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

September, 2010

Government of Japan

Convention on Nuclear Safety

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Acronym and Abbreviation Used in this Report

ABWR	Advanced Boiling Water Reactor
ACNRE	Advisory Committee for Natural Resources and Energy
AEC	Atomic Energy Commission
ALARA	As low as reasonably achievable
ANRE	Agency of Natural Resources and Energy
APWR	Advanced Pressurized Water Reactor
AMTA	Ageing management technical assessment
BTC	BWR Operator Training Center Corporation
BWR	Boiling Water Reactor
ConvEx	Convention Exercise, IAEA
Dose Notification	Notification for Dose Equivalent Limits on the Basis of the Rules for Commercial Power Reactors
ECT	Eddy Current Test
ENAC	Emergency Notification and Assistance Convention
ERSS	Emergency Response Support System
FBR	Fast Breeder Reactor
FY	Fiscal Year
GCR	Gas-cooled Reactor
HVAC	Heating, Ventilating and Air-conditioning
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
INES	International Nuclear Event Scale
INPO	Institute of Nuclear Power Operations
IRRS	Integrated Regulatory Review Service
JAEA	Japan Atomic Energy Agency
JANTI	Japan Nuclear Technology Institute
JCO Criticality Accident	Criticality Accident at JCO Co. Uranium Fuel Fabrication Facility
JEAC(G)	Japan Electric Association Code (Guideline)
JNES	Japan Nuclear Energy Safety Organization
KEPCO	Kansai Electric Power Company
Technical Standards Ministerial Ordinance	Ministerial Ordinance for Establishing Technical Standards for Nuclear Power Generation Equipments
METI	Ministry of Economy, Trade and Industry
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MITI	Ministry of International Trade and Industry (METI at present)
Monju	Prototype fast breeder reactor owned by the JAEA

Acronym and Abbreviation Used in this Report

MOX	Uranium and Plutonium Mix Oxide fuel
NCA(A)	National Competent Authority (Abroad)
NCA(D)	National Competent Authority (Domestic)
NDT	Non-destructive Test
NEAT	Nuclear Emergency Assistance and Training Center
NISA	Nuclear and Industrial Safety Agency
NSC	Nuclear Safety Commission
NS Net	Nuclear Safety Network
NTC	Nuclear Power Training Center Ltd.
Nuclear Emergency Preparedness Act	Act on Special Measures Concerning Nuclear Emergency Preparedness
NUSS	Nuclear Safety Standard, IAEA
NWP	National Warning Point
OECD/NEA	Organization of Economic Co-operation and Development/Nuclear Energy Agency
OJT	On the Job Training
OSART	Operational Safety Assessment Review Team
PNRA	Pakistan Nuclear Regulatory Authority
PWR	Pressurized Water Reactor
Radiation Hazard Prevention Act	Act concerning Prevention from Radiation Hazards due to Radioisotopes, etc.
RANET	Response Assistance Network, IAEA
Reactor Regulation Act	Act on the Regulation of Nuclear Material, Nuclear Fuel Material and Reactors
RM	Relationship Management
SNW	Senior Network
SPEEDI	System for Prediction of Environmental Emergency Dose Information
TEPCO	Tokyo Electric Power Company
TRU waste	High level radioactive waste and long-lived low-heat generation radioactive waste
WANO	World Association of Nuclear Operators

A Introduction

1 National policy in nuclear energy

National policy in nuclear energy is built on the Basic Plan for Energy formulated by the Government and the Framework for Nuclear Energy determined by the Atomic Energy Commission of Cabinet Office. In October 2005, the Cabinet decided to respect the Framework for Nuclear Energy, which considers nuclear power generation as the key power source and requests its steady promotion.

With regard to promotion of nuclear utilization, the Framework for Nuclear Energy set the following five policies and or principles, namely.

The level of nuclear power generation is to be about 30 to 40 % or greater of the total power generation in 2030 or later.

The basic policy on the fast breeder reactor is to introduce it on a commercial basis in around 2050, on the premise of meeting the necessary conditions including economic viability.

The basic policy is to establish the nuclear fuel cycle and effectively use uranium and plutonium as energy sources. To avoid international suspicion about nuclear proliferation, Japan has determined in principle not to have excess plutonium that will be not be used.

For assuring safety, the guidelines on responsibilities of the Government and licensees, development and establishment of safety culture and continuous improvement of operation management, utilization of risk information, measures for aging management, and communication on nuclear emergency preparedness and safety activities are provided.

The guarantee of peaceful uses, treatment and disposal of radioactive waste, development and securing of human resources and coexistence of nuclear energy and the public/local communities should be strengthened as the basic activities for nuclear utilization.

2 Present status of nuclear energy utilization

(1) Situations of reactor facilities

In July 1966, Tokai Power Station (GCR: 166 MWe) of the Japan Atomic Power Co. started commercial operation as the first commercial nuclear power plant in Japan. Since then, construction and operation of nuclear installations have been steadily promoted. Tokai Power Station and Hamaoka Nuclear Power Station Units 1&2 ceased commercial operation in March 1998 and January 2009, respectively. Tomari Power Station Unit 3 of Hokkaido Electric Power Co., Inc.(PWR: 912 MWe) was commissioned on December 22, 2009. As of the end of March 2010, nuclear installations in operation amount to 54, with the total output of 48,847 MWe (licensed output). The nuclear installations under construction are three in total with two BWRs and one FBR, and those in preparation for construction are twelve. Out of nuclear installations under construction, fast breeder prototype reactor Monju, which was shutdown due to sodium leakage from the secondary cooling system during test run in December 1995, resumed test run in May 2010.

Nuclear power generation is recognized as an important power source that accounts for approx. 29 % of the total power generation in Japan. Fig. A-1 shows the composition of power sources as of the end of FY2009.

In response to the experience of two oil crises in 1970s, Japan decreased dependency on oil and encouraged diversification of power sources. As a result, nuclear power and natural gas increased their shares in the total power generation. Because of scarce natural resources, Japan also promotes the nuclear fuel cycle in which spent nuclear fuel is reprocessed to recover nuclear fuel materials to be used for the energy source. This nuclear fuel cycle also pursues effective use of uranium resources through reprocessing and, at the same time, proceeds with the plu-thermal program using uranium and plutonium mixed oxide fuel (MOX fuel) in the existing light water reactors, while aiming at establishing the fast breeder reactor cycle that uses extracted plutonium in the fast breeder reactor.

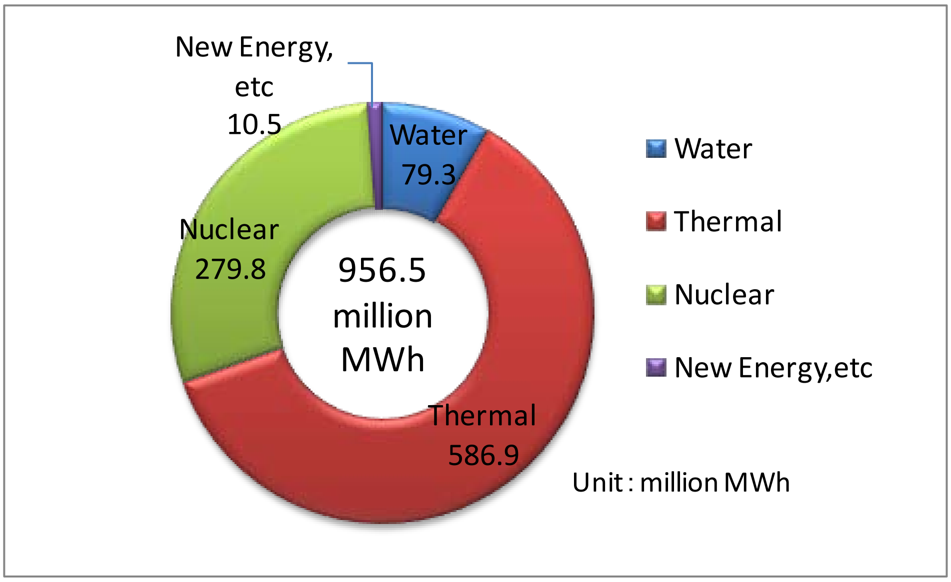


Fig. A-1　Composition of Power Sources

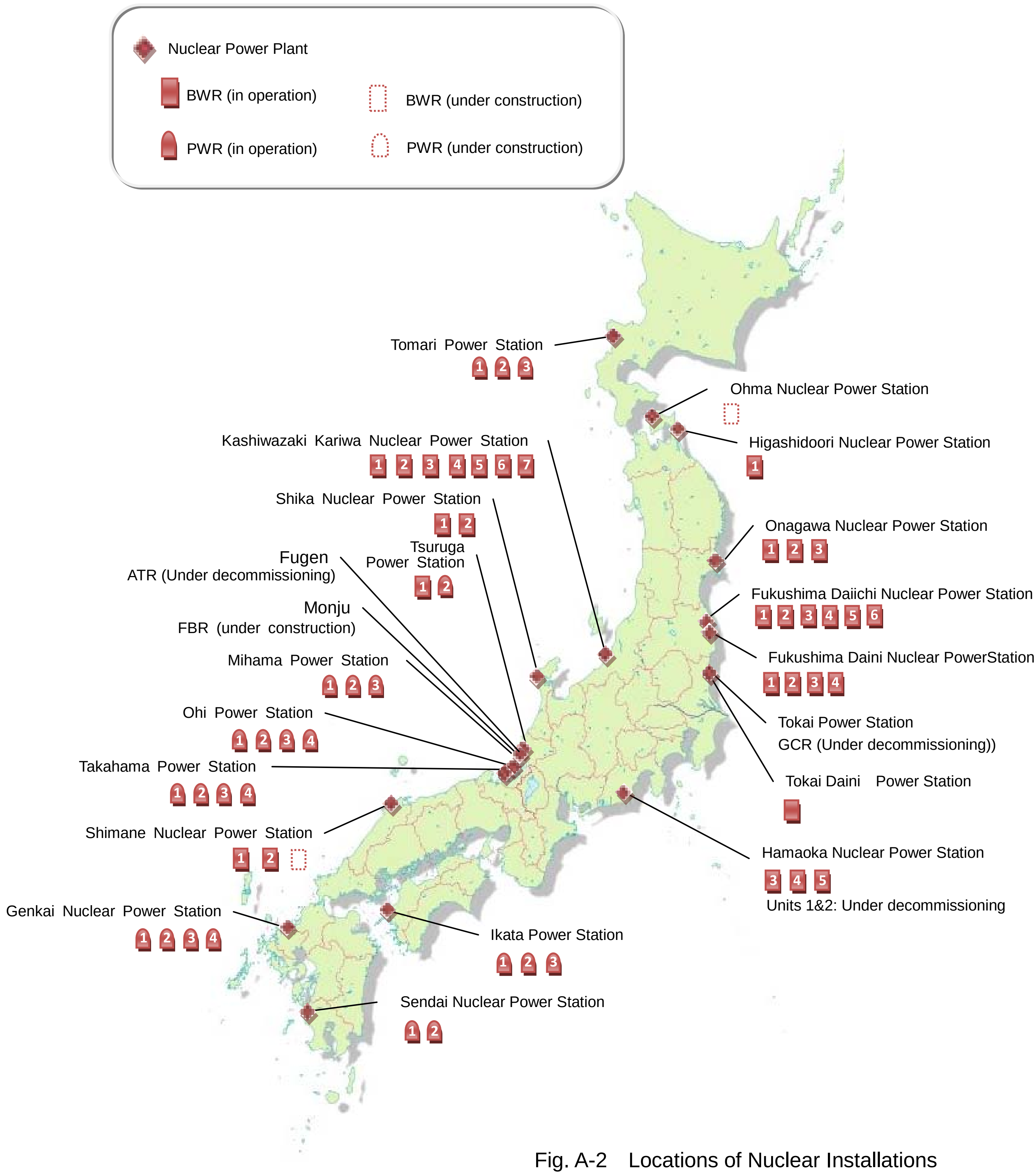


Fig. A-2 Locations of Nuclear Installations

(2) Plutonium utilization in light water reactors

In October 2009, 16 MOX fuels were loaded into Genkai Nuclear Power Station Unit 3 (PWR: 1,180 MWe) of Kyushu Electric Power Co., Inc. and started operation in November. This marked the first utilization of MOX fuel in the commercial LWR (plu-thermal) in Japan.

Subsequently, in February 2010, Ikata Power Station Unit 3 (PWR: 890 MWe) was loaded with 16 MOX fuels and started operation. In the future, Hamaoka Nuclear Power Station of Chubu Electric Power Co., Inc. is also expected to adopt the plu-thermal program.

In adopting the plu-thermal program to existing nuclear installations, permission for amendment of the reactor installment license is required to load MOX fuel into the reactor core. The licensees seeking for the plu-thermal program consecutively obtained the permission of license amendment. Table A-1 shows the nuclear installations that have obtained permission of license amendment as of the end of March 2010 to start the plu-thermal program.

Table A-1 Reactor Facilities Licensed for Installment Alteration to Start Plu-thermal Program

Licensee of Reactor Operation	Reactor Facility	Licensed Date
The Kansai Electric Power Co., Inc.	Takahama Units 3&4 (PWR)	Dec. 1998
Tokyo Electric Power Co., Inc.	Fukushima Daiichi NPS Unit 3 (BWR)	Jul. 1999
	Kashiwazaki Kariwa NPS Unit 3 (BWR)	Mar. 2000
Kyushu Electric Power Co., Inc.	Genkai NPS Unit 3 (PWR)	Sep. 2005
Shikoku Electric Power Co., Inc.	Ikata Unit 3 (PWR)	Mar. 2006
Chubu Electric Power Co., Inc.	Hamaoka NPS Unit 4 (BWR)	Jul. 2007
Electric Power Development Co. Ltd.	Ohma* NPS (ABWR)	Apr. 2008
The Chugoku Electric Power Co., Inc.	Shimane NPS Unit 2 (BWR)	Oct. 2008
Tohoku Electric Power Co., Inc.	Onagawa NPS Unit 3 (BWR)	Jan. 2010

*: Ohma Nuclear Power Station obtained license for use of uranium-plutonium mixed oxide fuel from the initial start-up. The licensed date in the Table corresponds with the date of licensing for installment.

3 Implementation of the obligations under the Convention and Approach to Nuclear Safety

(1) Implementation of obligation of the Convention

Japan has ensured implementation of the Convention on Nuclear Safety, including establishing and maintaining a legislative and regulatory framework to govern the safety of nuclear installations and establishing or designating a regulatory body entrusted with the implementation of the legal framework, and has been steadily implementing the obligations under the Convention in accordance with the related laws such as the Atomic Energy Basic Act, the Reactor Regulation Act and the Electricity Business Act. In compliance with Article 5 of the Convention, Japan submitted four National Reports on Nuclear Safety so far.

(2) Approach to nuclear safety

As an approach to ensure nuclear safety, the Nuclear and Industrial Safety Agency (hereinafter referred to as NISA), the regulatory body in Japan, has focused on the development of institutional, knowledge and human resource bases since its establishment in 2001. Part of the development of the institutional base, an inspection program on preservative action based on the Preserving Program was introduced in 2009. This is aiming at enhancing the safety regulation system by putting an emphasis on the software side as seen in inspection of quality assurance activities by the licensees. To comply with the policy of developing the performance code on the technical standards, the standards established by academic societies and associations that could be used as the regulatory standards have been organized step by step. In the pursuit of increasing the public’s trusts in regulatory activities, NISA’s efforts are being exerted to make the information on regulatory activities available to public, using information service tools such as the web site. In addition, basic policies of developing the international nuclear safety activities were developed to vitalize international cooperation in the field of nuclear safety. In preparation for nuclear emergency, responsibilities of the Government, local communities and licensees have been clearly assigned and identified and emergency centers to respond to a nuclear emergency have been established. The Government takes a leadership in holding the Integrated Nuclear Emergency Response Drill almost every year.

Issues concerning safety regulations to be addressed in the future were identified in the report prepared by the Basic Safety Policy Subcommittee of Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy. NISA, considering efforts made so far significantly helped to develop the infrastructure of the safety regulation, determined to continuously deal with the proposed issues by properly responding to changes in nuclear environment. The activities requiring continuous commitment, for example, re-evaluation of seismic safety of the existing nuclear installations, etc., shall be pursued systematically and steadily.

4 Structure and preparation of the National Report

Based on the Guidelines regarding National Reports under the Convention on Nuclear Safety (INFCIRC/572/Rev.3) adopted by the First Extraordinary Meeting of Nuclear Safety Convention in September 2009, the National Report of Japan for the Fifth Review Meeting was prepared by NISA of the Ministry of Economy, Trade, and Industry (hereinafter referred to as METI), which is the regulatory body of nuclear installations under the Convention. The National Report was prepared in cooperation with the governmental organizations including the Agency of Natural Resources and Energy of METI, the Cabinet Office (the Atomic Energy Commission (hereinafter referred to as AEC))and the Nuclear Safety Commission (hereinafter referred to as NSC)), the Ministry of Education, Culture, Sports, Science and Technology (hereinafter referred to as MEXT), the Ministry of Health, Labor and Welfare and Ministry of Foreign Affairs, as well as the Incorporated Administrative Agency Japan Nuclear Energy Safety Organization (hereinafter referred to as JNES), Incorporated Administrative Agency Japan Atomic Energy Agency (hereinafter referred to as JAEA) and the Federation of Electric Power Companies.

In principle, this report compiles the information available as of the end of March 2010, unless otherwise specified. It is also released to public via the web site of NISA/METI and other measures.

The basic principles of preparing this report consist of comprehensive and concise explanation on the safety regulation on nuclear installations in Japan and description of major issues occurred during this reporting period for the past three years. As INFCIRC/572/Rev.3 shows issues recommended to be included in more detailed and clearer way, the contents of the report are reviewed completely to meet INFCIRC/572/Rev.3, not to just update the Fourth National Report.

The main part of the report shows the corresponding Article of the Convention in the top box of each Article.

“Introduction” summarizes the nuclear program in Japan as well as the nuclear utilization program. “Summary” briefly reports the main developments after the last report and actions that were taken to deal with the issues requiring the response in the last Review Meeting. Some issues described in “Summary” are discussed in more detail in each report for the Articles. Article 6 reports completed or ongoing activities during this reporting period. Information on summary of the safety regulation system shows the corresponding issues for each of articles in Article 7 and after. The data with a considerable volume inappropriate to be included in the main part are attached as Annexes. As for the articles of national legislations, English translation of the Reactor Regulation Act, the Electricity Business Act and Act on Special Measures Concerning Nuclear Emergency Preparedness were posted on the web site of the Ministry of Justice. Therefore, they are not included in this report. Each URL for the English versions of these Acts is listed in the Annexes.

B Summary

1 Progresses on nuclear safety since the previous National Report

(1) Introduction of new inspection system

NISA started to review the inspection program in the Task Force on Inspection System from January 2005. It compiled the report on a new inspection system based on the Preservation Program in August 2008. Taking into account the deliberations so far, the ministerial ordinance was revised and a new inspection system was enacted in January 2009. The inspection system in Japan is described in Article 19.

(2) Introduction of measures to inform the public of emergency information promptly

NISA adopted the emergency information mailing service in July 2008 to deliver the emergency information to the registered e-mail addresses promptly. Emergency information has been experimentally provided to foreigners staying in Japan in their native languages through foreign embassies to Japan since the Comprehensive Nuclear Emergency Drill which was held in October 2008. Measures to transmit the emergency information are described in Article 16.

(3) Approaches to human factor

In February 2008, NISA developed the guidelines for the regulatory body to evaluate the licensee's voluntary actions aiming at correcting incompliance directly caused by human factor. Approaches to human factor are reported in Article 12.

(4) Approaches to long-term operation

Tsuruga Unit 1 (BWR: 357 MWe) of the Japan Atomic Power Co. marked its 40-years operation in March 2010 since its commissioning in 1970. NISA evaluated that the aging management technical assessment (AMTA) conducted by the licensee was appropriate. Approaches to long-term operation are reported in Article 6.

