Periodic Inspection to confirm compliance with the provisions of the NRA Ordinance on Technical Standards. Licensees must report a timing, scope, method of inspection, and other necessary matters to the NRA before the Licensee's Periodic Inspection.

Reactor facilities for which Licensee's Periodic Inspection should be performed by the licensee are reactors, nuclear fuel material handling and storage systems, reactor cooling systems, instrumentation and control systems, radioactive waste handling and storage systems, radiation control systems, reactor containment systems, emergency power supply systems, commercial power supply systems, auxiliary boiler systems, fire protection systems, inundation protective systems, facilities for supporting systems, emergency water intake systems, civil engineering structures on sites, emergency response centers and main bodies and accessory equipment of steam turbines.

A Licensee's Periodic Inspection shall be implemented by the methods to sufficiently confirm the occurrence of any damage, deformation, wear, and abnormality in any part such as open-up, overhaul, non-destructive inspections etc. or to sufficiently confirm

functions and operating situation such as test operation, etc.

When a licensee who is implementing Licensee's Periodic Inspection finds parts that are likely not to meet the technical standards[21] after the elapse of a certain period of time, the licensee shall evaluate the time when these parts are expected not to meet the technical standards, record and preserve the results thereof, and report to the NRA.

Scope of the evaluation is the core shroud and the shroud support among the vessel, piping and core support structure which belong to Class 1 Components defined in the NRA Ordinance on Technical Standards.

Licensees evaluate the time when these parts become not to meet the technical standards[22] by presuming the cause of crack generation, specifying its shape and size, and predicting the development of the crack in a certain period based on its shape and size, while taking into account the assumption that the crack develops as expected.

If it's necessary for the licensee to repair the parts as a result of this evaluation, the licensee shall evaluate whether the time, scope and method to repair are appropriate.

2 Confirmation of Activities of Licensees by the NRA

(1) Nuclear Regulatory Inspections

Licensees shall implement Pre-service Inspections and Licensee's Periodic Inspection on their own responsibility, while the NRA oversights the licensees through Nuclear Regulatory Inspection, which is an inspection program that enables the NRA to constantly inspect the safety activities of licensees (i.e., the NRA implements inspections "at any time" and "to anything"). If there is any concern about the safety activities of licensees, the NRA should be pointed it out as an inspection finding, and supplemental inspections should be implemented depending on the safety significance and severity of the inspection finding.

The NRA's inspectors are stationed in the Regional Office near nuclear sites. As explained in the Article 8th, a senior inspector is assigned as an office chief, and a nuclear emergency preparedness officer is assigned as a deputy office chief, and adequate number of inspectors for the nuclear facility is designated according to the size of the

[21] Article 18th of Technical standard Rules prescribes specifically, Class 1 Components, Class 1 Support

[22] 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 or other defects penetrating said pressure part.

facility.

Nuclear Regulatory Inspection shall be implemented based on the approximate number of inspection samples in the annual inspection plan specified by the NRA.

In the event of a discovery of suspected performance degradation in Nuclear Regulatory Inspection, the inspectors and relevant sections of the NRA shall evaluate the safety significance and severity of it in accordance with the guide. The safety significance assessment shall be implemented based on the degree of impact on the function or performance of safety assurance, and the severity shall be evaluated from the viewpoint of whether the case involved violations of regulatory requirements or intentional violations. The results of these assessments are typically classified into 4 levels. In some cases, the licensees are requested to report on the plan of corrective actions and the results of its implementation. Furthermore, the NRA implements supplemental inspections for the licensee's implementation.

Based on the results of Nuclear Regulatory Inspection, when the NRA determines it necessary, the NRA may order regulatory actions to licensees such as to suspend the use of the reactor facilities, remodel the facilities, repair or relocate the facilities, designate the method of operation of the reactors, or take other necessary measures.

The result of Nuclear Regulatory Inspection is summarized and reported to the NRA every quarter of the fiscal year. In addition, the NRA comprehensively evaluates the level of safety activities for each reactor facility every fiscal year based on the inspection result and safety performance indicators for the past year, and the result is disclosed to the public through the website of the NRA.

(3) 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 the on-site inspections, the NRA staff may enter the offices or buildings of licensees and inspect documents, records, and other articles, as well as questioning the personnel there.

These inspections include inspections of vendors. 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 the facilities in question.