(5) Completion of safety assessment of Fast Breeder Prototype Reactor Monju

Monju had suspended its commissioning test operation for 14 years due to a sodium leak accident from the secondary system during commissioning test in 1995. In the meantime, various measures were taken and the unit has resumed commissioning test operation. Safety assessment on Monju is discussed in Article 6.

(6) Adoption of system to reflect latest knowledge

NISA adopted a new system in the pursuit of more efficient review of the permission for the reactor installment license or its amendment and implementation of safety examination based on the latest knowledge. This system is described in Article 6.

(7) OSART review on Mihama Power Station Unit 3 of Kansai Electric Power Co., Inc.

Kansai Electric Power Co., Inc. decided to further support safe plant operation through the international comparative review of their operation management system of Mihama Unit 3. They invited the Operation Safety Review Team (OSART) from the International Atomic Energy Agency (hereinafter referred to as IAEA) for review. The OSART review is summarized in Article 6.

2 Planned measures to improve safety

(1) Re-evaluation of seismic safety

In response to the revised Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities in September 2006, the existing nuclear installations and others are being evaluated by the licensees, seeking for further improvement in seismic safety. As Kashiwazaki Kariwa Nuclear Power Station hit by Niigata Chuetsu-oki earthquake in July 2007, NISA required the licensees to reflect the insights obtained from this earthquake into re-evaluation of seismic safety. Re-evaluation of seismic safety is reported in Article 6.

(2) Risk-Informed Regulation

The utilization of risk information in the safety regulation has been continuously under consideration. More efficient and effective Risk-Informed Regulation would help allocate the regulatory resources appropriately to the priority issues within the constraints of the regulatory resources. However, it is recognized that further review will be essential to adopt this system. Some regulatory fields have already used risk information; a possibility to expand the scope of utilization will be discussed in the future.

3 Responses to the results of the previous Review Meeting

(1) Challenges

a Preparation and implementation of action plan based on IRRS recommendations and suggestions to prepare the IRRS follow-up mission

Giving due consideration to the Integrated Regulatory Review Service (IRRS) recommendations and suggestions given in June 2007, the Basic Safety Policy Subcommittee of the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy identified the issues to be addressed by the regulatory body. NISA is moving forward toward response to these issues. Summary of the IRRS review in Japan is reported in Article 8.

b Re-evaluation of seismic safety following the revision of the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Facilities

Taking into account the insights obtained from the review on effects of Niigataken Chuetsu-oki Earthquake in July 2007 on Kashiwazaki-Kariwa Nuclear Power Station, the plan for the seismic safety re-evaluation was revised by the licensees and the re-evaluation were steadily progressing and NISA is evaluating the reported results. Progress of re-evaluation of seismic safety is explained in Article 6.

c Assessment of the safety of Kashiwazaki-Kariwa Power units

Since the Niigataken Chuetu-oki earthquake in 2007, all units at Kashiwazaki-Kariwa Nuclear Power Station stopped operation to investigate for possible damages by the earthquake. Units 6 & 7 are now in operation, after the investigation concluded that both units would be operated safely, safety assessment of Kashiwazaki-Kariwa Nuclear Power Station is reported in Article 6.

d Completion of the study of improving the inspection system to make it more flexible and incorporate the measures against aging, past detected falsified inspection data

NISA started to review the inspection system in the Task Force on Inspection System from November 2005, and prepared a report on new inspection system based on the Preserving Program in August 2008. Taking into account the review so far, the ministerial ordinance was revised to enact a new inspection system in January 2009. Japan's inspection system is reported in Article 19.

e Improvement in Periodic Safety Reviews taking into account the possibility of back-fitting

NISA issued the guideline for implementation of Periodic Safety Review. This guideline clarifies the essential requirement to implement Periodic Safety Review and specified to incorporate the additional measures identified by the Periodic Safety Review into the quality assurance program. The Periodic Safety Review is reported in Article 19.

The Periodic Safety Review in Japan covers the operator safety activities at nuclear installations in operation, but it does not cover the design review. The nuclear installations have been designed with sufficient safety margin, than that they just met the necessary design criteria so that back-fitting has not been institutionalized. However, every time a new design insight to which the existing nuclear installations should be given is identified, safety assessment is conducted to ensure appropriate safety margin is maintained.

f Enhance the application of Risk Informed Regulation

NISA used the risk information on a trial basis during their inspection on nuclear installations. In January 2009, as a part of improvement of the inspection system, it started to use the risk information by adopting the safety significance determination process.

g Further reduction of collective operational dose

Japan is now reviewing the actions to be taken to reduce the collective dose. They are explained in Article 15.

(2) Planned measures to improve safety

a Promotion of mid-term and long-term efforts concerning Risk Informed Regulation including the development of an implementation plan

NISA issued the report of the Issues on Nuclear Safety Regulation in February 2010 and reported it to the Nuclear and Industrial Safety Subcommittee. The report concluded that it is appropriate to continuously study for a possibility to expand the scope of utilization of risk information from the point of view of improvement in safety or regulatory effectiveness, with referring to the latest experience in overseas.

b Complete preparations of the mid-term strategic and supporting workforce plans

In August 2009, NISA compiled its mission and action plan and reported it to the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy. The report reconfirms the mission of NISA, sets the mid-term goals, identifies major issues and actions to be taken and then formulates specific work programs.

c Harmonization of codes and standards with the IAEA and other international organizations including the management of the “softer” issues

NISA prepared the guidelines for evaluating the approaches to prevent degradation of the licensee’s safety culture and organizational climate in November 2007, in cooperation with the Japan Nuclear Energy Safety Organization, for assessing the safety activities by the licensees. These guidelines are explained in Article 10.

4 Responses to all recommendations adopted at the previous Review Meeting

Regarding the issues that were discussed in the summary report of the previous Review Meeting, actions were taken, or are now being taken on the issues regarding the legislative framework of nuclear safety in Japan, independence of the regulatory body, safety management and safety culture, staffing and competence, Probabilistic Safety Assessment, Periodic Safety Review, Aging Management and Lifetime Extension, Emergency Management and new Nuclear Power Plants. The details are discussed in the related sections.

C Reporting Article by Article

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.

Overview of Article 6

In Japan, during this reporting period, two nuclear installations ceased operation and entered the decommissioning phase, and a new nuclear installation commenced operation. Therefore, a total of 54 units are currently operating.

In accordance with the revision of the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities in September 2006, Japan has been conducting reevaluation (back check) of the seismic safety of all existing nuclear power reactor facilities across the country, and completed the reevaluation for some of the nuclear installations during this reporting period. In addition, at the Kashiwazaki Kariwa Nuclear Power Station, which was affected by the Niigata-ken Chuetsu-oki Earthquake in July 2007, the licensee of reactor operation has steadily been conducting checks. And confirmation of the safety of Units 6 and 7 has been completed and they are currently in normal operation. Furthermore, the commissioning test of the fast breeder prototype reactor Monju, which had been suspended since the sodium leak accident in 1995, was recently resumed.

Approximately 60 incidents have been reported in accordance with legislation in the past three years, and they are all evaluated to be below or equal to Level 1 on the International Nuclear Event Scale (INES).

1 Nuclear installations of Japan

In Japan, as of the end of March 2010, a total of 54 nuclear power reactors (30 boiling water reactors (BWRs) and 24 pressurized water reactors (PWRs)) are operating. In addition, three reactors are being constructed, and four reactors are being decommissioned.

In Japan, in any decade of the 1970s, 1980s, 1990s and 2000s, multiple nuclear installations were commissioned. Japan also has nuclear installations that will be commissioned in the 2010s. These facts indicate that the construction of nuclear installations has been implemented continually and steadily, and the technologies for constructing them have been passed on. However, domestic construction of nuclear installations has recently remained stagnant, and it is necessary to maintain or strengthen the depth of technological abilities and human resources in the nuclear power industry of Japan by capturing overseas markets until the renewal construction of existing reactors will shift into full swing in 2030. In addition, boiling water reactors and pressurized water reactors have been equally operated in a balanced manner, and four ABWRs (advanced BWRs) have been commissioned and the construction of APWRs (advanced PWRs) has been planned. Thus, technological improvements have also been made. Additionally, the commissioning of the fast breeder prototype reactor, which has been developed as the next-generation reactor, was resumed in May 2010. Furthermore, the decommissioning of nuclear installations those have ceased operation has been progressing.

Therefore, activities related to all stages in the construction, operation and decommissioning of nuclear installations are conducted in Japan, and it is expected that this situation will continue in the future.

A list of the nuclear power reactors in Japan is provided in the Annex.

2 Major events that occurred during the reporting period

Among the events in nuclear installations that occurred in three years: fiscal 2007, 2008 and 2009, a total of 63 events have been reported to the regulatory authority in accordance with the Reactor Regulation Act. A list of these events is provided in the Annex.

In the past three years, there has been no event in Japan that had any significant impact on safety. However, some events from which we should learn lessons, including ones that occurred in connection with an earthquake, are described below.

(1) Events in connection with the Niigata-ken Chuetsu-oki Earthquake

a Fire of a house transformer for Unit 3 of the Kashiwazaki Kariwa Nuclear Power Station

In the Niigata-ken Chuetsu-oki Earthquake, a fire occurred at a house transformer 3B for Unit 3. As the

House transformer of Unit 3 after fire was extinguished (Source: TEPCO) cause of the fire, it is inferred that the foundation of a duct for the secondary connection bus of the house transformer subsided due to the earthquake, causing the duct to contact the connection terminal, damaging the bushing to allow the insulation oil to leak, causing an arc due to ground fault and short circuit, igniting the leaked insulation oil, resulting in the fire.

b Leak of water containing radioactive material to a non-controlled area in the Unit 6 reactor building of the Kashiwazaki Kariwa Nuclear Power Station

In the Niigata-ken Chuetsu-oki Earthquake, water leak was found in a non-controlled area on the 3rd floor and the 3rd floor mezzanine of the reactor building. As a result of examining the leaked water, the volume of leaked water was approx. 0.6 liter and the amount of radioactivity was approx. 2.8×10^2 Bq on the 3rd floor, and the volume of leaked water was approx. 0.9 liter and the amount of radioactivity was approx. 1.6×10^4 Bq on the 3rd floor mezzanine. It was also found that leaked water in the non-controlled area had been discharged to sea through a drain path in the station. Its volume and radioactivity amount were approx. 1.2 m^3 and approx. 9.0×10^4 Bq, respectively. For the cause of the discharge of the leaked water, it is inferred that the water in the spent fuel pool spilled on the floor surface of the operating floor due to the earthquake flowed into the non-controlled area through a clearance gap of the seal of the electrical wire penetration in the fuel handling machine feeder box, which must remain hermetically sealed, then dripped down, and the dripping water flowed into the nonradioactive drain collector tank through a draining point, then was discharged by a drainage pump to sea.

c Damage of the coupling for the overhead crane in the Unit 6 reactor building of the Kashiwazaki Kariwa Nuclear Power Station

In a facility check of equipment after the Niigata-ken Chuetsu-oki Earthquake, it was found that the cross pin on the wheel side of the coupling for transmitting the motion of the south side and north side travelling devices, and the cross pin on the motor side of the coupling for transmitting the motion of the south side travelling device, had been broken (3 out of the 4 cross pins had been damaged). For the cause of the damage, it is inferred that an excessive rotational force was applied to the couplings for transmitting motion due to the earthquake, causing the cross pins to be broken.

d Flooding in the operating floor of the reactor building of the Kashiwazaki Kariwa Nuclear Power Station

In a patrol after the Niigata-ken Chuetsu-oki Earthquake, it was found that the water of the spent fuel pool had overflowed throughout the operating floors (controlled area) of the Units 1 to 7 reactor buildings. As a result of analyzing the overspilled water, it was found that it contained radioactive substance with approx. 4.1×10^0 Bq/cc to approx. 7.8×10^1 Bq/cc. The cause was the overflow of the water of the spent fuel pool due to sloshing resulting from the earthquake.

Before the earthquake　　After the earthquake

Fig. 6-1 State of the spent fuel pool of Unit 3 of the Kashiwazaki Kariwa Nuclear Power Station before and after the earthquake (Source: TEPCO)

3 Efforts to secure safety

(1) Actions taken after the Niigata-ken Chuetsu-oki Earthquake

State of the on-site road of the Kashiwazaki Kariwa Nuclear Power Station after the earthquake (Source: TEPCO)

On July 16, 2007, a 6.8-magnitude earthquake centered offshore Chuetu of Niigata Prefecture occurred. At the Kashiwazaki Kariwa Nuclear Power Station, which is located approx. 16 km from the epicenter, Units 2, 3, 4 and 7, which were operating or at the stage of start-up operation, automatically shut down. These reactors were brought to cold shutdown approximately 9 to 20 hours after the earthquake through the cooling/depressurizing processes performed by operators, and thus the safety functions of all reactors were secured. In this earthquake, accelerations exceeding the maximum acceleration assumed in designing the power station were observed, including acceleration 680 gal at a maximum recorded at Unit 1.

Table 6-1 Maximum acceleration of motions of the Niigata-ken Chuetsu-oki Earthquake

	North-south	East-west	Vertical
Unit 1	311 (274)	680 (273)	408 (235)
Unit 2	304 (167)	606 (167)	282 (235)
Unit 3	308 (192)	384 (193)	311 (235)
Unit 4	310 (193)	492 (194)	337 (235)
Unit 5	277 (249)	442 (254)	205 (235)
Unit 6	271 (263)	322 (263)	488 (235)
Unit 7	267 (263)	356 (263)	355 (235)

Observed values at the base mat level of the lowest floor of each reactor building

Unit: gal (cm/s^2); the values in the parentheses are assumed maximum accelerations.

Attaching importance to the fact that the power station was exposed to ground motions exceeding the acceleration assumed in designing the station, NISA decided that it is necessary to check whether the integrity of the facilities exposed to such large tremors has been affected, to identify why the ground motions exceeded the motions assumed in the design, and to confirm the seismic safety of the Kashiwazaki Kariwa Nuclear Power Station.
The Tokyo Electric Power Company (hereinafter referred to as TEPCO) started checking the facilities immediately after the earthquake, and confirmed 3,600 nonconformities (deviations from the required state of facilities). Of these nonconformities, 85 were regarded as important for safety, and 4 were considered necessary to be reported to the regulatory body under legal provisions. These 4 nonconformities were described in the preceding section.
NISA had its Nuclear Safety Inspectors check the state of the facilities and equipment, directly interviewed the shift supervisor, operators and other persons involved, and check documents such as log book, operation parameter records and walk-down records. Thus, the agency verified the procedures and actions taken until the cold shutdown of all reactors was achieved after the earthquake in chronological order. NISA also confirmed that the framework of nonconformity control by TEPCO was appropriately functioning, and selected cases for feedback to other nuclear operators after examining the safety importance.
Considering the actions taken following the earthquake, the regulatory body and the licensee of reactor operation recognize the following agenda, and have taken measures.

- Evaluation of seismic safety based on knowledge acquired from the Niigata-ken Chuetsu-oki Earthquake
- State of operational management of the reactors and integrity of equipment when the Niigata-ken Chuetsu-oki Earthquake occurred, and future actions
- Optimal use of the in-house fire brigade system and the information communication system and optimal provision of information to the community by the nuclear operator in case of earthquakes

TEPCO has been working on check/evaluation of the facilities, geological investigation, evaluation of the basis ground motion, etc. In addition, for the in-house fire brigade system and the information communication system, the company has taken measures to enhance the initial fire extinguishing system, improve reliability of the fire extinguishing equipment, improve reliability of the communication equipment related to firefighting activities, and conduct practical firefighting training in cooperation with municipal firefighting organizations.
On June 20, 2008, NISA decided to revise Ministerial Ordinance for Commercial Nuclear Power Reactors concerning the Installation, Operation, etc. and required licensees of reactor operation of the establishment of an initial fire extinguishing

system in the operational safety program.


State of the administrative building room immediately after the earthquake (Source: TEPCO)

For the information communication system, TEPCO originally planned to set up an emergency response headquarters to collect information on the state of the power station and provide external communication in case of earthquakes. However, the doorway of the emergency response room was deformed to prevent access, and it was inevitable to set up a temporary emergency response headquarters to perform operations, resulting in delay in cognizance of the situation and communication. Using this as a lesson, the company has taken actions such as securing the information collection systems, preventing the system equipments from overturning and multiplexing the power supply. These actions were also introduced to other licensees of reactor operation, and they have been completed by the end of September 2008.

The NSC established a Special Committee on Seismic Safety Evaluation in December 2007 in order to comprehensively investigate and deliberate seismic safety as a neutral position. The Special Committee investigates and deliberates the reevaluation (back check) of seismic safety conducted by the nuclear operator and NISA for the existing nuclear power reactor facilities and the evaluation of the facilities of the Kashiwazaki Kariwa Nuclear Power Station in terms of integrity. The re-evaluation was conducted by the nuclear operator and NISA in accordance with the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities, which was revised in September 2006.

NISA was providing information to international organizations since immediately after the earthquake. To make the lessons and knowledge acquired through this earthquake shared across the world, and to contribute to raising the nuclear safety level, NISA accepted mission of the IAEA for 5 days from August 6, 2007. NISA also accepted a follow-up mission by the IAEA for 5 days from January 28, 2008, and a secondary follow-up mission by the IAEA for 5 days from December 1, 2008. In addition, in June 2008, a workshop organized by the IA EA on seismic safety was held in Kashiwazaki City, and a total of 335 people consisting of participants and audience from 28 countries and 2 international organizations attended the workshop. At this workshop, the IAEA announced its decision to establish an “International Seismic Safety Center,” and the center was founded in October 2008. Japan has actively been providing cooperation such as sending staff to the International Seismic Safety Center and making a special contribution. As part of the activities of the International Seismic Safety Center, it held a second workshop organized by the IAEA in Kashiwazaki City in March 2010.

(2) Safety evaluation of the Kashiwazaki Kariwa Nuclear Power Station

The ground motions of the Niigata-ken Chuetsu-oki Earthquake exceeded the design basis ground motion, and un-expectedly large force may have been applied. Thus it was necessary to evaluate the impact of the earthquake on the facilities, equipment, buildings and structures in the power station, including assessment of whether any invisible damage or effect that may influence safety was left, in order to evaluate the integrity of the Kashiwazaki Kariwa Nuclear Power Station. However, there had been no reference case of the check method applicable to evaluation of integrity of facilities, equipment, buildings and structures after earthquakes, and no relevant checking criteria was available. Therefore, NISA studied the issue based on expert opinions, and decided it necessary to analyze the level of a force applied due to the seismic force (seismic response analysis) by calculating the force using a model, and evaluate the integrity by combining them, in addition to detailed check of individual facilities and equipment. NISA presented the following basic policies for integrity evaluation of facilities.

- Check the facilities, equipment, buildings and structures that the regulatory body confirmed when the power station was constructed. For important facilities and equipment, perform not only visual check, but also detailed check through testing such as operational test, leakage test and overhaul. In addition, analyze the level of the force applied due to the seismic force, and combine the analysis result with the check result to make comprehensive evaluation.
- If no damage is observed as a result of check, and it is inferred that no force that may cause deformation has been applied as a result of analysis, evaluate it as intact.
- If it is considered that a certain level of force that may cause deformation has applied as a result of analysis, perform additional check and detailed examination based on expert opinions even if no damage is observed as a result of check.
- Based on the results of the check and the analysis above, evaluate the compliance with the technological requirements and whether or not repair/replacement is necessary.

NISA decided to instruct TEPCO to implement integrity validation in accordance with these perspectives, and that it would check the result of the validation.
NISA requested that check and evaluation program for each unit at the power station should be prepared and submitted in consideration that the design and tremors are different unit by unit. On November 9, 2007, based on the above requests, NISA provided the following instructions to TEPCO.

- Check all the major facilities, equipment, buildings and structures that the regulatory body checked when the power station was constructed.
- For those buildings, structures, facilities and equipment important for safety, perform analysis of the impact of the ground motions in addition to their checks. When analyzing the impact, identify the ground motion assumed to have been applied to each part based on the actual ground motions at the time of the

Niigata-ken Chuetsu-oki Earthquake, and evaluate the impact based on that.

- For portions to which a particularly large force is assumed to have been applied as a result of analysis, perform thoroughgoing check.
- Analyze the form of assumed damage in earthquakes for each type of facility, and reflect the result in the method of check.

In response to these instructions, TEPCO submitted a check/evaluation program with regard to integrity evaluation of Unit 7 on November 27, 2007. As the result of examining the content of the program, NISA evaluated the program as appropriate since the facilities and others to be checked and the method of checks are appropriately defined in accordance with the above instructions, and subsequently TEPCO commenced check and other works. The company also prepared and submitted check programs for other units, and then commenced the checks after similar processes.

For facilities and equipment, it is necessary to not only perform checks of individual facilities/equipment, but also check that they normally function as a whole system, and for final confirmation, to start up the plant to generate power. Consequently, TEPCO performed the inspection in the following three steps.

- Evaluate whether the integrity is maintained by evaluating the impact of the earthquake on individual equipment that constitute the unit concerned (evaluation by individual equipment).
- Evaluate whether the safety function of each system consisting of these equipment remains intact (evaluation by individual systems).
- Based on the evaluation by individual equipment and by individual systems, evaluate whether the functions of each unit as the whole nuclear power plant remain intact by commissioning the whole plant combining the reactor and power generator of each unit (evaluation of the whole plant).

NISA evaluated that the series of start up test procedures for the Unit 7 reactor of the Kashiwazaki Kariwa Nuclear Power Station, i.e.; power increase, and the functional test of the whole plant were appropriately performed and their results are also appropriate, and determined that there is no problem in the functional integrity of the whole Unit 7 plant of the Kashiwazaki Kariwa Nuclear Power Station. In addition, the agency determined that combining the results of evaluations by equipment and by systems, the fitness for service of Unit 7 of the Kashiwazaki Kariwa Nuclear Power Station is maintained and the unit could be continuously and safely operated without problem.

For Unit 6, safety check program was implemented in the same steps as Unit 7, and it was confirmed that the fitness for service of the unit is maintained.

(3) Re-evaluation of seismic safety

In response to the revision of the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities by the NSC in September 2006, NISA issued a written instruction “Basic Idea, Evaluation Method and Validation Criteria in Evaluation and Validation of Seismic Safety of Existing Commercial Power Reactor Facilities in Accordance with the New Seismic Regulatory Guide”. And NISA asked electric power companies to perform seismic safety evaluation of their commercial power reactor facilities that are operating or under construction in accordance with the revised Regulatory Guide.

In addition, NISA also instructed the electric power companies to appropriately reflect the knowledge acquired from the Niigata-ken Chuetsu-oki Earthquake, which occurred on July 16, 2007, in their seismic safety evaluation and quickly complete the evaluation.

The licensees of reactor operation submitted interim reports and other documents to NISA by March 2008, and NISA is currently evaluating the documents. As of the end of March 2010, reviews by NISA and the NSC on the result of re-evaluation (including the interim evaluation reports) of seismic safety of 11 nuclear installations were deliberated, and the evaluation of adequacy was completed. In addition, a review of one nuclear installation by NISA has been finished and it is under review by the NSC, and the other reactor facilities are under review by NISA.

The licensees of reactor operation are implementing evaluation works, etc. for the preparation of final reports including the response to the review result by NISA.

(4) Resumed commissioning of the fast breeder prototype reactor Monju

Fast breeder prototype reactor Monju
(Source: Japan Atomic Energy Agency)

After sodium of the secondary cooling system leaked in December 1995, the fast breeder prototype reactor Monju had been shut down for approx. 14 years. However, in May 2010, its commissioning was resumed.

Since September 2005, the JAEA, which is the licensee of reactor operation, implemented the remedial work to cope with the sodium leakage (completed the work in May 2007), and conducted tests to confirm the validity of the work, the functions and performance of the plant. In addition, the JAEA improved safety management system, such as establishing an autonomous quality assurance system, preparing manuals required for resuming the commissioning after long period of suspension, developing an operations management system and an accident response system, and implementing maintenance management reflecting the characteristics of Monju.

In February 2010, NISA put together an evaluation that “the JAEA has established a system in which it can satisfactorily ensure safety in resuming the commissioning” on the grounds that the improvements based on indications for comprehensive safety check relating to the sodium leak accident have appropriately been made, and the fitness for start of commissioning test of the facilities has been confirmed.

Concerning the evaluation of the seismic safety in accordance with the revised Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities, NISA evaluated its validity in March 2010.

The JAEA has announced that after resuming the commissioning of the fast breeder prototype reactor Monju, it will conduct performance testing and full-scale operation of the reactor in order to verify the reliability of Monju as a power plant and establish a sodium handling technology through its operating experience. NISA intends to continually check the safety of the fast breeder prototype reactor Monju by performing inspections such as operational safety inspection, on-site inspection and pre-service inspection.

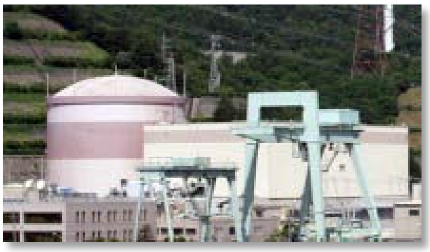
(5) Introduction of a system for reflecting new knowledge

NISA recently introduced a new system aimed at improving the efficiency of the review relating to the license for installment or alteration and conducting reviews based in the latest knowledge. This system allows the industry including nuclear power plant manufacturers to submit reports on new technologies or knowledge relating to the safety of plants (topical reports) to the regulatory body in advance to undergo evaluation of safety. This will benefit both the regulatory body and the industry from the viewpoint of improving the predictability related to decision making in safety regulations, and is expected to improve the review through utilization of the topical report in the evaluation concerned in actual licensing.

In Japan, by laws of the regulatory body relating to the topical report system for fuel design and safety analysis codes have been formulated as an area with high versatility in utilization for various plants. Currently, topical reports on fuel rod thermal and mechanical design submitted by fuel fabricators are being evaluated.

(6) Efforts for long-term operation

The Japan Atomic Power Company performed the 40th-year aging management technical assessment (AMTA) of Tsuruga Unit 1 (BWR: 357 MWe), which entered 40th year of operation in March 2010. In this AMTA, the company analyzed the management of ageing effects in sufficient detail including the operational experience and technical knowledge acquired after the 30th year AMTA to conclude that the plant can be operated safety supposing 60-year operation. Additionally, the company evaluated the validity of the 30th AMTA and the effectiveness of the long-term maintenance program defined in the 30th AMTA in order to reflect to the 40th AMTA.



Tsuruga Unit 1 of the Japan Atomic Power Company (Source: the Japan Atomic Power Company)

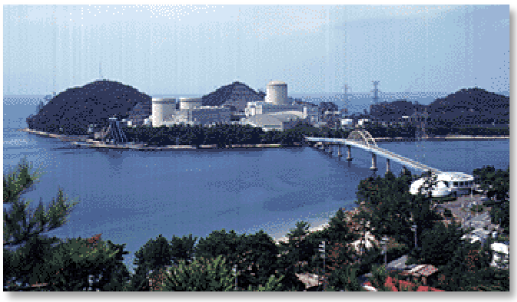
Based on the 40th AMTA, the company defined the long-term maintenance program in addition to the currently performed maintenance activities to maintain the plant in safe for the next 10 years operation.

NISA reviewed the adequacy of the submitted long-term maintenance program taking account of the verification result the 40th AMTA conducted by the Japan Nuclear Energy Safety Organization. In the course of the review, NISA sought an expert opinion from a working group on AMTA established under the Aging Countermeasures Examination Committee, which belongs to the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy. NISA also conducted on-site inspection of the Tsuruga Power Station in order to directly verify data and documents that support, or serve as the basis for, the implementation system, method and result of the evaluation performed by the licensee of reactor operation, whereas such data and documents are stored and managed mainly at the station.

NISA indicated items to be required further examination on the content of the AMTA report to the applicant in the course of the above review, and the licensee of reactor operation amended the report. NISA comprehensively reviewed the report, and determined that the contents of the report and the long-term maintenance program based on the report are complied with the Guidelines in Implementing Measures for Aging Management.

The licensee of reactor operation intends to operate Tsuruga Unit 1 until 2016, which is Japan’s first reactor facility that has entered 40th year of operation

(7) Evaluation of Mihama Unit 3 by the Operational Safety Review Team of the IAEA



Mihama Power Station of the Kansai Electric Power Company
(Source: the Kansai Electric Power Co.,Inc.)

As a remedy to the pipe rupture accident in the secondary system of Unit 3 of the Mihama Power Station in August 2004, the Kansai Electric Power Company (hereinafter referred to as KEPCO) took various measures to prevent recurrence in line with the “Action Plan concerning the Measures to Prevent Recurrence of the Accident in Mihama Unit 3,” and resumed operation of the reactor concerned in January 2007. Based on the judgment that it would be productive to have the reactor undergo an evaluation based on the comparison with international good practices and the safety standards of the IAEA, the power company announced that KEPCO would invite the Operational Safety Review Team (OSART) of the IAEA for their evaluation. With the request of KEPCO, NISA requested the IAEA to send the OSART mission. The OSART mission stayed at the Mihama Power Station for 17 days from January through February 2009, and a group of 13 experts from 12 counties including staff of the IAEA evaluated Unit 3 in 9 areas. The areas of evaluation were: organization/management/operation; training/qualification; operation; maintenance; technical assistance; utilization of operational experience; radiation protection; chemistry; emergency preparedness.

An evaluation report of OSART was put together by the review team, and was published by KEPCO in August 2009. In the report, the review team concluded that the management of KEPCO and the Mihama Power Plant were striving to increase the safety and reliability related to the operation of the power plant. In addition, the report presented good practices, recommendations and proposals as indicated in Table 6-2.

Table 6-2 Good practices, recommendations and proposals selected by the OSART

Good practices	
Organization / management / operation	A comprehensive mechanism for evaluating the safety culture is established.
	The ladders in the power station are equipped with safety blocks for preventing fall accidents.
Training / qualification	The lecturers of the Nuclear Operation Support Center and the Nuclear Power Training Center are selected from experts with extensive work experience.
Operation	An “S ring” with keys bundled in the order of operations is utilized in order to prevent erroneous operation of interrupters, disconnecting switches, etc.
	On the walls, pipings and valves hidden behind the walls are displayed.
	A network of cameras for monitoring the site that are linked with fire alarms are installed.
Maintenance	Toolbox meetings are held before works.
Utilization of operational experience	Continual information sharing is practiced through briefing sessions on blood-chilling cases.
Radiological protection	High-performance personal dosimeters (glass badges) are used.
Chemistry	A CCD camera is used to automatically detect the separation surface of the condensate demineralizer.
	An electrical conductivity meter using a cation membrane is installed in the secondary system.
Emergency plan and countermeasures	Comprehensive nuclear emergency drills involving Fukui Prefecture and Mihama-cho are conducted on a regular basis.
Recommendations	
Training / qualification	It is recommended to improve the repetitive and continual training programs for technical staff involved in facility maintenance, quality assurance, radiological protection, chemistry and nuclear fuels so that they are implemented in accordance with SAT.
Operation	It is recommended to ensure perfect operation by improving the requirements for entering and leaving the main control room.
	It is recommended to improve the inflammable material management practiced in various places of the power station so that it is effectively implemented.
Chemistry	It is recommended to prepare manuals including for analysis work in the chemical test laboratory.
	It is recommended to improve the quality control for raising the technical level of the analysis ability in the chemical test laboratory.
Emergency plan and countermeasures	It is recommended to make more effective preparations in order to protect people in the power station from radiation in case of emergency.
Proposals	
Organization / management / operation	It is proposed to formulate operational indices consistent in different places of the power station, and study their operation for trend management and utilization.
Training / qualification	It is proposed to study a mechanism for verifying the ability of an operator who has been off duty for a long period and is returning to work.
Operation	It is proposed to study operational improvements such as improvement of the environment surrounding the emergency shutdown panel.
	It is proposed to study temporary operational change of the operational actions, and improvement of the handling of the instructions concerning the change.
Maintenance	It is proposed to study improving the prevention of foreign material from entering equipment, pipings, etc.
Technical assistance	It is proposed to study enhancing the trend management of the result of the surveillance test of power station facilities.
Radiological protection	It is proposed to study methods for implementing works to minimize the chance of spreading of any pollution occurring in the controlled area.

KEPCO recognizes that the OSART evaluation mission implemented at Unit 3 of the Mihama Power Station was very productive for the company, and intends to work on further improvement of the operations management of the nuclear power station based on the evaluation result of the report that the OSART has put together. In addition, KEPCO intends to accept a follow-up mission of the OSART concerning the state of the response of the power station to the recommendations and proposals presented in this evaluation mission from the end of May to early June 2010.

4 Facilities to be decommissioned

(1) Tokai Power Station of the Japan Atomic Power Company

Tokai Power Station of the Japan Atomic Power
(Source: Japan Atomic Power)

Electric output: 166,000 kW
Reactor type: graphite-moderated CO2 gas-cooled reactor (GCR)
Fuel: natural uranium
Commissioning: July 25, 1966
Operation shutdown: March 31, 1998
Operation period: 31 years and 8 months
State: under decommissioning

Overview:

The Tokai Power Station is an advanced reactor facility that is based on the Calder-Hall type natural uranium, CO_2 gas-cooled reactor, which was developed and put to practical use in the United Kingdom, and that adopted an seismic design unique to Japan. It was commissioned in July 1966 as Japan's first commercial nuclear power station. However, the output of the power station is small despite the large sizes of the reactor and the heat exchangers because it is a CO_2 gas-cooled reactor, and the power cost is higher than light water reactors. In addition, the maintenance cost and the fuel cycle cost are relatively high since it is the only reactor type in Japan. For these reasons, its commercial operation was ceased in March 1998. The licensee of reactor operation commenced decommissioning the power station on December 4, 2001, which serves to demonstrate safe and rational decommissioning of Japan's first commercial nuclear power station. Technological know how acquired at the Tokai Power Station would have been accumulated in order to play a pioneering role to contribute to decommissioning light water reactors in the future by promoting the establishment of a remote dismantling technology, realization of methods of the volume/radioactivity evaluation, realization of waste disposal/treatment and development of a project management system. In the decommissioning, removal of facilities has been implemented at first from auxiliary equipment and the Japan Atomic Power Company plans to dismantle and remove the facilities in the reactor area after safely storing them for approximately 10 years until their radioactivity is decayed out.

(2) Advanced thermal reactor Fugen of the JAEA

Advanced thermal reactor Fugen
(Source: Japan Atomic Energy Agency)

Electric output: 165,000 kW
Reactor type: heavy water moderated, boiling light water cooled prototype reactor (pressure tube reactor)
Fuel: natural uranium, enriched uranium, mixed oxide
Commissioning: July 29, 1978
Operation shutdown: March 29, 2003
Operation period: 24 years and 8 months
State: under decommissioning

Overview:

The advanced thermal reactor Fugen is a prototype reactor that Japan has independently developed. During its operation period, a total of 772 MOX fuel assemblies were loaded, and achievements were made including the realization of a small-scale fuel cycle in which plutonium separated from spent fuels was re-used as a fuel in Fugen. However, since the advanced thermal demonstration reactor program was aborted in 1995, development of this reactor type was terminated. Subsequently, the licensee of reactor operation obtained approval for its decommissioning plan on February 12, 2008. The NPS is renamed as a “Reactor decommissioning R&D center”. It is planned to safely and rationally proceed dismantling the reactor facility while taking into account the conditions for those facilities that require maintenance management even after the shutdown. The JAEA plans to actively publish the results obtained through technological development, various preparations and the achievements from the decommissioning in order to be effectively utilized them for decommissioning reactor facilities in Japan, while providing collaboration and technological cooperation with the related organizations.

(3) Units 1 and 2 of the Hamaoka Power Station of Chubu Electric Power Co., Inc.

Electric output: 540,000 kW (Unit 1); 840,000 kW (Unit 2)
Reactor type: boiling water reactor (BWR)
Fuel: enriched uranium
Commissioning: March 17, 1976 (Unit 1); November 29, 1978 (Unit 2)
Operation shutdown: January 30, 2009
Operation period: 32 years and 10 months (Unit 1); 30 years and 2 months (Unit 2)
State: under decommissioning

Overview:

Chubu Electric Power Company was initially studying an improvement work for increasing the seismic margin of five reactor facilities installed in the Hamaoka

Nuclear Power Station. However, for Units 1 and 2, the power company concluded that it would require a considerable work cost and a long work period in order to make them resistant to the voluntary set target of the ground motion, and determined that it would hardly be economical if the operation were resumed after the improvement work for increasing the seismic margin. On November 18, 2009, the power company obtained approval for the decommissioning plan.

5 Operation of nuclear Installations of those safety is ensured

Japan domestically secures the obligations defined in the Convention on Nuclear Safety under the safety regulations enforced in accordance with legislation. In other words, for all existing nuclear installations in Japan, steps mentioned in Article 6 of the Convention are taken. If a licensee of reactor operation was unable to make necessary safety improvements such as defined in Article 6 of the Convention, the licensee would not be able to continue the operation of the nuclear installation under legislation and safety regulations of Japan. This means that the operation of any nuclear installation in Japan would not be continued without meeting the requirements defined under laws and safety regulations of Japan, and therefore, the operation of the nuclear installation would not be continued without fulfilling the obligations defined in Articles 10 to 19 of the Convention on Nuclear Safety. Therefore, any decision to continue operation without complying with the obligations of the Convention would not be made in Japan.

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 Article 7

In the legislative framework for nuclear safety in Japan, under the Atomic Energy Basic Act that defines basic philosophy of utilization of nuclear energy, the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors, and the Act concerning Prevention from Radiation Hazards due to Radioisotopes, etc. have been established as the legislation those specify the Governmental safety regulation. The laws necessary to ensure nuclear safety have been also organized, such as the Electricity Business Act, which regulates nuclear installations from the view point of electric facilities, and the Act on Special Measures Concerning Nuclear Emergency Preparedness, which specifies the nuclear emergency response. In addition, the Nuclear Safety Commission developed the guides to be used in the examination of the safety review conducted by the regulatory body. These guides are also used when the regulatory body conducts safety examination, to achieve more efficient and smooth safety reviews by the Government.
During this reporting period, Ministerial Ordinances were revised to improve safety regulation, but no change was made to the legislative and regulatory framework mentioned above. The major Ministerial Ordinances revised during this reporting period include:

Ministerial Ordinance for Commercial Nuclear Power Reactors concerning the Installation, Operation, etc.:
- Revised to improve the fire protection system by reflecting the lessons learned from the Niigata-ken Chuetsu-oki earthquake
- Revised to enhance maintenance management

Ministerial Ordinance for Establishing Technical Standards for Nuclear Power Generation Equipment:
- Revised to request compliance of the emergency core cooling system equipments

The number of standards of academic societies and associations endorsed by NISA as technically adequate standards to be used for specification codes has increased to 45 from 21 shown in the previous report.

Article 7 (1) Establishing and maintaining a legislative and regulatory framework

1 Overview of main legislation and regulations regarding nuclear safety

(1) The Atomic Energy Basic Act

The Atomic Energy Basic Act promulgated in 1955 serves as the basis of utilization of nuclear energy in Japan. The objectives of the Atomic Energy Basic Act are quoted as "to secure future energy resources, achieve progress in science and technology, and promote industry, by encouraging research, development, and utilization of nuclear energy, and thereby contribute to improvement of the welfare of human society and the people's living standard." The basic policy is prescribed as follows: "the research, development and utilization of nuclear energy shall be limited to peaceful purposes, on the basis of the highest priority of ensuring safety, and performed on a self-controlled basis under democratic administration, and the results obtained shall be made public and actively contribute to international cooperation." In order to operate nuclear administration democratically, the Act also requires establishment of the Atomic Energy Commission and the Nuclear Safety Commission and observance of the governmental regulations in the case of construction of a nuclear reactor, use of nuclear fuel material, etc.

The governmental regulations that shall be complied with in construction etc. of a nuclear reactor are specified in the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (hereinafter referred to as the “Reactor Regulation Act”) and the Electricity Business Act.