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, the licensee is obliged to take the necessary steps, in the form of emergency measures, to prevent radiation hazards.
This is prescribed in the Operational Safety Programs as a measure that should be taken in an emergency.
Furthermore, the licensee is obliged to detail "matters relating to the operation of reactor facilities" in their Operational Safety Programs.
These matters include procedures relating to handling operation in the event of an accident or other abnormal situation, as well as procedural manuals focused on the handling of normal operation, and 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 these procedures and the system for their implementation.

2 Operating Procedures in an Emergency

The emergency operating procedures are put in place as subordinate provisions 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 stipulates as follows with regard to responses to severe accidents, and 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. (this personnel is called as "key response personnel")
- Implementing regular education and exercises at least once a year for key response personnel
- Furnishing mobile generators, fire engines, 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 the 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 stipulates that matters relating to putting in place systems for carrying out activities to maintain the integrity of reactor facility in the event of fire, internal flooding, volcanic eruptions, a severe accident, or loss of large area of nuclear facility should be detailed in the Operational Safety Programs, and accordingly, licensees take measures to prepare for these events.

Article 19 (5) Engineering and Technical Support

The licensee can act flexibly, at their own discretion, if they require engineering or technical support to ensure the safety of reactor facilities.

If the licensee outsources technical support for duties relating to the operation and management of reactor facilities to a specialized 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, the "Rule on Standards for Systems Necessary for Quality Management relating to Operations for Ensuring Safety of Nuclear Facilities" and the Operational Safety Programs require the licensee to monitor and manage the contractor appropriately, on the basis of their own QMS, and the licensee's performance in this regard is checked by the NRA in inspections such as Operational Safety Inspections.

Article 19 (6) Reporting of Accidents and Failures, etc.

1 Regulatory Requirements

In the event of an accident or a failure at a reactor facility, the licensee is obliged to report the fact immediately to the NRA, 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 this event without delay from its occurrence.
Moreover, in the event of a specified event or emergency prescribed in the Nuclear Emergency Act, the licensee is required to notify the Prime Minister and the NRA of this fact immediately.

2 Outline of Reporting Criteria and Reporting Procedures for Accidents, Failures, etc.

The criteria for reporting events in accordance with the provisions of the Reactor Regulation Act are prescribed in the NRA Ordinance on Commercial Reactors.
The licensees are required to report such events to the NRA, based on these criteria.
The NRA has constructed a system that enables reports of events to be accepted 24 hours a day, 365 days of the year. In the events that should be reported, the licensee immediately provides an initial report to the NRA's duty officer and continues to provide reports thereafter in accordance with the legislation.
Upon receiving reports from licensees, the NRA releases such information as the details of the events, the NRA's response, and the provisional International Nuclear and Radiological Event Scale (INES) rating without delay.

3 Reporting of Accidents and Failures, etc. during the Past Three Years

The Annex 2 provides the list of events reported by licensees to the NRA during the period FY2019-2021, in accordance with the provisions of the Reactor Regulation Act.

4 Investigation of the Causes of Accidents or Failures, etc. and Measures to Prevent Their Recurrence

The licensee has a prime 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 of preventing recurrence.
The NRA checks this process is being carried out appropriately or leads them to do so.
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, the licensee also publishes 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.
Moreover, with regard to measures to prevent recurrence of the event in question, the licensee is required to take preventive measures not only in regard to knowledge gained from events occurred 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.
The NRA started to hold Meetings for Dealing with Accidents and Failures at Nuclear Facilities which is open to the public to share information and discuss among licensees in order to improve the transparency in the process of dealing with accidents and failures, and five meetings were held in 2018.