(2) The Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors and related Ministerial Ordinances

The Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors, promulgated in 1957, comprehensively covers safety regulation of utilization of nuclear energy in Japan. The Reactor Regulation Act regulates the utilization of nuclear source material, nuclear fuel material, and reactors. Namely the act regulate the refining, fabricating and enrichment, storage, reprocessing and waste disposal activities, installation and operation, etc. of nuclear reactors, to be limited to peaceful purposes, to be carried out in a planned manner, and to ensure safety of the public by preventing the hazards due to these utilization and by providing physical protection of nuclear fuel material, in accordance with the spirit of the Atomic Energy Basic Act. The act also provides necessary regulations on the use of the internationally controlled material, etc. to execute the obligations in accordance with the conventions and/or other international agreements concerning utilization of nuclear energy. The Reactor Regulation Act provides the procedures for safety regulation and the licensing criteria as for the installment and operation of reactors, etc, including installment license, approval of design and construction methods, pre-service inspection, facility periodic inspection, approval of operational safety program, Operational Safety Inspection, decommissioning, etc.. The act also provides disposition such as suspension of operation and license revocation and criminal punishment including imprisonment and fine.

The allegation system was established so that the personnel of the licensees can allege violation of the Reactor Regulation Act to the competent minister or the Nuclear Safety Commission without concern about being treated unfavorably by employer. The allegation system is expected to help uncover the licensee's violation of legislation and regulations early.

For commercial power reactors, the provisions of the Electricity Business Act are applied to the regulations on "approval of design and construction methods," "pre-service inspection," "the welding method and inspection" and "Facility Periodic Inspection." Therefore, the corresponding provisions of the Reactor Regulation Act are exempted from application.

The Ministerial Ordinances complied with the Reactor Regulation Act, which are related with the safety regulation of nuclear installations are:

- Ministerial Ordinance for Commercial Nuclear Power Reactors concerning the Installation, Operation, etc. (Ministerial Ordinance for Commercial Power Reactors)

  The Ministerial Ordinance was enacted to implement the provisions of the Reactor Regulation Act. The Minister of Economy, Trade and Industry is responsible for their revision and abolishment. The Commercial Power Reactor Rules regulate major nuclear power plants in Japan. That is commercial boiling water reactors and pressurized water reactors are regulated by the Rules.
- Ministerial Ordinance for the Installation, Operation, etc. of Nuclear Power Reactors at the Stage of Research and Development (Ministerial Ordinance for Reactors at the Stage of Research and Development)

  The Ministerial Ordinance was enacted to implement the provisions of the Reactor Regulation Act. The Minister of Economy, Trade and Industry is responsible for their revision and abolishment. The Ministerial Ordinance for Reactors at the Stage of Research and Development aim to regulate the fast breeder prototype reactor Monju.
- Ministerial Ordinance for Technical Standards on Design and Construction Methods of Nuclear Power Reactors at the Stage of Research and Development

  The Ministerial Ordinance provides the technical standards to be used in approval for design and construction methods based on the provisions of the Reactor Regulation Act and the Ministerial Ordinance for Reactors at the Stage of Research and Development.
- Ministerial Public Notice for Radiation Exposure Dose Limits

  On the basis of the Ministerial Ordinance for Commercial Power Reactor and for Reactors at the Stage of Research and Development, the Ministerial Public Notice for defining radiation exposure dose limits were set out by the Minister of Economy, Trade and Industry, respectively. These notices specify the radiation exposure doses in the controlled area and the environmental monitoring area, the surface contamination limit, radiation exposure dose limits of radiation workers, radioactivity concentration limits outside of the environmental monitoring area, etc.

(3) Electricity Business Act and related Ministerial Ordinances

The Electricity Business Act was promulgated in 1964. The objectives are to protect the interests of the electricity users and to achieve sound development of Electricity Business by realizing appropriate and reasonable management of Electricity Business and to assure public safety and to promote environmental preservation by regulating the construction, maintenance and operation of Electric Facilities.

The Electricity Business Act, which is applied to not only nuclear power but thermal power and hydraulic power generation, comprehensively regulates the electricity business in Japan. The Electricity Business Act regulates nuclear power plants in Japan as one type of electricity business, but the issues specific to nuclear energy utilization are regulated by the Reactor Regulation Act.

The Ordinances which comply with the Electricity Business Act and are related with the safety regulation of nuclear installation are:

- Ministerial Ordinance for the Enforcement of the Electricity Business Act
  Specific processes of the procedures specified by the Electricity Business Act are provided in order to implement the said Act.
- Ministerial Ordinance of Establishing Technical Standards for Nuclear Power Generation Equipments
  Technical standards applied to the approval of construction plan, pre-service inspection and periodic inspection based on the provisions of the Electricity Business Act are specified.
- Ministerial Ordinance of Establishing Technical Standards on Nuclear Fuel Material for Power Generation Facilities
  Technical standards that applied to the approval of fuel assembly design and fuel assembly inspection based on the provisions of the Electricity Business Act are specified.
- Ministerial Public Notice for Technical Standards on Dose Equivalent, etc. due to Radiation Relating to Nuclear Power Generation Facilities
  Details of doses provided in the Ordinance of Establishing Technical Standards for Nuclear Power Generation Facilities are specified.

(4) Act on Special Measures Concerning Nuclear Emergency Preparedness

Taking into account the specificity of nuclear emergency, the Act on Special Measures Concerning Nuclear Emergency Preparedness established in 1999 stipulates special measures for Nuclear Emergency Preparedness, including licensee’s obligation for preparedness on nuclear emergency, the Declaration of Nuclear Emergency, and establishment of the Nuclear Emergency response Headquarters. The act also stipulates the activation of emergency measures in nuclear emergency to improve the actions to deal with nuclear emergency and give protection to the public lives, bodies and property from nuclear emergency, together with the Reactor Regulation Act, the Basic Act on Disaster Control and other laws to prepare for nuclear emergency.

This Act focuses on actions to be taken during nuclear emergency as afore-mentioned, and also establishes the measures to be conducted in recovery operations. Other general emergency measures are stipulated in the Basic Act on Disaster Control. Article 16 explains nuclear emergency preparedness in detail.

(5) Act on Compensation for Nuclear Damage

The Act on Compensation for Nuclear Damage was promulgated in 1961, for the purpose of establishing the basic system on compensation for nuclear damage caused by reactor operation etc., protecting victims from nuclear damage and contributing to sound development of nuclear power industry. The Law stipulates liability of compensation for nuclear damage, financial security, the Governmental actions, and Dispute Reconciliation Committee for Nuclear Damage Compensation.

The Law adopts the “liability without fault” principle, which imposes sole liability of compensation for nuclear damage by reactor operation on “nuclear operator”, in the aspect of protection for victims, based on the general principle of the Civil Law. Furthermore, the Law imposes infinite liability of compensation on the nuclear operator. To secure the fund of nuclear operator and to facilitate the compensation, the nuclear operator is required to make the Financial Arrangement for Liability for Nuclear Damage. The amount of the Arrangement is 120 billion yen for each site in principle.

Financial security consists of the Contract of Liability Insurance for Nuclear Damage and the Indemnity Agreement for Compensation of Nuclear Damage. The former is a civil insurance, which covers nuclear damage caused by a general accident. The latter is an insurance, which is concluded between the national government and the nuclear operator. The latter supplements the former in the case of nuclear damage, caused by earthquake, volcanic eruption etc. On the basis of decision by the Diet, the National Government shall give a nuclear operator an aid, required to compensate the nuclear damage, in the case that the actual amount exceeds that of the financial security and of the compensation the National Government regards it as necessary to attain the objectives of the Law. In the case of a catastrophic natural disaster, nuclear operators are exempted from liability for compensation and the national government bears the compensation.

(6) Environmental Impact Assessment Act

The Environmental Impact Assessment Act was enacted in June 1999, replacing the Decision of MITI Departmental Council, July 1977, which stipulated the environmental impact assessment of nuclear installation other than safety assessment. The environmental impact assessment is implemented in accordance with the Act.

The objective of the Environmental Impact Assessment Act is for licensees to perform proper assessment of a large business plan which may pose large impact on the environment, and to prepare appropriate plan. The Act provides a set of procedures for it. Environmental assessment on commercial power facilities, including nuclear power stations, is performed in accordance with the provisions of the Environmental Impact Assessment Act and the corresponding provisions of the Electricity Business Act. In installing a nuclear power plant, the environmental impact assessment is obligatory for nuclear installations regardless of its scale.

(7) Act Concerning Prevention from Radiation Hazards due to Radioisotopes, etc.

The Act Concerning Prevention from Radiation Hazards due to Radioisotopes, etc. (hereinafter referred to as "Radiation Hazard Prevention Act") was promulgated in 1957, and, in compliance with the Atomic Energy Basic Act, regulates use, sale, lease, disposal or other handling of radioisotopes, use of radiation generating device, and disposal or other treatment of the materials contaminated by radioisotopes to prevent radiation hazard and secure public safety.

Under the Radiation Hazard Prevention Act, the Cabinet Order for Enforcement of the Radiation Hazard Prevention Act and the Ministerial Ordinance for Enforcement of the Radiation Hazard Prevention Act were established.

A person or an organization that has obtained the license, etc. for use, sales, leases and disposal activities stipulated in the Radiation Hazard Prevention Act is obliged to receive the facility inspection before start of the service and the periodic inspection when it has a storage facility larger than a certain level of scale or uses the radiation generating device.

A user, etc. shall prepare the Ministerial Ordinance for Radiation Hazard Prevention Act, appoint the supervisor of radiation protection and report them before starting handling. In addition, the user, etc. is obliged to comply with the criteria of a usage facility, etc. and the criteria of usage specified by the legislation and regulations, as well as to measure the radiation dose both within and on the border of the place of business, measure the exposure dose of radiation workers and to give education and training, the medical check-up, etc. (excluding some licensees).

Radioactive waste generated from the place of business that handles radioisotopes, etc. or materials contaminated by radioisotopes shall be processed of in the said place of business or in the place of business of processing in pursuant to the criteria provided by the legislation and regulations. The Radiation Hazard Prevention Act revised in June, 2004 and the related Cabinet Order for Enforcement and the Ministerial Ordinance for Enforcement established the basic framework for disposal of radioactive waste by the licensee of disposal. Ministerial Public Notice of technical details including the dose criteria at the disposal site, etc. is now being compiled to put waste disposal into practice.

When the use of radioactive isotopes or radiation generating device is discontinued, the Minister of Education, Culture, Sports, Science and Technology shall be notified of it, and actions that had been taken to discontinue etc. shall be reported.

The Ministry of Education, Culture, Sports and Technology shall implement the witness testing by the radiation inspector, if necessary, to confirm the status of observance of the criteria, etc. specified by the legislation and regulations.

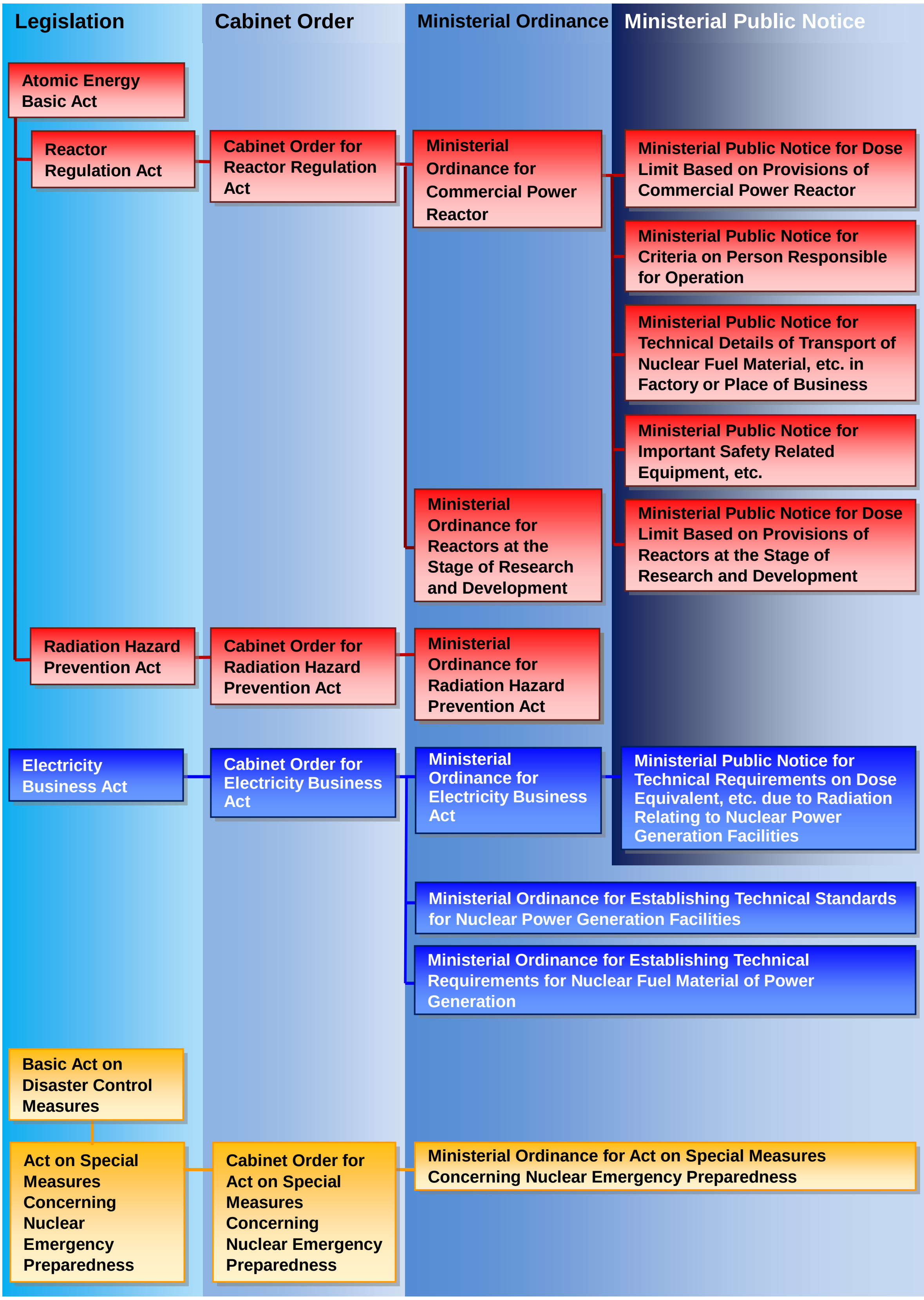


Fig. 7-1 Main Legal Structure of Safety of Nuclear Installations in Japan

2 International conventions

Japan is a contracting party of the following nuclear related conventions:

- Convention on Nuclear Safety
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
- Convention on Early Notice of a Nuclear Accident
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency
- Convention on the Physical Protection of Nuclear Material
- International Convention for the Suppression of Acts of Nuclear Terrorism

To ratify a convention, Japan takes adequate actions by providing reasonable assurance by the legislation and regulations regarding necessary domestic actions. Thus, the Government of Japan recognizes that the obligations of the contracting party of the Convention on Nuclear Safety have been adequately observed in Japan as shown in the current and previous National Reports.

In addition, Japan was assigned to the Country Group Officer in the Review Meetings of the Convention on Nuclear Safety and has made efforts to smooth the convention process. Japan also took the leadership as President in the review process during the 3rd Review Meeting of the Joint Convention held in May, 2009. In the Meeting of Competent Authorities with respect to the two emergency conventions held in July, 2009, Japan was elected as the representative of the Asian and Australasia region of the National Competent Authority Coordinating Group from 2009 to 2011. As a part of nuclear emergency preparedness among the contracting parties in Asia and Australasia region, Japan has assumed the leading role in the actions such as preparation of regional activity plan, development of the regional information network, inspection of the domestic comprehensive nuclear emergency exercise and activities to enhance awareness of nuclear emergency activities.

In preparation for providing appropriate assistance for nuclear emergency in other countries, registration of assistance capabilities that Japan can provide on IAEA's response assistance network, IAEA (RANET) is now under consideration. In 2010, the National Institute of Radiological Sciences voluntarily formed the Nuclear Disaster Assistant Team. As can be seen in these cases, development of various international cooperation systems is moving ahead both on the bases of the public and the private sectors.

Article 7 (2) Safety requirements and regulation

1 Regulatory requirements stipulated by the Minister of Economy, Trade and Industry

The regulatory requirements for securing safety of the nuclear installations are specified in the Reactor Regulation Act or the Electricity Business Act. Based on them, the Ministerial Ordinance for Establishing Technical Standards were provided in accordance with the Reactor Regulation Act or the Electricity Business Act.
The competent minister is responsible for establishment, revision and abolishment of Ministerial Ordinances and Ministerial Public Notices regarding technical standards; namely, preparation and revision of specific regulatory requirements are assigned to the regulatory body.
In January, 2006, NISA revised the Ministerial Ordinance for Establishing Technical Standards for Nuclear Power Generation Equipments (hereinafter referred to as "Technical Standards Ministerial Ordinance") so that the standards provided by academic societies and associations endorsed by the regulatory body (standards of academic societies and associations) may be used for the codes on the detailed technical specifications in the regulatory requirements. Accordingly, the safety performance that the nuclear installation should comply is provided by the Technical Standards Ministerial Ordinance, while the specific technical specifications are determined using the standards of academic societies and associations endorsed by NISA. When NISA endorses the standards of academic societies and associations, it implements the technical evaluation with taking into account the opinions of experts from Advisory Committee for Natural Resources and Energy.
In this technical evaluation, for the determination whether the standards have met the regulatory requirements as the regulatory codes, the following conditions are considered:
The development process of the standards shall value fair, equitability and openness (an unbiased constituent of members, release of proceedings, implementation of public review, documentation and release of the development procedures, etc.)

- The items and scope of the standards shall comply to the performance required by the technical standards or other legislation and regulations, or the documents based on them (consistency with the scope of the regulatory requirements).
- The specific approaches and specifications for technical matters necessary to achieve the performance required by the technical standards shall be described. The specific approaches, specifications, methods and actions shall be described for the technical matters necessary to attain the requirements by the other legislation and regulations or the documents based on them.
- The technical validity of the specific approaches, specifications, methods and actions shown in the standards of academic societies and associations shall be verified or its rationales shall be described.

In order to improve the efficiency and effectiveness of the regulations, NISA has determined to make its decision promptly, with respecting the engineering insights of the experts participating in the development processes of the standards. As of the end of March, 2010, NISA announced a total of 45 standards of academic societies and associations could be used. Annex shows a list of the standards of academic societies and associations that have been endorsed by NISA.

2 Guides specified by the Nuclear Safety Commission

The Nuclear Safety Commission established the guides such as the Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities as the evaluation criteria for reviewing the safety review implemented by the regulatory body. Table 7-1 lists the regulatory guides regarding the nuclear installations. These regulatory guides were developed by the Nuclear Safety Commission after hearing the views of the experts.

Revision of the regulatory guides undergoes examination and deliberation by the experts with the Nuclear Safety Commission taking into consideration the development of the science and technology. Recently revised was the Regulatory Guide for Reviewing Classification of Importance of Safety Functions of Light Water Nuclear Power Reactor Facilities in March, 2009. These Regulatory Guides do not correspond to the regulatory requirements, but the internal regulations to be used by the Nuclear Safety Commission in the secondary review. NISA also examines the compliance with the Regulatory Guides in the safety review for the installment of the nuclear installations.