5 Use of INES

In July 1989, Japan began to use its own nuclear event evaluation scale to assign ratings to events that occurred in Japan, but since August 1992, it has used INES to evaluate an event.
The NRA accepts the report from the licensee of an accident or a 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. For the TEPCO's Fukushima Daiichi NPS, INES rating is not applied for the event occurred after approval of its Implementation Plan and assumed of INES level to be less than 6. This is because the criteria of the defense in depth and the standards to manage radiation barrier for the facility are considered not appropriate to apply.
INES is the communication tool to convey importance of the safety of an event in nuclear facilities, and its rating is announced at the website of the NRA. An event which INES rating is level 2 or higher will be registered on the NEWS website that the 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, the licensee is 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 discloses the details and checks the response of the licensee to the event. Moreover, once the root cause has been identified and measures to prevent recurrence have been decided, these information are also published.
Having received advice from experts in operation management, inspection, and radiation control, the NRA scrutinizes information concerning the event, strives to identify safety lessons from it, and if necessary, requests licensees to reflect these lessons in their operation and maintenance activities, or reflects them to its own regulatory activities.
The NRA has been conducting improvement of ordinances and/or guides to incorporate latest knowledge gained through national and foreign regulatory activities, operational information relating to incidents and troubles occurred at domestic or overseas nuclear facilities, results of safety research conducted by the NRA, surveys of academic research and state-of-the-art technical and scientific knowledge obtained from activities of international organizations such as the IAEA and the OECD/NEA.
In the implementing process, the NRA collects information of incidents and troubles occurred at national or foreign nuclear facilities, studies and scrutinizes them. The NRA

decides whether to take regulatory actions or not on these items after the discussion at the Technical Information Committee and advices from the Reactor Safety Examination Committee or the Nuclear Fuel Safety Examination Committee.
Prescribed in the NRA Ordinance as the obligation, the licensee shall define the Operational Safety Programs to cover the matters related to sharing of technical information on operational safety among licensees when such knowledge is gained by the licensee that conducted maintenance or inspection.
This regulation is a measure for the licensee to share event information among licensees and utilize for nuclear safety, even if it has only small influence.
Licensees manage the NUCIA, a database for nuclear facilities' information which is disclosed to the public, cooperating with JANSI.
The database of the NUCIA contains operating information from the first nuclear reactor in 1966 to the current reactors or reprocessing plants, 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, collects domestic and overseas information such as events at nuclear facilities, analyzes, assesses and provides the result for the domestic electricity utility.
Also 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 internationally with a wide range of countries, and that it has a responsibility to do so in order to improve global nuclear safety.
The NRA shares information internationally via mechanisms of international organizations such as the IAEA and the 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 IAEA Incident Reporting System (IRS), the IAEA Fuel Incident Notification and Analysis System (FINAS) and the IAEA Incident Reporting System for Research Reactors (IRSRR). In Japan, the NRA gathers information about operational experiences within Japan,

compiles it as a database, and provides these data for the IRS, the FINAS, and the IRSRR. In terms of bilateral activities, information is shared through regular meetings etc., to exchange information.

Article 19 (8) On-Site Management of Spent Fuels and Radioactive Wastes

1 On-Site Management of Spent Fuels

In addition to the spent fuel pools used at many reactor facilities, dry storage casks are used to store spent fuels at some power stations.

In storing the spent fuel, a licensee is required to take the necessary measures to cool the spent fuel, and to ensure that the design of the storage system is such that the spent fuel is kept subcritical in accordance with the provisions of the NRA Ordinance on Commercial Reactors. The Pre-service Operator Check is to be performed that construction work has been carried out according to this design, while the Licensee's Periodic Inspections carried out by licensees to check that the soundness of the storage facility is being maintained during the lifetime of the reactor facility.

The on-site management of spent fuels 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.

As for dry storage of spent fuels at site by the DPC which could be used both for transportation and storage, the NRA established the reasonable regulation and procedure based on stringent specifications for transportation. It requires that the DPC is to be designed to cope with the seismic design condition applicable to any candidate site with a sufficient margin and added DPC to Type Certification for Design of Specified Equipment and Designation of Type of Specified Equipment. As far as the certified and designated DPC is applied, reviews on Reactor Installation Permit and the approval of Design and Construction Plan are carried out only for site specific conditions such as site boundary radiation dose or separation distance from a fire source. The NRA will revised/established the NRA Ordinance on Standards for Installation Permit, the NRA Ordinance on Technical Standards, and relevant guides, and promulgated and enforced them in April 2019.

2 On-Site Management of Radioactive Waste

The licensee is required to take appropriate measures in relation to the transport, storage, and/or on-site disposal of radioactive waste as a 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, the licensee is required to ensure that this takes place under the supervision of personnel 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 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, and its residue to be 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 prescribes 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. The licensee stores radioactive waste generated by their own reactor facilities at on-site storage facilities until it can be taken out 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 vent 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, and apart from what has an extremely low level of radioactivity, the treated liquid is generally re-used in the facility 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 Licensee's Periodic 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 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 as part of measures to ensure the operational safety of reactor facilities under safety regulations, so its implementation status is checked in Operational Safety Inspections.
The above-mentioned procedures have been carried out from the past. However, it is important to continuously improve such measures without interruption for ensuring safety, and reviews on these measures will be continued.