The major guides stipulated by the Nuclear Safety Commission are available on its web site: http://www.nsc.go.jp/NSCenglish/guides/index.htm

Table 7-1 Major Regulatory Guides Specified by the NSC for Power Generating Light Water Reactors

Hazards Prevent	Siting	Regulatory Guide for Reviewing Nuclear Reactor Site Evaluation and Application Criteria
	Design	Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities
		Regulatory Guide for Reviewing Classification of Importance of Safety Functions of Light Water Nuclear Power Reactor Facilities
		Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities
		Regulatory Guide for Reviewing Fire Protection of Light Water Nuclear Power Reactor Facilities
		Regulatory Guide for Reviewing Radiation Monitoring in Accidents of Light Water Nuclear Power Reactor Facilities
		Fundamental Policy to be Considered in Reviewing of Liquid Radioactive Waste Treatment Facilities
	Safety Evaluation	Regulatory Guide for Evaluating Safety Assessment of Light Water Reactor Facilities
		Regulatory Guide for Evaluating Core Thermal Design of Pressurized Water Cooled Nuclear Power Reactors
		Regulatory Guide for Evaluating Emergency Core Cooling System Performance of Light Water Power Reactors
		Regulatory Guide for Evaluating Reactivity Insertion Events of Light Water Nuclear Power Reactor Facilities
		Regulatory Guide for Evaluating Dynamic Loads on BWR MARK-I Containment Pressure Suppression Systems
		Regulatory Guide for Evaluating Dynamic Loads on BWR MARK-II Containment Pressure Suppression Systems
		Regulatory Guide for Meteorological Observation for Safety Analysis of Nuclear Power Reactor Facilities
	Dose Target	Regulatory Guide for the Annual Dose Target for the Public in the Vicinity of Light Water Nuclear Power Reactor Facilities
		Regulatory Guide for Reviewing Evaluation of Dose Target for Surrounding Area of Light Water Nuclear Reactor Facilities
		Guide for Radiation Monitoring of Effluent Released from Light Water Nuclear Power Reactor Facilities
Technical Competence		Regulatory Guide for Examining Technical Competence of License Holder of Nuclear Power

3 Licensing system

In installment of a nuclear reactor, the license shall be issued by the competent minister in accordance with the provisions of the Reactor Regulation Act. The reactors are classified into five types: reactors for purpose of power generation, reactors to be installed in ships, reactors for purpose of testing and research, reactors for purpose of power generation and at a stage of research and development, and reactors at a stage of research and development other than those for purpose of power generation. Competent ministers who issue the license have been determined depending on each reactor type. The license for installment of reactors for purpose of power generation shall be obtained from the Minister of Economy, Trade and Industry.

The Reactor Regulation Act sets out the ineligibility for license: persons who are not allowed to have the license. They are those: a person whose installment license has been rescinded, and for whom two years have not yet elapsed from the day of the rescission, a person who has been sentenced to a penalty consisting of a fine or severer punishment for violating the provisions of the Act, and for whom two years have not yet elapsed after the penalty was executed or an adult ward. If the licensee of reactor operation intends to alter the licensed matter, he/she shall obtain permission for alteration or notify the alteration.

As no particular expiration date is specified for the license for reactor installment in Japan, procedure for license renewal does not exist. For the extended period of operation, safety is regularly evaluated not by a license renewal, but by the procedures for the periodic inspection, aging assessment, etc.

NISA the regulatory body conducts the safety examination for the installment license as remitted by the Ministry of Economy, Trade and Industry. The safety examination is described in Article 17.

When the safety examination by NISA is completed, the Minister of Economy, Trade and Industry shall listen to the views from the Atomic Energy Commission from the perspective that there would be no possibility of nuclear power to be used except for peaceful purpose, the license would not obstruct planned execution of nuclear development and utilization, and there would be accounting foundation for establishing a reactor; the said Minister also shall listen to the views from the Nuclear Safety Commission from the perspective that the technical competence of properly installing and operating a reactor would be provided, and that there would be no problem in preventing nuclear hazards caused by a reactor. The licensing system in which the regulatory body implements the safety examination, while the Atomic Energy Commission and Nuclear Safety Commission double-check (secondary review) the regulatory body's review, is an effective mechanism to ensure the independency and transparency of nuclear safety regulation in Japan.

In response to consultation from the Ministry of Economy, Trade and Industry about the review result of the application for permission of reactor installment, the Nuclear Safety Commission holds an open public hearing to hear the opinion of local residents before starting examination and deliberation. In the public hearing, NISA, the regulatory body in charge of safety examination, summarizes the safety examination to the local residents and shows its view to the stated opinions. The Nuclear Safety Commission conducts the secondary review with taking into account the opinions stated in the public hearing, and reports the result to the Minister of Economy, Trade and Industry. When the Minister of Economy, Trade and Industry received the report from the Atomic Energy Commission and the Nuclear Safety Commission, the said Minister issues the license for reactor installment to the applicant with the consent of the Minister of Education, Culture, Sports, Science and Technology, in accordance with the provisions of the Reactor Regulation Act. Any person who installed a reactor without the license for reactor installment is punished by imprisonment with work for not more than three years or by a fine of not more than three million yen, or by both, in pursuant to the provisions of the Reactor Regulation Act.

A person who has obtained the license for reactor installment shall be approved the construction plan by the Minister of Economy, Trade and Industry prior to construction based on the provisions of the Electricity Business Act. Among the alterations of construction work, certain alteration construction work provided by the Ordinance of the Ministry of Economy, Trade and Industry shall be notified in advance.

The design of fuel assembly to be loaded into the reactor shall be approved by the Minister of Economy, Trade and Industry based on the provisions of the Electricity Business Act. If any person who has implemented construction without approved construction plan shall be punished by imprisonment with work for not more than three years or by a fine of not more than three million yen, or by both, based on the provisions of the Electricity Business Act.

4 Inspection and evaluation system

In construction of the nuclear installation, the licensee of reactor operation shall receive and pass the pre-service inspection, which is implemented for each construction phase by the Minister of Economy, Trade and Industry, based on the provisions of the Electricity Business Act, before using the electric facilities.

The fuel assembly to be loaded into the reactor shall receive and pass the fuel assembly inspection implemented for each construction phase by the Minister of Economy, Trade and Industry, based on the provisions of the Electricity Business Act before use.

The welds of pressure boundary components and the containment, etc. shall undergo the operator's inspection on welding, as well as the review by the Japan Nuclear Energy Safety Organization (safety management review on welding) on the organization in charge of implementation of inspection, process management and other issues specified by the Ordinances of the Ministry of Economy, Trade and Industry.

After the reactor starts operation, the licensee of reactor operation shall conduct periodic operator's inspection, and receive the periodic inspection by the Minister of Economy, Trade and Industry on the pre-determined important safety related components. The licensee shall also receive the review by the Japan Nuclear Energy Safety Organization (periodic safety management review) on the organization in charge of implementation of inspection, process management and other issues specified by the Ordinances of the Ministry of Economy, Trade and Industry.

Safety inspection on the operating facilities includes the compliance inspection of the operational safety program periodically conducted by the Minister of Economy, Trade and Industry based on the provisions of the Reactor Regulation Act. NISA's Nuclear Safety Inspector conducts inspection work, consigned by the Minister of Economy, Trade and Industry. In accordance with the Reactor Regulation Act, the compliance inspection of physical protection program is conducted as the physical protection inspection.

Any person who has used the electric facilities or fuel assembly that did not pass the pre-service inspection or fuel assembly inspection, or who has refused, prevented or avoided the pre-service safety management review, safety management inspection on welding, periodic inspection or periodic safety management review shall be subject to imprisonment with work for not more than one year or a fine of not more than a million yen, or both, under the provisions of the Electricity Business Act. Any person who has refused, prevented or avoided the access, inspection or submission of samples involved in the operational safety inspection or physical protection inspection, or has failed to make a statement or has made a false report in response to the questioning, is subject to imprisonment with work for not more than one year or a fine of not more than a million yen, or both, under the provisions of the Reactor Regulation Act. Article 19 explains the detailed inspection program, in Japan.

5 Law enforcement

Law enforcement concerning nuclear safety regulation in Japan can be classified into two categories: enforcement by the regulatory body and enforcement by the law enforcement agency including judiciary. If the licensee of reactor operation is found to violate the provisions, etc. of the laws, the Minister of Economy, Trade and Industry may order revocation of the license for reactor installment or suspension of operation of reactor not more than one year. If the performance of the nuclear installment is not found to comply with the technical standards, the Minister of Economy, Trade and Industry may order suspension of operation, modification, repair or transfer of the nuclear installation, specification of operating method or other actions required to ensure safety.

The past experience of orders of measures such as suspension of operation issued by the regulatory body on a nuclear installation under the provisions of laws is the administrative disposition by falsification regarding the reactor containment leak rate inspection at Fukushima Daiichi Nuclear Power Station of the Tokyo Electric Power Co., Inc. in November 2002, which resulted in one-year suspension of its operation.

Article 8 Regulatory Body

1.	Each Contracting Party shall establish or designate the 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.

Overview of Article 8

The Minister of METI have jurisdiction over nuclear installations in Japan. The organization that administers the safety regulation is NISA, which was established as a special organization of the Agency of Natural Resources and Energy of METI to ensure safety of nuclear power reactor installations.

The Science and Technology Policy Bureau of Ministry of Education, Culture, Sports, Science and Technology (MEXT) is responsible for the safety regulation of the research reactor facilities that are not covered by this Convention.

The Nuclear Safety Commission (NSC) of the Cabinet Office audits and supervises the adequacy of the safety regulation implemented by these regulatory bodies from the perspective of the third party to ensure independency and transparency of the safety regulation. These regulatory bodies and regulation system have not changed since the last report.

During this reporting period, NISA strengthened its system for development of human resources and sending out of information. It also moves ahead aiming at further improvement by sorting out the mid- and long-term challenges with taking into account recommendations and suggestions of the Integrated Regulatory Review Service (IRRS).

As reported in this Article, NISA has the human resources with a wide variety of specialties. NISA not only educates them within the organization but also accepts the resources with career from other organizations. NISA secures sufficient manpower, thus resulting in the sufficient human resources. As NISA is financed by the national budget, they also have sufficient financial resources.

Article 8 (1) Establishment of the regulatory body

1 Nuclear and industrial safety agency

(1) Organization, authority and responsibility

The Minister of METI is responsible for the safety regulation of the nuclear installations in Japan, and NISA, as remitted by the Minister of METI, implements its administrative work. NISA was established pursuant to the provisions of the Law for Establishment of the Ministry of Economy, Trade and Industry as a special organization of the Agency of Natural Resources and Energy. Specifically, NISA, conducts clerical work on enforcing the competence of the Minister of METI described below. A special organization refers to an organization that may be established if judged necessary under the National Government Organization Law. The Law for Establishment of the Ministry of Economy, Trade and Industry stipulates that NISA is the organization to ensure safety of nuclear and other energies and industrial safety. NISA belongs to METI in the organizational structure, but the Director-General of NISA has the authority to appoint and dismiss his personnel.

The Minister of METI is in charge of the safety regulation of the nuclear installations and has the authority to issue licenses for installment of nuclear installations, after examining siting, structure, and equipment to assure the installment of a nuclear installation will not cause any radiological hazard. The Minister of METI has the authority to establish Ordinances specifying the details of the safety regulations including measures for the safe operation and physical protection of specific nuclear fuel materials, the Operational Safety Program, measures to be taken in emergency, etc. The functions of the said Minister include approval and inspection of the design and construction of the facilities, approval of the Operational Safety Program and the decommissioning plan, etc. of the nuclear installations, collection of reports from the licensees of reactor operation and execution of on-site inspection, if necessary. The said Minister also has the authority to evocate or discontinue utilization of a license for installment of a nuclear installation, order measures for operational safety, dismiss a Chief Engineer of Reactor, implementation order concerning decommissioning, implementing order for an emergency preparedness, etc.

The divisions of NISA involved in nuclear safety consist of the Policy Planning and Coordination responsible for comprehensive coordination within in NISA, Nuclear Safety Public Relations and Training, Nuclear Safety Regulatory Standard, Nuclear Safety Special Investigation, Nuclear Power Inspection, Nuclear Power Licensing, Nuclear fuel Cycle Regulation, Nuclear Fuel Transport and Storage Regulation, Radioactive Waste Regulation, Nuclear Emergency Preparedness and Electric Power Safety (Fig. 8-1). As shown in Table 8-1, the Nuclear Safety Inspectors and Senior Specialists for Nuclear Emergency Preparedness are stationed at nuclear site.

NISA has a total of approximately 370 staff engaged in the nuclear safety regulation, out of which 110 staff members are Nuclear Safety Inspectors and Senior Specialists for Nuclear Emergency Preparedness stationed at nuclear sites.

Fig 8-1 Organization of NISA

Table 8-1 Nuclear Safety Inspectors Offices Under METI

	Name of Office	Facility Covered
1	Tomari Nuclear Safety Inspectors Office	Power Plant (P)
2	Higashidori Nuclear Safety Inspectors Office	Power Plant (B)
3	Rokkasho Nuclear Safety Inspectors Office	Fuel Facility
4	Onagawa Nuclear Safety Inspectors Office	Power Plant (B)
5	Fukushima Daiichi Nuclear Safety Inspectors Office	Power Plant(B)
6	Fukushima Daini Nuclear Safety Inspectors Office	Power Plant (B)
7	Kashiwazaki-kariwa Nuclear Safety Inspectors Office	Power Plant (B)
8	Tokai & Oharai Nuclear Safety Inspectors Office	Power Plant (B), Fuel Facility
9	Yokosuka Nuclear Safety Inspectors Office	Fuel Facility
10	Shika Nuclear Safety Inspectors Office	Power Plant (B)
11	Hamaoka Nuclear Safety Inspectors Office	Power Plant (B)
12	Tsuruga Nuclear Safety Inspectors Office	Power Plant (P, B, F)
13	Mihama Nuclear Safety Inspectors Office	Power Plant (P)
14	Ohi Nuclear Safety Inspectors Office	Power Plant (P)
15	Takahama Nuclear Safety Inspectors Office	Power Plant (P)
16	Kumatori Nuclear Safety Inspectors Office	Fuel Facility
17	Kamisaibara Nuclear Safety Inspectors Office	Fuel Facility
18	Shimane Nuclear Safety Inspectors Office	Power Plant (B)
19	Ikata Nuclear Safety Inspectors Office	Power Plant (P)
20	Genkai Nuclear Safety Inspectors Office	Power Plant (P)
21	Sendai Nuclear Safety Inspectors Office	Power Plant (P)

The facility covered is classified as follows:

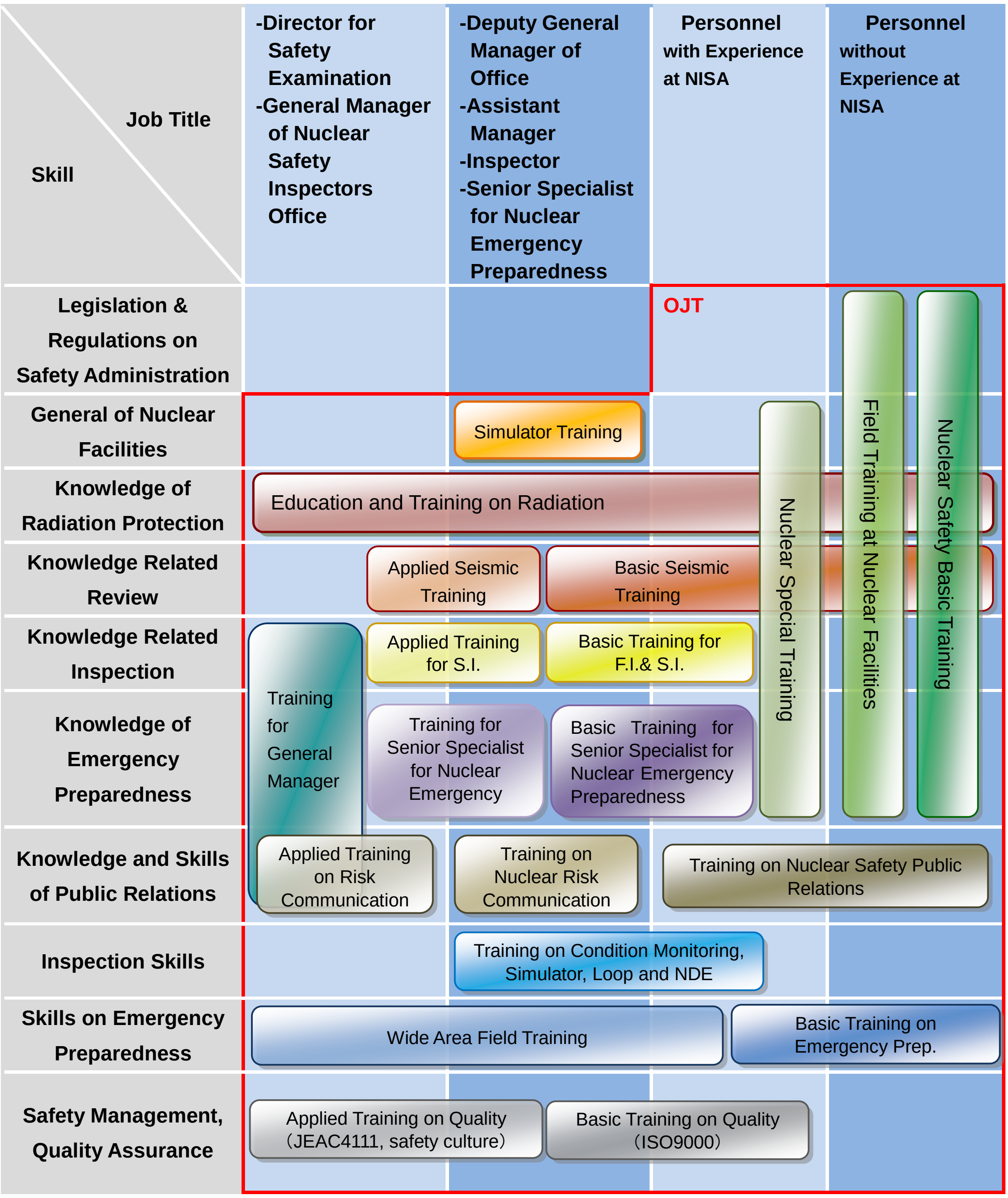
P: PWR B: BWR F: FBR

Fuel Facility: Uranium enrichment, fabrication, reprocessing and disposal

(2) Development of human resources

Despite a move to downsizing and restructuring promoted by the Government, NISA has requested the personnel management office of the necessary staffing and secured the human resources to implement the safety regulation firmly. The regulations on the nuclear installations are reviewed and revised flexibly in the context of technological development and social requirements. In view of such circumstances, securing adequate human resources has become important in fulfilling the responsibility of the regulatory body. The regulatory administration concerning nuclear safety requires high level of expertise. Therefore, to prevent possible deficiency due to the retirement of the employees on the work management, a special arrangement has been made for employees with broad expertise to allow them to continue working as regular staff.

In 2009, NISA introduced the competency management system into its training and education program. This system not only provides opportunities for training or OJT to obtain the knowledge necessary for performing the work assigned to the personnel, but also develops education and training programs under the involvement of the management to ensure such training and on the job training (OJT) can be received. The objectives of the competency management system include to encourage the employees to take the training proactively and to provide the opportunity to take training programs under the personnel's tight work schedule, which has been the long-time concern to be resolved. It should be noted that the traditional education and training programs other than the competency management system continue to be effective in parallel. The personnel should acquire necessary skills and knowledge while he/she is on the job; this has been acknowledged an important element in cultivating the regulatory staff. Fig. 8-2 shows the skills necessary for the personnel of the nuclear safety divisions and the related major training programs.



S.I. : Safety Inspector , F.I. : Facility Inspector

Fig. 8-2 Skills Required for Personnel of Nuclear Safety Divisions and Related Major Training Programs

In April, 2008, in relation with the development of human resources, NISA established the Japan Nuclear Safety Training Center in Hitachi-naka City, Ibaraki Prefecture to strengthen the training program, aiming at developing and improving the competency of the personnel. This center provides the training facilities for BWR operation simulators (PC simulators), non-destructive test training equipment, eddy current test (ECT) equipments for steam generator tubing, 3-Dimentional cut models of NPP major components, electrical and instrumentation training facilities, the e-learning system (to study the PWR system), loop test devices (incident simulating loop and process instrumentation loop), condition monitoring testing facility and classrooms for lecture.

NISA continuously recruits personnel who have gained career in nuclear industry. This is recognized as a useful method to contribute to level up technical competence of the regulatory body.