3 Clearance System

In Japan, regarding the scrap material generated due to the operation and maintenance of reactor facilities or decommissioning, radioactive waste with an extremely low radioactivity concentration is classified as “material not required to be handled as radioactive waste” after the approval and confirmation by the NRA so that it can be appropriately and rationally recycled or disposed of (this framework is called as “Clearance system”).
The NRA is involved at the following two stages.

- Stage 1: The NRA reviews and approves the validity of the radioactivity concentration measurement and evaluation methods formulated by the licensee
- Stage 2: The NRA confirms that the licensee is carrying out radioactivity concentration measurement and evaluation using the approved methods in Stage 1, and that the objects that the licensee classified as “material not required to be handled as radioactive waste” are actually below the clearance level in the Clearance system by performing Nuclear Regulatory Inspections on implementation status of licensees’ measures.

In addition, this system targets not only reactor facilities, but also other nuclear fuel cycle facilities.

D Annexes

1 Result of IAEA IRRS Follow-up Mission

2 Result of IAEA First Review Mission to the NRA

3 List of Nuclear Installations (as of the end of March 2022)

4 List of accidents and failures reported under the Reactor Regulation Act during the Reporting Period

5 References

1 Result of IAEA IRRS follow-up Mission

NRA's website：Publication of report on IRRS follow-up mission、
https://www.nsr.go.jp/activity/kokusai/IRRS20200318.html

2 Result of IAEA First Review Mission to the NRA

IAEA's website：IAEA Task Force Releases Report on Regulatory Aspects of Water Discharge at Fukushima Daiichi」, https://www.iaea.org/newscenter/pressreleases/iaea-task-force-releases-report-on-regulatory-aspects-of-water-discharge-at-fukushima-daiichi

3 List of Nuclear Installations (as of the end of March 2022)

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	Decommissioning
		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	Decommissioning
		2	BWR5	1,100	Feb 03, 1984	Decommissioning
		3	BWR5	1,100	Jun 21, 1985	Decommissioning
		4	BWR5	1,100	Aug 25, 1987	Decommissioning
	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	Decommissioning
		2	PWR	500	Jul 25, 1972	Decommissioning
		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	Decommissioning
		2	PWR	1,175	Dec 05, 1979	Decommissioning
		3	PWR	1,180	Dec 18, 1991	In Operation
		4	PWR	1,180	Feb 02, 1993	In Operation
Chugoku	Shimane	1	BWR3	460	Mar 29, 1974	Decommissioning

Licensee	Power Station	unit	Reactor Type	Output (MWe)	Commissioned	Status
Electric Power Co., Inc.		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	Decommissioning
		2	PWR	566	Mar 19, 1982	Decommissioning
		3	PWR	890	Dec 15, 1994	In Operation
Kyushu Electric Power Co., Inc.	Genkai	1	PWR	559	Oct 15, 1975	Decommissioning
		2	PWR	559	Mar 30, 1981	Decommissioning
		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 No2		BWR5	1,100	Nov 28, 1978	In Operation
	Tsuruga	1	BWR2	357	Mar 14, 1970	Decommissioning
		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)	Ohma	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		Decommissioning

Notes:

In Planning:	NPS for which the operator submitted a license application, but not yet approved
Under Construction:	NPS has been authorized, but has not yet passed a pre-service inspection[23]
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

[23] "a pre-service inspection" refers to the inspection performed prior to the amendment of Reactor Regulation Act in 2020.

4 List of accidents and failures reported under the Reactor Regulation Act during the Reporting Period

Accidents and failures reported in FY2019

Power Station	Accidents and Failures	Date	INES
Takahama Power Station	Indication of flaw of heat transfer tube for unit 4 Steam Generator, found through the Periodic Inspection	17 Oct 2019	0
Fukushima Daiichi NPS	Breakage of the shaft of the handle for manual operation of the suppression chamber suction valve of residual heat removal system (System B) of unit 6	26 Nov 2019	Below scale[24]
Fukushima Daiichi NPS	Leakage of nuclear fuel materials in the exhaust cylinder drain sump pit of unit 1/2 within the controlled area	28 Nov 2019	Below scale[24]
Ikata Power Station	Lifted control rods during the lifting of the reactor core upper structure of unit 3	15 Jan 2020	0
Takahama Power Station	Indication of flaw of heat transfer tube for unit 3 Steam Generator, found through the Periodic Inspection	18 Feb 2020	0