(3) Financial resources

All financial resources to cover the activities of NISA come from the coffers of state. NISA annually submits the budget request based on the estimates necessary for the projects or regulatory activities related to nuclear safety for the coming fiscal year to the financial authorities. These procedures are common to the all governmental organizations in Japan. As the financial authorities assess the requested budget on the basis of Japan's financial situation, a slight increase or decrease will be seen every year; however, the budget necessary to cover the regulatory activities has been secured so far. NISA's budget for the reporting period amounts to 37.64 billion yen (including 22.51 billion yen as subsidies for operation of JNES) in FY 2008, 36.92 billion yen (22.19 billion yen as subsidies for the operation of JNES) in FY 2009 and 32.55 billion yen (20.7 billion yen as subsidies for operation of JNES) in FY 2010.

(4) Ensuring transparency

a Information disclosure

NISA is one of the governmental organizations, and is obligated of disclosure of documents based on the Act on Access to Information Held by Administrative Organs. The claim of information disclosure in accordance with this Act shall be accepted except for the information defined not to be disclosed because disclosure of the said information is likely to cause harm to the rights and interests of an individual or public.

b Public hearing and public relations activities

In addition to the said legal framework for the information disclosure, NISA has systematically developed the information release activities in a way combined with the regulatory processes. As a new move to reflect the feedback of opinions from the outside into the quality improvement of regulatory activities, the relationship management (RM) system was introduced for active information release. The challenges of RM include gaining of recognition of NISA throughout the society, well understanding of NISA's daily activities by public, response to the special interest of the public, formation of opinion on the direction and revision of the regulatory system, response to an emergency such as an accident and activation of the internal communication. Under these circumstances, in April

2004, the Nuclear Safety Public Relations and Training Division responsible for enhancing public hearing and public relations was newly established in order to provide various public hearing and public relations activities. Resident Public Relations Officers are also assigned. The major public hearing and public relations activities include (i) supply of information on policies and activities of nuclear safety regulation (supply of information on its web site, issuance of the news letters, development of brochures, preparation and distribution of the newspaper ads or leaflets, supply of information using CATV, etc.); (ii) various symposia and explanation meetings to the residents; (iii) two-way dialogue communication with the local residents in nuclear installation site area, (iv) public hearing and public relations activities hosted by Nuclear Safety Inspectors Office and (v) information distribution during emergency ("Mobile NISA"*, the web site on an emergency). For the purpose of expanding the staff knowledge, training programs focusing on nuclear safety public relations, risk communication, etc. are given. In addition, the Nuclear Energy Library was established in JNES and the applications for reactor installment license and nuclear incident reports are available to the pubic.

Mobile NISA: This is the mailing service to release the information promptly to the local residents and public when a large-scale earthquake, etc. occurs in the communities hosting the nuclear facilities. NISA intends to deliver to the pre-registered persons with the first report on the emergency via e-mail within one hour or so after its occurrence. The information to be disseminated consists of the operating status of the concerned nuclear facility, radiation monitoring data around the facility, etc. This mailing service promptly released the information during the earthquakes in the northern coastal area of Miyagi Prefecture in July, 2008 and in Suruga-wan in August, 2009, etc.

NISA has been steadily improving its communication activities in Japan, while much remains to be addressed with the public relations in foreign languages such as the information release to abroad. A considerable amount of valuable insights that Japan has accumulated with 40-year experience of regulation for the nuclear installations is shared within only a limited extent. It is undeniable that the international contribution by Japan, which has a large nuclear program, shows low profile compared with other countries with a similar size of the program.
To break out this situation, Japan has been focusing on the emergency information release service in foreign languages, which seems to have the top priority, during this reporting period, to begin with. The emergency information will be disseminated via foreign embassies to Japan and Japanese diplomatic offices in foreign countries. The system was operated on a trial basis in the comprehensive reactor emergency drill during this reporting period and at the time of occurrence of a large-scale earthquake as well. In the future, the English web site will be open, aiming at sharing broad knowledge on nuclear safety including operating experience.

(5) Technical support

a Technical support organization

NISA established JNES (approx. 400 executives and employees as of April 1, 2010) as their technical support organization in October, 2003.

JNES takes a neutral position independent from the licensees of nuclear energy related activities to be regulated. Their mission is to implement nuclear safety regulation efficiently and appropriately together with NISA. JNES is in charge of the inspection of nuclear facilities pursuant to the laws by sharing responsibilities with NISA. In addition, JNES as an entity of the expert engineers to ensure nuclear safety, provide technical support to NISA with the safety review and assessment on the nuclear installations, with the development of the safety regulation criteria, as well as with the emergency preparedness activities and with the collection of safety information.

In accordance with the Law for the Incorporated Administrative Agency Japan Nuclear Energy Safety Organization, JNES implements the following activities:

- Inspection of nuclear installations and nuclear facilities, and related work,
- Safety analysis and evaluation of designs of nuclear installations and nuclear facilities;
- Work for prevention of nuclear emergency, mitigation of nuclear emergency (including the probability of occurrence of nuclear emergency), and restoration from a nuclear emergency;
- Investigation, testing, research, and training to ensure safety in utilization of nuclear energy; and
- Collection, analysis and provision of information to assure nuclear safety.

In fulfilling their work, based on the General Rules for the Incorporated Administrative Agency, JNES shall prepare a scheme (mid-term program) to accomplish the mid-term objectives directed by NISA to obtain approval from the Minister of METI, develop an annual plan based on the mid-term program, and report to the Minister of METI. The Evaluation Committee on Incorporated Administrative Agencies that was set up in METI assesses the performance of each fiscal year and achievements to the mid-term objectives.

The fund of JNES comes mainly as the Governmental subsidies and also as the fees paid by the licensees of reactor operation for the inspection.

In October, 2007, JNES established Seismic Safety Division and enhanced their function to address the Niigata-ken Chuetsu-oki Earthquake, etc. In April, 2009, JNES drastically reformed their organizational structure in the pursuit of improvement in tasks, technology transfer and enhanced comprehensive coordination function.

b Council

The council related with NISA is the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy, which was established to advise issues such as securing nuclear safety and operational safety activities of utilities. This subcommittee was structured to explore discussion more specifically from both perspectives of generals and details. To be specific, the nuclear safety regulation systems are deliberated in the subordinate subcommittees or in working groups of each regulatory field and offers suggestion to NISA.

The members of working groups or subcommittees include the staff not only with the academic background in nuclear thermal design, fuel design, system design, mechanical design, seismic design, material strength, radiation control, meteorology, geology, soil, and other engineering expertise, but also in the fields of cultural science and social science and the representative from the ordinary consumers and the mass media and all these members participate in the discussion. Neutral position of these members is assured and the deliberation is held open to public in principle. In addition, NISA may hear the views from the members of the Nuclear and Industrial Safety Subcommittee and other experts other than the opportunity of discussion in the above councils when the safety regulations should be implemented.

Table8-1 List of Nuclear Related Councils of Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy

Nuclear and Industrial Safety Subcommittee
Basic Safety Policy Subcommittee
INES Evaluation Subcommittee
Chuetsu-Oki Earthquake Nuclear Installations Investigation and Study Subcommittee
WG for Operation Management and Equipment Integrity Evaluation
Nuclear Fuel Cycle Safety Subcommittee
Reprocessing WG, Study Group on Comprehensive Inspections of Rokkasho Reprocessing Plant, WG for Aging Management Evaluation, WG for Interim Storage of Spent Fuel, WG for Transport of Radioactive Material
Seismic and Mechanical Design Subcommittee
Joint Working Group on Earthquake, Tsunami, Geology, and Ground Structure, Mechanical WG
Nuclear Emergency Preparedness Subcommittee
Risk Management WG, WG on Measures for Incident and Failure, Accident Management WG, Fire Protection WG
Nuclear Reactor Safety Subcommittee
Review Meeting of Maintenance Management, Confirmatory Meeting of Safety of Monju, WG for Operation Management, WG for Safety Assessment, WG on Technical Validation of Standards, Fuel WG, WG for Evaluation of Inspection Technology, WG for Comprehensive Preventive Maintenance, WG for Evaluation of Safety Management Technology, WG for Upgrade of Reactor Thermal Output
Aging Countermeasure Examination Committee
WG for Technical Evaluation of Aging
Radioactive Waste Safety Subcommittee
WG for Study on Supporting Radioactive Waste Regulation , Engineering WG for Returned LLW, Review WG for Clearance of Uranium
Decommissioning Safety Subcommittee
WG for Evaluation of Decommissioning Technology
Nuclear Safety Infrastructure Subcommittee
WG for Study of Safety Infrastructure
Study Group on the Way of Inspection
Radiation Safety Subcommittee

c Safety research

In fulfilling its regulatory administration, NISA makes use of the result of safety research, as it necessitates.

Safety research is necessary for NISA or JNES to implement the safety regulations appropriately. These examples are shown below:

- Planning and coordination of safety regulatory system
  - Research to coordinate the procedures for safety review, etc. by the

regulatory body in preparation to the establishment of the legal framework for safety regulations on high level radioactive waste disposal
  - Research to study regulatory measures for reducing exposure (collective dose) of radiation workers
- Establishment of technical approaches and methods for implementing safety regulatory actions
  - Acquisition of engineering knowledge necessary to prepare engineering manuals, guidelines, etc. used in approval of design and construction plan, welding inspection, pre-service inspection, periodic inspection, fitness-for-service assessment of equipment, etc.
- Acquisition of engineering knowledge necessary for decision making of safety regulatory actions
  - Study of off-shore ultrasonic survey, etc. to validate the seismic safety evaluation by the licensee of reactor operation
  - Acquisition of the data necessary to confirm validity during the safety review in adopting fuel, etc. using new design or materials by licensee of reactor operation
  - Study of engineering insights, etc. to evaluate validity of plant aging measurers, and acquisition of engineering data on aging degradation
  - Acquisition of data necessary for the confirmation by the regulatory body in cause analysis of accidents or troubles
- Establishment of the engineering Infrastructure required for regulations
  - Basic study and research to use the risk information in the safety regulations on nuclear installations and nuclear fuel cycle facilities
  - Collection and analysis of the information on accidents and troubles occurred in Japan and abroad, on their causes and on countermeasures
  - Investigation on trends of establishment and revision of foreign regulatory standards, acquisition and compilation of the evaluation data and examination of compilation of safety criteria of the international organizations such as IAEA

(6) Management system of NISA

NISA's staff is obliged to comply with the legislation and regulations as the staff of the Japanese government in accordance with the National Public Service Act. In consideration of importance of securing nuclear safety in protection of the public lives and property, NISA provides a strong commitment to its mission, scientific and reasonable judgments, transparency, neutrality and fairness as the code of conduct for the staff's activities.

For administration work, the Policy Planning and Coordination Division watches and assesses the performance of other divisions of NISA in discharging their duties, and takes timely remedial actions after consulting with the senior management. In order to improve the quality of regulatory activities, the development of the NISA Work Management System started in FY 2006, which was implemented from FY 2007. According to the NISA Work Management System, NISA including the Inspectors Offices sets the annual goals to serve as the in-house business goals. Since 2008, these goals have been released to public to allow the external evaluation and help contribute to performing work with consciousness to accomplishment. In addition, NISA makes a continuous effort to maintain the high quality of regulatory work through education and training of the personnel, international activities and the hearing of advice from experts such as members of the Nuclear and Industrial Safety Subcommittee.

2 Overview of the Integrated Regulatory Review Service

In June, 2007, the IRRS team of the International Atomic Energy Agency visited NISA. The objective was to confirm the compliance with the IAEA's safety standards, as in the conventional review, and, in addition to this, a wide range of political dialogue with the senior regulators from Member States on the regulatory concerns.
The IRRS team reviewed the following relevant areas:

- Legislative and governmental responsibilities
- Authority, responsibilities and functions of the regulatory body
- Organization of the regulatory body
- The authorization process
- Review and assessment; inspection and enforcement
- Inspection and enforcement
- The development of regulations and guides
- Management system for the regulatory body

The mission included a series of interviews and discussions with key personnel at NISA and at other organizations, and observation of an inspection at a nuclear power plant. NISA supplied a package of documentation and self-assessment in advance of the mission and the team presented its findings based on the IAEA safety standards. Additionally, the IRRS team, together with NISA staff, discussed policy issues relating to the regulation of nuclear safety. The results of the discussions will serve as a useful basis for the evolution of future IRRS missions and will assist with continuous improvement in the regulation of nuclear safety.
The IRRS Review Team noted the open, transparent and learning attitude of NISA staff throughout this mission, and it was evident that significant effort had been put into the preparation of the mission. During the review the

administrative and logistical support was excellent and the team was extended full cooperation in technical discussions with NISA personnel.
The IRRS Review Team appreciates and acknowledges NISA's participation in international cooperation activities and encourages NISA to continue its active role in the exchange of experience and expertise among regulators.
The IRRS team highlighted following three major findings:

1) Japan has a comprehensive national legal and governmental framework for nuclear safety in place; the current regulatory framework was recently amended and is continuing to evolve;
2) NISA as the regulatory body plays a major role for directing and coordinating the evolution of the regulatory framework;
3) Challenges have already been addressed to improve the relations among NISA, the nuclear industry and stakeholders in order to come with a better understanding and cooperation. Further work is underway.

The IRRS Review Team identified good practices and made recommendations and suggestions that indicate where improvements are necessary or desirable to further strengthen the effectiveness of regulatory oversight.
The IRRS report was issued in December, 2007 and is available on the METI's web site: http://www.meti.go.jp/press/20080314007/report.pdf
Taking into account the recommendations and the suggestions of the IRRS, the Basic Safety Policy Subcommittee of the Nuclear and Industrial Safety Subcommittee of Advisory Committee for Natural Resources and Energy (hereafter referred to as "ACNRE") proposed the issues to be addressed on the part of the regulatory body for the future. NISA has now been actively engaged in the realization of the proposal.
The IRRS follow up mission was initially to be invited in February, 2010. However, it was postponed because it would be more effective to receive their review after the suggestions of the Basic Safety Policy Subcommittee were implemented.

Article 8 (2) Status of the regulatory body

1 Position of NISA in the government

The Japanese government consists of 1 office and eleven ministries. Of them, the ministries involved in the nuclear safety regulation are the Ministry of Economy, Trade and Industry, the Ministry of Education, Culture, Sports, Science and Technology, the Ministry of Land, Infrastructure, Transport and Tourism and Ministry of Health, Labor and Welfare. The Atomic Energy Commission and the Nuclear Safety Commission established in the Cabinet Office are the independent organizations to supervise and audit the regulatory bodies set up in these Ministries.
Type of utilization of nuclear energy determines the ministry in charge: METI is in

charge of utilization of nuclear power as an energy source and MEXT is in charge of utilization of nuclear energy regarding research and development. The safety regulations are also provided by each ministry concerned. NISA of METI serves as the regulatory body of the power reactor facilities. Fig 8-3 shows the position of NISA in the Government.

Structures and roles of the Atomic Energy Commission and the Nuclear Safety Commission of the Cabinet Office are explained in Section 3 below.

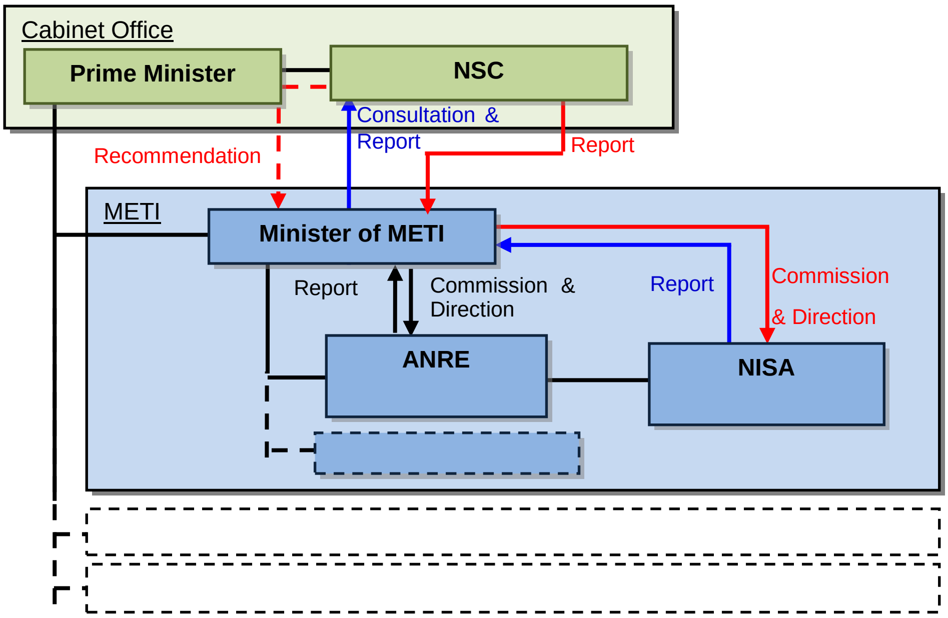


Fig. 8-3 Position of NISA in the Government

2 Establishment of effective separation

The Law for Establishment of the Ministry of Economy, Trade and Industry Law clearly stipulates that NISA is “the organization to ensure safety of nuclear energy,” and it is positioned as a special organization of ANRE of METI.

NISA has definitive authorities and functions for the safety regulation based on the provisions of the Reactor Regulation Act and the Electricity Business Act. The Minister of METI is responsible for the regulatory activities over the nuclear facilities such as the license for reactor installment pursuant to the Reactor Regulation Act, and the approval of construction plan and pre-service inspection pursuant to the Electricity Business Act. The Minister of METI commits these regulatory activities to NISA, which independently makes a decision or consults their proposed decision with the Minister of METI without involvement of ANRE. As NISA performs the safety regulation administrative work committed by the Minister of METI, and at the point of completion of safety review when NISA issues the license for reactor installment pursuant to the Reactor Regulation Act, they shall consult the review with the Atomic Energy Commission and the Nuclear Safety Commission. This means implementation of the safety regulation is supervised independently. NISA reports the

regulatory activities such as approval of construction plan and inspection on the facilities and safety activities to the Nuclear Safety Commission subsequently and also undergoes regulatory review implemented by the Nuclear Safety Commission.
The Nuclear Safety Commission is an organization established under the Cabinet Office, independent from the ministries and agencies involved in utilization of nuclear power. It has the authorities to supervise and audit the safety regulation implemented by the regulatory bodies from the independent perspective and make recommendation to the regulatory bodies via the Prime Minister, if necessary.

3 Nuclear related organizations of Cabinet Office

(1) Atomic Energy Commission

The Atomic Energy Commission was established under the Prime Minister's Office on January 1, 1956 to conduct national policy concerning research, development and utilization of nuclear energy in a planned manner and to ensure the democratic administration of the nuclear energy policy. (The AEC was transferred to the Cabinet Office on January 6, 2001.)
The AEC has duties of planning, deliberation, and decisions concerning:

1) preparation of the basic policies on research, development and utilization of nuclear energy,
2) planning of allocation of nuclear related expenses,
3) statements of views to the competent minister on application of permission criteria specified in the Reactor Regulation Act,
4) coordination of administrative work of research, development and utilization of nuclear energy of the related administrative agencies.

If the AEC deems it necessary as part of its assigned duties, on the basis of the Atomic Energy Basic Law and the Law for Establishment of the Atomic Energy Commission and the Nuclear Safety Commission, it may advise by way of the Prime Minister, and request reports and cooperation including the submission of materials, statements of viewpoint, and explanation from the heads of relevant administrative organizations. The Ministers of METI and MEXT, before issuing the license of nuclear related installations based on the Reactor Regulation Act (excluding nuclear fuel use facilities) shall receive views of the AEC with regard to the following items: (1) the nuclear installations will not be used for any purposes other than peaceful purposes, (2) the license will cause no hindrance to the planned development or utilization of nuclear energy, and (3) the applicant has an adequate financial basis to construct and maintain the nuclear installations.
The AEC has developed the Long-Term Program for Research, Development and Utilization of Nuclear Energy, which determined the basic nuclear policy in Japan, almost every five years since 1956. The title of the Long-Term Program for Research, Development and Utilization of Nuclear Energy was changed to the

“Framework for Nuclear Energy” in 2005, and the AEC compiled the basic objectives and concepts. (The Framework for Nuclear Energy was endorsed by the Cabinet in October, 2005.)