Accidents and failures reported in FY2020

Power Station	Accidents and Failures	Date	INES
Fukushima Daiichi NPS	Deviations in operational safety restriction on nitrogen encapsulation facilities located in the nuclear containment vessel	1 May 2020	Below scale[24]
Takahama Power Station	Indication of flaw of heat transfer tube for unit 4 Steam Generator, found through the Periodic Inspection	20 Nov 2020	0
Fukushima Daiichi NPS	Leakage of radioactive materials in the temporary storage area within the controlled area	25 Mar 2021	Below scale[24]

[24] In the case of judging level of event occurred at Fukushima Daiichi NPS, INES rating is not applied for the event less than INES 6 level.

Accidents and failures reported in FY2021

Power Station	Accidents and Failures	Date	INES
Fukushima Daiichi NPS	Leakage of water containing radioactive materials from tanks installed in the temporary storage area to outside the controlled area	19 Jul 2021	Below scale[24]
Ohi Power Station	Leakage of seawater from circulating water pipe of unit 3	5 Aug 2021	0
Takahama Power Station	Indication of flaw of heat transfer tube for unit 3 Steam Generator, found through the Periodic Inspection	30 Mar 2022	0

5 References

The following documents are references for writing national report.

In General

- The Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors, Act No.166, 1957
- NRA Ordinance Concerning the Installation and Operation, of Commercial Power Reactors, Ordinance of the Ministry of International Trade and Industry No. 77, 1978
- NRA Ordinance Prescribing Standards for the Location, Structure, and Equipment of Commercial Power Reactors and their Auxiliary Facilities, NRA Ordinance No. 5, 2013
- NRA Ordinance Prescribing Technical Standards for Commercial Power Reactors and their Auxiliary Facilities, NRA Ordinance No. 6, 2013

A INTRODUCTION

- The 6th Strategic Energy Plan, October 2021

B Summary of Major Activities During the 9th Reporting Period

- INTEGRATED REGULATORY REVIEW SERVICE (IRRS) FOLLOW-UP REPORT TO JAPAN

Article 8

- The Basic Policy on Human Development for the Nuclear Regulation Authority Personal, the Nuclear Regulation Authority
- The Nuclear Regulation Authority Management Rules, 10 October 2014, the Nuclear Regulation Authority
- The Mid-Term Goal for the First Term of the Nuclear Regulation Authority, March 2017 amended, the Nuclear Regulation Authority
- The Mid-Term Goal for the Second Term of the Nuclear Regulation Authority, 5 February 2020, the Nuclear Regulation Authority

Article 14

- The Guideline for Periodic Safety Assessment of Continuous Improvement of Commercial Power Reactor, March 2020 amended, the Nuclear Regulation Authority

Article 15

- Report on radiation control in nuclear installations, 2015, 16 November 2016, the Secretariat of the Nuclear Regulation Authority
- Report on radiation control in nuclear installations, 2016, 4 October 2017, the Secretariat of the Nuclear Regulation Authority
- Report on radiation control in nuclear installations, 2017, 27 February 2019, the Secretariat of the Nuclear Regulation Authority

Article 16

- The Basic Act on Disaster Management, 1961, Act No.223
- The Nuclear Emergency Act, 1999, Act No.156
- Basic Plan for Disaster Preparedness, part 12 Nuclear Emergency Preparedness, 17 June 2022 amended, the Central Disaster Management Council
- The NRA EPR Guide, 7 July 2022 amended, the Nuclear Regulation Authority
- The Installation Guideline for Emergency Monitoring Center, 25 June 2019, the Nuclear Regulation Authority

Article 19

- Accidents and failures reported in FY2019, the Secretariat of the Nuclear Regulation Authority
- Accidents and failures reported in FY2020, the Secretariat of the Nuclear Regulation Authority
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- Challenges and actions regarding the improvement of regulatory requirements, 22 November 2016, the Secretariat of the Nuclear Regulation Authority
- Operation of the International Nuclear and Radiological Event Scale for Events occurred in nuclear facilities, 18th March 2015, the Nuclear Regulation Authority