The AEC is composed of a chairman and four other commissioners appointed by the Prime Minister with the consent of the Diet. The Cabinet Nuclear Energy Policy Office assumes responsibility for the administration of the AEC coordinates the clerical work among the related administrative agencies and makes an effort to realize the decision made by the AEC.

The AEC may have experts to investigate and deliberate the special issues and set up the advisory committees, round-table conferences and other necessary organizations. Currently, five advisory committees have been established (Advisory Committee on the Evaluation of Framework for Nuclear Energy Policy, Advisory Committee on Nuclear Security, Advisory Committee on Research and Development, Advisory Committee on Nuclear Fusion and Special Committee on International Affairs) to deliberate the related matters. The members of committees are appointed by the Prime Minister out of those with the academic background pursuant to the Ordinance for Enforcement of the Law for Establishment of the Atomic Energy Commission and the Nuclear Safety Commission.

In principle, all deliberations including those in the advisory committees, subordinates under the AEC are open to public. The contents of the deliberations are provided to the public on the AEC’s web site (http://aec.go.jp/) or via Nuclear Energy Library, etc.

(2) Nuclear Safety Commission

The Atomic Energy Basic Act was partially revised on October 4, 1978 to establish the Nuclear Safety Commission under the Prime Minister’s Office. The NSC administers the function of safety regulation that had belonged to the AEC up until then, in order to strengthen the system of ensuring nuclear safety.

(Note: The NSC was transferred from the Prime Minister’s Office to the Cabinet Office due to central government reform on January 6, 2001.)

The NSC is responsible for planning, deliberation and decisions on matters that are related to ensuring safety of the research, development, and utilization of nuclear energy.

The NSC conducts its own review of the results of NISA’s (as commissioned by the Minister of METI) examination on the application for the license to install nuclear installations from the neutral view points of the experts:

(i) whether the applicant has technical competence necessary to install the nuclear facility and to perform reactor operation appropriately, and

(ii) whether the location, structure and equipment of the facility do not hinder prevention of hazards caused by nuclear fuel materials or a reactor.

The NSC reviews the regulatory activities conducted by the regulatory body subsequent to the licensing to install nuclear facilities in order to supervise and audit from view points of reasonableness, effectiveness and transparency. In doing so, the NSC encourages continuous improvement in quality, effectiveness and transparency.

Concerning the assigned duties, when the NSC deems necessary may make recommendation by way of the Prime Minister to the heads of relevant administrative organizations, and may request reports and ask cooperation including submission of materials, statements of viewpoint, and explanation to the heads of relevant administrative organizations. Since April 2003 (partially, from October 2003), the above functions have legally been enacted. The NSC may receive from NISA on the quarterly bases the following; reports on incidents and failures and reports on the conduct s of regulatory activities including approval of construction plan which is submitted after approval of a license to install nuclear facilities, Pre-service Inspection, Periodic Inspection, Periodic Safety Management Review, Safety Management Review on Welding, Approval of Operational Safety Program, implementation status of the Operational Safety Inspection. The NSC also has the authority to inquire directly of the licensees, and of the contractors of maintenance and/or check work in order to supervise and to audit the safety regulation implemented by regulatory bodies.

In the case of a violation of the safety regulations in any of nuclear facilities, the employee can directly allege the fact to the NSC, and it has the authority to investigate the allegation. The NSC is composed of five commissioners appointed by the Prime Minister with the consent of the Diet, and these commissioners elect a chairman among them. General affairs of the NSC are performed by the NSC Secretariat of the Cabinet Office. The NSC Secretariat is composed of the Secretary-General, the Management and Coordination Division, the Regulatory Guides and Review Division, the Radiation Protection and Accident Management Division and the Subsequent Regulation Review Division and has about 100 members of staff.

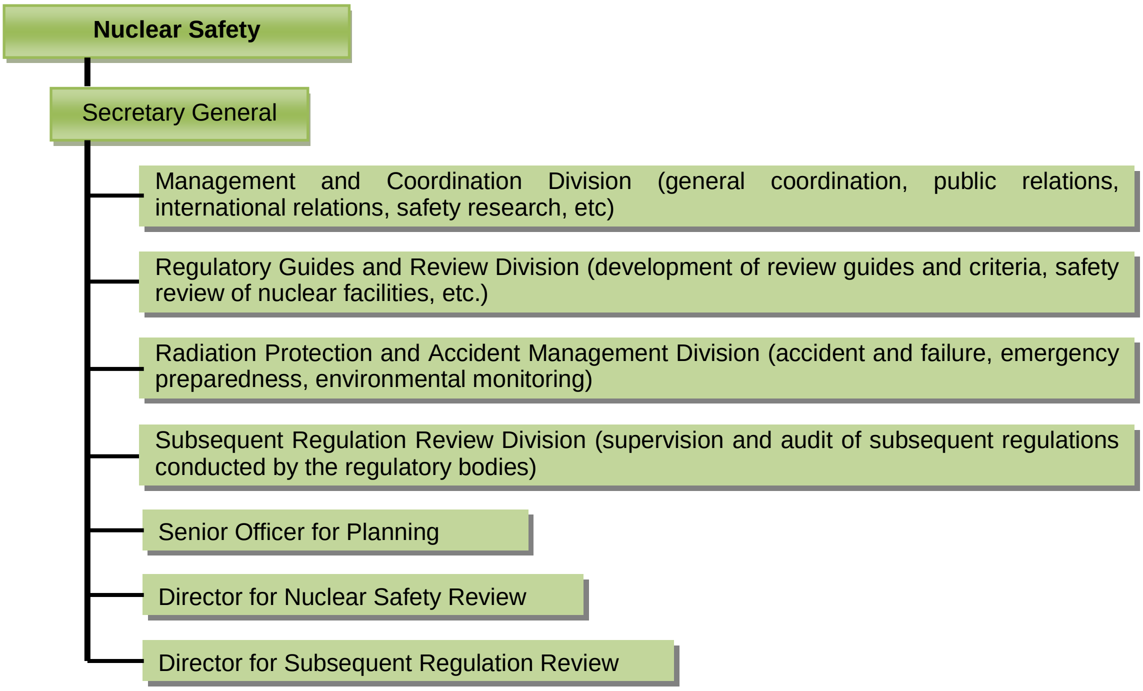


Fig. 8-4 Organization of the NSC

Under the NSC, two safety examination committees and fifteen special committees are organized as shown in Table 8-2. The Special Committees may organize working groups under them, if necessary. The members of the Committee on Examination of Reactor Safety and the Committee on Examination of Nuclear Fuel Safety are appointed from persons of knowledge and experience by the Prime Minister in accordance with the Law for Establishment of the Atomic Energy Commission and the Nuclear Safety Commission. The Emergency Technical Advisory Body is composed of the commissioners of the NSC and the commissioners on the Emergency Technical Advisory Body who are also appointed by the Prime Minister from persons of knowledge and experience.

Results of the investigation and evaluation by each review board and special committee are reported to the NSC and are deliberated by the NSC. Reflecting the results of the discussion in the Emergency Technical Advisory Body, the NSC determines the recommendation items for an emergency.

Deliberations of all committees, including the special committees and working group under the NSC are open to the public. The contents of the deliberations are provided to the public on its website (http://www.nsc.go.jp/) or via Nuclear Energy Library.

Table 8-2 Councils of the NSC

Safety Examination Committee
Committee on Examination of Reactor Safety
Committee on Examination of Nuclear Fuel Safety
Special Committee, etc.
Commissioner on the Emergency Technical Advisory Body
Special Committee for Nuclear Safety Standards and Guides
Special Committee on Analysis and Evaluation of Nuclear Accidents and Failures
Special Committee on Radioactive Waste and Decommissioning
Special Committee on Radiation Protection
Special Committee on Safe Transport of Radioactive Materials
Special Committee on Nuclear Disaster
Special Committee on Nuclear Safety Research
Special Committee on Safety Goals
Investigatory Advisory Board on Assessment of Seismic Safety
Project Team on Safety Survey of Reprocessing Facilities
Advisory Board on High-level Waste Repository Safety
Emergency Technical Advisory Body for Nuclear Disaster Prevention due to Armed Attacks
Emergency Technical Advisory Body for Disaster Prevention of Nuclear Carriers and Submarines
Emergency Technical Advisory Body

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 licensee meets its responsibility.

Overview of Article 9

In Japan, it is clearly stated in the Atomic Energy Basic Act that use of nuclear power shall be conducted in autonomic manner, and this principle serves as the basis for providing for responsibility of the licensee. The safety regulations are established as a mechanism to ensure this principle. The licensee fulfills its responsibility by complying with the safety regulations, while the regulatory body makes the licensee comply with the regulations to ensure that the licensee fulfills its responsibility. There is a mechanism to issue penalties to the licensee in case it violates the legislation or the order based on the legislation and regulations.

1 Prime responsibility for safety

Article 2 of the Atomic Energy Basic Act which establishes the most fundamental matters related to use of nuclear energy in Japan states that "the research, development and use of nuclear energy shall be limited to peaceful purposes, shall ensure priority to safety, and shall be conducted in autonomic manner under democratic administration, and the results obtained shall be made public and shall actively contribute to international cooperation." In pursuant to this provision, the prime responsibility for the peaceful use of nuclear power and ensuring safety rests with the licensee.

Furthermore, Article 14 of the Atomic Energy Basic Act provides that "those who attempt to construct reactors shall be subject to the regulations to be enforced by the Government as provided by other laws." More specifically, the licensee shall have a duty to conform to the regulations enforced by the Government. The regulations to be enforced by the Government are established by the Reactor Regulation Act and the Electricity Business Act.

2 Measures for the licensee to fulfill its duties

The licensee must comply with the relevant legislation and regulations so as to fulfill its prime responsibility for the safety of a nuclear installation. Various arrangements are undertaken for the licensee to fulfill its responsibility, which include promotion of the spirit of compliance through the education on operational safety, and activities aiming at further improving safety consciousness in a workplace for the purpose of ensuring the safety of a nuclear installation. Regulatory requirements and procedures for ensuring safety, established by the legislation and regulations, are provided in Article 17 to 19.

As an institutional mechanism which encourages the licensee to fulfill its responsibility, licensee is a primal entity for safety examination, inspection or related penalty based on the legislatives.

When the Minister of METI finds that the performance of the nuclear installation does not confirm with the stipulated technical standards or that the operation of a nuclear installation violates the regulatory requirements, he/she may order any licensee to designate a method for operating the reactors or order the necessary safety measures to be taken. When the licensee violates the order, the Minister of METI may rescind the permission of nuclear installation or specify a period not exceeding a year and order suspension of operation for that period imprisonment with work, a fine, or both shall be imposed on the basis of the provisions of Act, when violation such as installing nuclear reactor without permission is found. It is the same when the licensee does not obtain approval for the Operational Safety Program (the program which must be established by the licensee for the safety of a nuclear installation) from the Minister of METI before commencing operation of the reactors, when the licensee amends the Operational Safety Program without obtaining prior approval from the Minister of METI, or when the licensee or its employees do not comply with the Operational Safety Program. As mentioned above, a mechanism is provided to impose penalties on the licensee when it does not fulfill its responsibility.

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 facilities shall establish policies that give due priority to nuclear safety.

Overview of Article 10

In Japan, the regulatory authority and the licensee are respectively making efforts for fostering the attitude to put utmost priority to safety.

NISA has introduced the quality assurance into the operational safety activities conducted by the licensee. In addition, NISA has promoted activities to prevent degradation of organizational climate and to foster safety culture for the ultimate purpose of enhancing safety culture. During this reporting period, NISA has been preparing the guidelines for the root cause analysis of accidents and failures, and taking measures to thoroughly permeate the attitude of priority to safety.

The licensees make individual efforts as well as concerted industry-wide efforts.

1 Regulatory requirements for prioritizing safety

The provisions of the Reactor Regulation Act requires that the Operational Safety Program established by the licensee must provide for the matters related to the system for compliance to the relevant laws and Operational Safety Program, the system for fostering safety culture, and also the matters related to quality assurance in the operational safety activities. The requirement for quality assurance was introduced to the regulatory requirements by amending the Ministerial Ordinance for the Installation, Operation, etc. of Commercial Power Reactors enforced in November 2003 in response to the suggestion of the interim report prepared by the Study Group on the Way of Inspection in June 2002. On the other hand, the regulatory requirements related to the systems for compliance to relevant laws and Operational Safety Program and for fostering safety culture were established by amending the said Ministerial Ordinance in December 2007, in response to the order of the Minister of METI to conduct comprehensive check of electric power facilities in November 2006, which was issued after the incidents such as data falsification by a certain electric power company.

In Japan, prior to the above reform, a mechanism was constructed and has been implemented since January 2006 that the licensee must examine its efforts to prevent degradation of safety culture and organizational mind as part of its own quality assurance activities during the Periodic Safety Review which is conducted every 10 years as part of the operational safety activities, while the regulatory body must examine the efforts of the licensee for prioritizing safety during the process of the Approval Operational Safety Program and Operational Safety Inspection.

The report on the issues of the inspection system and future improvement policies, which NISA prepared based on the discussions at the Study Group on the Way of Inspections in September 2006, pointed out the necessity to prepare a guideline to evaluate the efforts of the licensee toward preventing degradation of safety culture and organizational mind during routine operational safety activities in the entire organization so as to reinforce the efforts for ensuring safety. NISA drew up the “Guideline for the Regulatory Authority to Evaluate Licensees' Efforts to Prevent Degradation of Safety Culture and Organizational Mind” in November 2007 in cooperation with JNES. This guideline is a compilation of perspectives and methods for the regulatory authority to understand and evaluate the routine efforts for developing safety culture and organizational mind in the safety operational activities of the licensee. It is used in the quarterly Operational Safety Inspections and the inspections carried out for the safety significant activities, and also in the compliance survey of the Operational Safety Program carried out outside the Operational Safety Inspection period.

This guideline adopted definition of safety culture from INSAG-4, and is prepared by referring to the concepts of degradation of safety culture of the IAEA (TECDOC-1321, 1329, INSAG-13, 15, Safety Report Series No. 11, No. 42 etc.) and OECD/NEA, paying attention to be in harmony with international standards.

This guideline presents 14 items as important factors of safety culture, which function as the viewpoints for evaluating the efforts for preventing degradation of safety culture and organizational mind in the routine operational safety activities. These are top management's commitment, senior management's clear policies and behavior, avoidance of incorrect decision-making process, consistently questioning attitude, reporting culture, good communication, accountability and transparency, compliance, learning organization, organization working on prevention of accidents and failures, self or 3rd party assessment, work management, alteration management and attitude and morale.

Efforts of the licensee are evaluated at each step as before start of evaluation, during evaluation and comprehensive evaluation periods. In the comprehensive evaluation period, the items considered to require enhanced efforts by the licensee are abstracted. Those items requiring further efforts are suggested to the licensee, while those efforts which should be encouraged as good practice are founded. It is confirmed at the subsequent Operational Safety Inspection whether the items requiring efforts are appropriately conducted.

2 Efforts of the NSC

(1) First-Series Roundtable Discussions on Safety Culture

The NSC, as one of measures taken after the JCO nuclear criticality accident occurred in September 1999, held the "First-Series Roundtable Discussions on Safety Culture" with unit managers and shift supervisors of twenty one (21) nuclear facilities in Japan from July 2001 to December 2003. The contents were compiled and published in a document "Site interviews about Safety Culture -Discussions on sites where the safety should be assured-"(January 2004). The summary is as follows;

- Opinions and comments proposed during the Roundtable Discussions on Safety Culture are summarized in three viewpoints, namely, "a viewpoint related to individual personnel's consciousness and awareness," "a viewpoint related to the organizational management," and "a viewpoint related to work activities (contents)", and it is necessary to appropriately address respective viewpoints.
- It is also important to focus on the external factors those may influence the safety culture (external environment). Those are "feelings/attitudes of the general public towards nuclear power," "media coverage of nuclear power," "relationship with residents/local governments around the site of a nuclear installation," "relationship with the regulatory bodies," and "electricity market".
- It is necessary to manage safety culture according to its state focusing on the above three viewpoints and the viewpoint related to the external influences so as to develop safety culture in a nuclear installation and to upgrade safety

culture to the healthier condition.

(2) Second-Series Roundtable Discussions on Safety Culture

The NSC held a series of “Roundtable Discussions on Safety Culture”, from October 2004 to April 2005, as one of the measures after the secondary system pipe rupture accident at the Mihama Power Station Unit 3 in August 2004, in order to exchange opinions with top managements of electric power companies and major contractors. The contents were compiled and published in a document "Fostering a Culture of Safety in Japan’s Nuclear Industry Exchange of Views with Top Management" (June 2005). The summary is as follows.

- Management safety consciousness and activities
  In the use of nuclear energy, everybody in the organization must share and practice the concept of “safety priority”, by constantly questioning whether the current practices of activities are appropriate from the viewpoint of ensuring safety. To this end, the top management should take leadership in such areas as organizational composition, resource allocation, quality assurance system, technology, human resources and training.
- Productive communications between site staff and upper management
  To give substantial significance to safety-ensuring activities, it is crucial that safety-related information permeates throughout the organization smoothly, and that a system and means be provided to enable it. With full awareness of the difficulties involved in creating smooth communications, management must constantly and intentionally motivate their staff to improve the situation by ensuring the bi-directional information channels, and appropriate and timely remedial actions.
- Workplace environment
  Regulators and licensees must continue to make bilateral efforts to improve the effectiveness of regulatory activities for productively improving safety assurance, without being content with the formalities in meeting regulatory standards in effect. It is necessary that the management of licensees and contractors will maintain and promote a thoroughgoing cooperative relationship, while sharing a strong perception that ensuring safety is the prerequisite to everything else in nuclear activities, and that it be the most efficient means of cost optimization.

3 Licensee’s measures for priority to safety

(1) Efforts of the licensee

All licensees have declared their principles to give due priority to nuclear safety at nuclear installations, and have tried hard to improve not only in the safety culture but also the corporate ethics or quality assurance. Under the policy to give priority to safety, each licensee constructed a system so that the top management participates in ensuring safety under his direct responsibility. The causes of data falsification occurred under such circumstances were that efforts by the licensees were not pervading thoroughly to the work fronts, and the support by top managements and managers were insufficient to lighten a burden of site staff. After discussing about the prevention of recurrence at the “Reliability Recovery Committee” of the Federation of Electric Power Companies, which is an electricity industry group, the electric power companies reexamined the action agenda of the Federation. Also in May 2007, it presented an action plan for prevention of recurrence to NISA, which includes participation of the top management, thoroughness of training and education of personnel, enhancement of sharing safety information, and this started the reconstruction and fixing of the safety culture.

The licensee incorporates the priority to safety policy to its management system as a basic principle of the operational safety activities of a nuclear installation. The activities aimed at priority to safety at the sites of a nuclear installation are deeply related to the operational safety activities such as human error prevention activities. Therefore, these operational safety activities are integrated into the management system, and subject to planning, monitoring/surveillance, evaluation and continuous improvement.

Specifically, the licensees share information and inculcate the attitude of priority to safety at work through the efforts to learn from the past failures, and training for anticipating risks associated with diverse works. For example, Chubu Electric Power Co.,Inc. built a “Corridor for Learning from Failures” in the training facility at Hamaoka Nuclear Power Station. In this space, along with the panels describing summaries of accidents and troubles, actual items and models, messages from the personnel who addressed the troubles, and newspaper articles at the time are on display and effectively used for personnel training so that lessons learned from the past accidents and troubles and the accumulated technical know-how are handed down without being forgotten. These efforts of each licensee are based on sharing of the in-house operating experiences. Sharing of operating experiences among the licensees is reported in Article 19.

Corridor for learning from failures
（Provided by Chubu Electric Power）

(2) Policies of the whole nuclear industry

The Japan Atomic Industrial Forum Inc., consisting of about 480 business operators including manufacturers who are directly or indirectly engaged in the nuclear business, established a "Charter for Safety by Nuclear Power Industry" composing of the following five articles in October 2006 for every person engaged in the nuclear industry to have a sense of pride and a sense of responsibility, to raise the consciousness of “not causing any accident by any means”, and to establish the safety by taking action in order to be trusted by society with public confidence.

Article 1 We have a sense of responsibility and an awareness of its duty, and we give the priority to ensuring safety over all, no matter what it may be in what status.

Article 2 We aim at thoroughness of safety measures by learning modesty from past faults and sharing safety information.

Article 3 We make effort to develop good working environments, where matters perceived to be unsafe can be discussed at any time, are produced.

Article 4 We always keep a "questioning attitude", without being self-conceited with good safety achievements.

Article 5 We positively release error information as well as we listen sincerely to the voice of society.

The top managements of all organizations are obligated to take necessary measures so that the "Charter" penetrates to the all fronts of each organization, and is practiced positively as an autonomous and continuous effort, and is aimed to the long-term continuation of safety achievement. The Japan Atomic Industrial Forum Inc. has performed activities to promote the establishment of the Charter by the President’s visit to local governments by the President, visiting members’ offices to explain the Charter, the presentation of each member's independent efforts at the member's liaison councils, etc.

In April 2005, the nuclear industry established the Japan Nuclear Technology Institute (JANTI), as a new entity that amasses the combined strength of the entire nuclear industry, by integrating and restructuring the functions of the Nuclear Information Center of the Central Research Institute of Electric Power Industry and "Nuclear Safety Network (NS Net)". JANTI inherited the activities of the above organizations and is provided with the function to develop and promote industry standards. JANTI promotes development of technological infrastructure based on the scientific and rational data, tries to utilize the infrastructure in a wide range of relevant organizations, and helps enhancing the nuclear industry’s voluntary safety activities. In the mean time, JANTI exercises a check function from an independent, objective and third-party point of view. JANTI set up a council consisting of third persons and makes an attempt to disclose information for upgrading transparency of organizational operation. The activities of this association are as follows:

a Safety culture dissemination activities

Seminars concerning safety and lecture meetings or opinion exchange meetings concerning safety for members including reactor operators, fuel manufacturers, plant vendors, etc. are held. E-learning materials and brochures for member companies’ staff to learn about safety culture are produced and distributed to the

members.
Information gathered by investigation of domestic and international movements is utilized for enhancing safety culture.

b Peer review activities

Peer reviews are periodically conducted for reactor operators, fuel manufacturers, plant vendors, etc., according to the business form. Conducting peer reviews focusing on site observations, in cooperation with the Institute of Nuclear Power Operations (INPO) who has abundant peer review achievements in the U.S. and the World Association of Nuclear Operators (WANO) who conducts the international peer reviews, and thus supporting the operations of the members by extract good practices and suggestions for improvement with taking account of the operational experiences over the world. Moreover, JANTI makes efforts to obtain good foreign practices and to make an international contribution, by dispatching personnel to the peer reviews of WANO and OSART of the IAEA.

c Gathering, analysis and utilization of operating experiences

Gathering, analyzing and utilizing operating experiences by inheriting and further enhancing the activities at the Nuclear Information Center of the Central Research Institute of Electric Power Industry, utilizing the nuclear power public information library "NUCIA" and overseas operating experiences, making suggestions based on the analysis results, and utilizing the obtained information for operation management and maintenance activities.
Extending cooperation and support for voluntary safety activities of reactor operators concerning quality management system, and enhancing and disseminating the root cause analysis to reactor operators, fuel manufacturers, plant vendors and reactor operators' group companies.

d Safety culture assessment activities

Questionnaire investigations and interviews to the employees of reactor operators, etc. are conducted as external assessment concerning the status of the safety culture of the members. The results obtained are sorted out and analyzed according to the seven principles of safety culture advocated by JANTI, and offered to the members to help support their voluntary activities for fostering safety culture.

4 Priority to safety at the regulatory authority

Staff of NISA is government employees, and they must work for public interest as servants for the entire nation in conformity with the National Public Service Act. They are also obliged to devote themselves to their tasks and to keep secrecy under the fundamental principles that government employees must make every possible effort to carry out their tasks. Violation of the said act is subject to punishment. In addition to the basic law-abiding system for government employees, NISA establishes the following code of conduct for raising the staff's morale for ensuring safety based on the recognition that ensuring safety of nuclear installations is their primary task:

- Execute one's tasks with a sense of tension based on the strong sense of mission
- Comprehend real situation of a workplace as an expert of safety and security administration, and act under scientific and rational judgment
- Ensure transparency in execution of tasks, promote information disclosure, and achieve accountability in order to gain trust of the nation.
- Make neutral and fair judgment as the safety regulation authority

NISA also provides for instructions for inspectors who work at the sites of nuclear installations so as to reinforce consciousness for priority to safety by keeping every inspector informed of the above code of conduct and the indices related to indication of safety culture degradation of cited from INSAG-14.

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 facility 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 facility, throughout its life.

Overview of Article 11

The regulatory authority confirms the financial resources of the licensee for ensuring safety, or for conducting necessary improvement in establishing and operating a nuclear installation in the process of safety examination for the permission of reactor installment license. The licensee is required to reserve internal resource for decommissioning so that smooth transition to decommissioning stage can be made when operation of a nuclear installation is terminated. Funding for reprocessing of spent fuel generated from a nuclear installation and disposal of high-level radioactive waste generated from reprocessing is also required. Thus, financial measures are taken so that no trouble shall occur in any phase of utilizing nuclear energy.

The licensee is also required to ensure human resources with necessary knowledge and skills for operation of a nuclear installation. A chief engineer of reactors must also be designated as an individual who is responsible for operational safety administration.

While educational institutes play an important role in human resource development, additional efforts are also being made including recent establishment of professional graduate schools specialized in nuclear energy.

Article 11 (1) Financial resources

One of the criteria for the permission stipulated in the Reactor Regulation Act requires that the applicant of reactor installment license shall have necessary financial basis for reactor installment. When applying for the reactor installment license, the applicant must prove that it has sufficient financial basis by attachment of application document and other sources to the application document so as to prove its financial basis. In turn, the regulatory authority examines if the applicant has necessary financial basis for reactor installment in the safety examination process for permission of reactor installment license.

Concerning the provision of financial resources required for decommissioning of a nuclear installation, and management of spent fuel and radioactive wastes, appropriate mechanism is respectively prepared.

In order to provide for decommissioning, electric companies deposit funds covering expenses for dismantling and removal of power reactors and expenses for the treatment and disposal of the waste generated from decommissioning, based on the Ministerial Ordinance concerning Reserve Fund for Dismantling Nuclear Power Facilities, established by the Minister of METI, in pursuant to the provisions of the Electricity Business Act. It is stipulated that electric companies must obtain approval of the Minister of METI by the end of every fiscal year, for the estimated total cost required for dismantling of each nuclear power generation facility. The balance of the reserved fund as of the end of March 2010 was approximately 1trillion 2 hundred billion yen.

Concerning the spent fuel management, electric companies reserve the fund in the administrative agency designated by the Minister of METI, at the time of generating power, based on the “Act for Deposit and Management of the Reserve Funds for Reprocessing of Spent Fuel from Nuclear Power Generation”, which came into effect in May 2005. It is provided that the amount of reserve fund for spent fuel reprocessing and so forth shall be the amount which is calculated by the Minister of METI and notified for each licensee, in accordance with the criteria defined by the Ministerial Ordinance of METI, based on the situation of spent fuel generation accompanied with operation of commercial power reactors, capacity of reprocessing and availability of a reprocessing facility, and expenses required for reprocessing and various other items. It is also provided that the Minister of METI can notify the amendment of the above-mentioned amount of money in case significant change of situation can be confirmed which include significant change of the amount of spent fuel generation. The fund reserved for spent fuel reprocessing amounted to approximately 2 trillion 1 hundred billion yen as of the end of March 2010.

With regard to high-level radioactive waste and long-lived low-heat generation radioactive waste (TRU waste), generated in the process of reprocessing, the Specific Radioactive Waste Final Disposal Act stipulates that the amount of fund shall be the amount of money required for final disposal work per unit quantity of high level radioactive waste, etc., multiplied by the amount of high level radioactive waste and that the necessary amount of money required for final disposal work per unit quantity shall be defined by the Ministerial Ordinance of METI based on the total expenses required for final disposal work and the total amount of high level radioactive waste subject to final disposal. A system has been developed for the Minister of METI to appropriately evaluate the amount of the reserve fund. The reserve fund for final disposal of high-level radioactive waste and so forth generated during reprocessing of spent fuel has been deposited in the administrative agency designated by the Minister of METI, and amounted to approximated 750 billion yen as of the end of March 2010.

The reserve fund for decommissioning shall be deposited by each electric company as its internal reserve because the fund is allocated for dismantling and removal of nuclear installations owned by electric companies. On the other hand, the services related to spent fuel management and final disposal of high-level radioactive waste generated from reprocessing are provided by the licensees of reprocessing activities and spent fuel management activity, which are different juridical persons from electric companies. Therefore, the reserve fund shall be deposited not in the internal reserve of electric companies, but in the administrative agency. There is a mechanism which prohibits reversal of the internal reserve and deposited reserve by legislation, and so the fund cannot be used except for its original purpose. Moreover, the Minister of METI can conduct on-site inspection for electric companies and the administrative agency by law, and a system is provided to evaluate appropriateness of the amount of money and the situation of the reserve fund.

Thus in Japan, when a nuclear installation is installed, it is confirmed that sufficient financial basis are available for the licensee to operate the nuclear installation safely and appropriately throughout its operating life, and the system for depositing the fund for decommissioning and for spent fuel and radioactive waste management during service life of the installation is legislated. Therefore, the provision of financial resources required by this article is satisfied.

Article 11 (2) Human resources

1 Regulatory requirements for human resources for operation of nuclear installation

The competent minister confirms that the licensee has sufficient technical competence to install and appropriately operate a nuclear installation when permitting to install a nuclear installation. The minister also consults the NSC for a license applicant's technical competence when giving permission to installing a nuclear installation.

The NSC established the Regulatory Guide for Examini9ng Technical Competence of License Holder of Nuclear Power in May 2004, and based on which it investigates and examines the applicant's technical competence for the following items and reports to the Minister of METI:

The examination items of technical competence;

- Organization for design and construction,
- Ensuring engineers for design and construction,
- Experience related to design and construction,
- Quality assurance activities concerning design and construction,

- Organization for operation and maintenance,
- Ensuring engineers for operation and maintenance
- Experience related to operation and maintenance,
- Quality assurance activities concerning operation and maintenance,
- Education and training for engineers,
- Designation and staffing of qualified personnel etc.

The Reactor Regulation Act stipulates that the licensee must take the operational safety measures and must establish the Operational Safety Program and its approval by the Minister of METI before commissioning of a nuclear installation.
The operational safety measures include that the licensee must assign those who have knowledge required for reactor operation to perform operation, that the licensee must not operate a reactor unless there is sufficient number of personnel required for operation, and that the person responsible for operation must be those who have necessary knowledge, skills and experience required for operation of reactors, and who satisfy requirements provided by the Minister of METI, and also that the methods and other means to judge if the persons satisfy the concerned requirements must be confirmed by the Minister of METI. These are the regulatory requirements for appropriate personnel assignment and qualification of on-site technicians. In addition, it is stipulated in the ministerial ordinance that the licensees must specify implementation policy and contents of education on operational safety of personnel in charge of operation and administration of a nuclear installation in the Operational Safety Program. NISA examines the licensees' situation of compliance to the Operational Safety Program four times a year, and confirms that the appropriate education and training is performed. Moreover, the licensees are obliged by law to appoint a Chief Engineer of Reactor to supervise safety operation of nuclear installation, a Chief Electrical Engineer and a Chief Engineer of Boiler and Turbine to supervise safety during construction, operation and maintenance of electric facilities. The licensees are responsible for ensuring safety of the decommissioning of nuclear installations and for securing sufficient personnel to safely carry out decommissioning.

2 Personnel for operation of nuclear installations

(1) Training of personnel involved in operation and maintenance of nuclear installations

The licensees continuously prepare the training plan for operation staffs, and carry out education and training programs so as to ensure sufficient number of personnel, and maintain and improve their skills and capabilities systematically for a long-term. With regard to operation of nuclear installations, the licensees establish their own standards for the skills required for personnel such as operation staff and maintenance staff. There is no established method to analyze necessity of training because the training for these personnel is performed in accordance with the training plan. On the other hand, when a manager such as a shift supervisor considers that training is necessary for particular personnel judging from the condition of daily work performance, or when personnel do not receive training required for performing intended work, it is flexibly decided if training is necessary or not.

Trainings of operators are carried out in the operator training facilities owned by the licensees when the operation staffs are not involved in shift work. Each licensee owns an operator training facility on site or in the vicinity of power station, and many of them are equipped with a full-scale simulator. A full-scale simulator is an essential training facility for operation staffs as it reproduces an actual control room where the operating staff operates the reactor. The instructors who govern the simulator training are chosen from those personnel who have a lot of experience in operation of nuclear installations, and contribute to performing effective simulator training.

Simulator for ABWR operation
(Source: BTC)

In addition, BWR and PWR operation staffs are periodically dispatched to the BWR Operator Training Center (BTC) or the Nuclear Power Training Center (NTC) respectively for intensive re-training. These training centers offer curriculum according to the capabilities of participating operation staffs.

For maintenance staffs, each licensee has established maintenance training centers for education and training of maintenance personnel. Various mock-up devices, inspection devices and training devices, etc., simulating plant facilities for training purposes, have been used to maintain and improve the knowledge, skills and work management capabilities of personnel involved in maintenance and inspection. Maintenance skill training is also provided through maintenance work using real plant facilities, which, effectively combined with training at the dedicated training centers, helps promote the skills to be maintained, improved and handed down.

Maintenance work of control rod drive mechanism at the reactor lower head (Source: Chubu Electric Power Co.,Inc.)

(2) Feedback of safety assessment to training

Licensees have performed various safety analyses in the process of operating nuclear installations, and accumulated operating experiences. The knowledge acquired through these analyses and experiences is utilized for safe operation of nuclear installations. The unique operational feedback training in Japan is the training of how to respond to major earthquakes. Niigata-ken Chuetsu-oki Earthquake in July 2007 affected the Kashiwazaki Kariwa Nuclear Power Station. Operating condition was reproduced based on the data of reactor behavior during the earthquake, and utilized in the simulator training of operation staffs at the BWR Operator Training Center.

Thus, the licensees have established a mechanism to accumulate knowledge by taking various opportunities and to utilize it in training.

(3) Personnel required for operation of nuclear installations

Ministerial Ordinance for the Installation, Operation, etc. of Commercial Power Reactors requires the licensees to ensure personnel necessary for safety operation of nuclear installations.

The licensees are responsible for appointing Chief Engineer of Reactors per nuclear power station and for authorizing them to be in charge of operational safety administration. A Chief Engineer of Reactors is a national qualification, and the licensees select from the candidates who have passed the written and oral examination conducted by the National Government.

Concerning the Chief Operation Staff, who is assigned at every nuclear installation, conditions related to experience, knowledge and position are defined in the rules of standards, etc. of the Chief Operation Staff (Notice of METI). The licensees must obtain confirmation of the Minister of METI regarding the method of judging conformity to these standards, system of implementing judgment, term of validity for conformity judgment, and procedure of renewal.

The quantity and quality of personnel required as operating staffs of nuclear installations, other than those who should act as administrator in operating nuclear installations, varies depending on the design of each nuclear installation and the skills needed for each operational action. Therefore, evaluation means cannot be decided in a single uniform way. Each licensee defines appropriate evaluation means taking into consideration characteristics of its installation. Every licensee has introduced some form of skill accreditation system which involves operation test, and thus tried to ensure sufficient skills of operation staff.

Table 11-1 Examples of operation simulator training course (The Kansai Electric Power Co., Inc.)

<table>
<tr><th>Training Course</th><th>Intended personnel</th><th>Purpose</th><th>Number of days</th></tr>
<tr><td>Main equipment operator course</td><td>Turbine operators</td><td>Skill improvement of turbine operators</td><td>3 days x once /year</td></tr>
<tr><td>Initial training course</td><td>Reactor control operators, Turbine operators</td><td>Development of reactor control operators</td><td>40 days x once</td></tr>
<tr><td>Control room operators course</td><td>Reactor control operators</td><td>Skill improvement of reactor control operators</td><td rowspan="2">5 days x twice /year</td></tr>
<tr><td>Supervisors course</td><td>Shift supervisors Shift foreman, Chief shift crew</td><td>Reinforcement of ability to judge and improvement of leadership of supervisors</td></tr>
<tr><td>Team work training course</td><td>Operation team</td><td>Reinforcement of responsive action and cooperation, and maintenance and improvement of teamwork of an operation team as a whole</td><td>2 days x 3 times /year</td></tr>
<tr><td>Reiteration drill course</td><td>Operation team</td><td>Follow up of an operation team and each operator.</td><td>1 day x once/year</td></tr>
</table>

(4) Administration of contract workers

Contract workers are essential in complementing and supporting the licensee's personnel in operation and maintenance of a nuclear installation, and it is extremely important for the licensee to administrate the quality of the contract workers in order to ensure safety. The licensee defines how to assure quality of the services it procures in its work management system, and requires the contractors to satisfy quality standards in the terms of contract. In other words, the policies and principles related to administration of contract workers are clarified in each contract.

For example, if the work requires national qualification, accreditation of contract workers can be confirmed by possession of the concerned national qualification. The individuals who work in a nuclear installation are, regardless of being a contract worker or not, required to receive equivalent education on operational safety as the licensee's personnel, and to be familiar to the rules for operational safety of the nuclear installation. The licensees establish the curriculum for operational safety education and number of hours of educational courses on the basis of the Operational Safety Program, and one cannot be engaged in the work in the nuclear installation without receiving the education on operational safety.

3 Human resource development in nuclear fields

(1) Efforts by the National Government

The Ministry of Education, Culture, Sports, Science and Technology established a technical discipline for nuclear and radiation technology as Professional Engineers in 2004 fiscal year, for the purpose of upgrading the skills of engineers in nuclear technology fields, utilizing their ability in nuclear safety regulation fields, and further strengthening safety management system in each entity. The Professional Engineers System is to accredit competent engineers with technical expertise related to scientific technology, and high level of practical ability and abundant experience in profession, and also with high level of engineers' ethics. Since the Professional Engineers of Nuclear and Radiation Technology was established, qualifying test is conducted every year, and as a result, the number of nuclear engineers who obtain this qualification is increasing, and thus the new system has contributed to development of human resources in nuclear fields.

(2) Efforts by the nuclear industry

Facing a crucial period that the first generation experts who had made experiences in commissioning test, operation, maintenance, and trouble shooting in abnormal events are in the age of retirement, the nuclear industry recognizes the vital task of ensuring experienced human resources and succession of expertise and technology which is challenged by the gap between generations. In order to accomplish the task, the nuclear industry has been carrying out the following activities:

- Training of on-site technicians and succession of skills

There are examples that the training for qualification, training of practical skills for maintenance, OJT training at the power station, etc. are implemented beyond the frame of an individual company.

- Study on qualification and certification system by private sectors

For the purposes of improved skills of maintenance workers, appropriate staffing, and ensuring future human-resources, the common standards and qualification / certification procedures for objective evaluation of skill level are being studied.

- Acquisition of advanced expertise

Licensees' engineers acquire the education in the graduate schools related to the nuclear energy, thus engineering specialists with advanced expertise are fostered.

(3) Efforts by Universities and Research Institutes

In Japan, importance of nuclear education is re-acknowledged in terms of ensuring human resources in the nuclear field. Thus the faculty, graduate school and professional school have been established for the purpose of training for engineering specialists with practical capabilities and engineering theories in the nuclear field. Moreover, since 2007, MEXT and METI have been carrying out the nuclear human resource development program, focusing on the development of basic nuclear education and study in the universities, graduate schools, and specialized vocational schools, assistance of educational activities including enhancement of internship and development of core curriculum of nuclear studies, and support of research activities in the field of basic and fundamental technologies which underpin the nuclear power in terms of steering succession of researches. In addition, some research organizations and graduate schools incorporate a cooperation system of graduate schools. Through the system, the facilities/equipment and human resources in the research organizations are shared, the contents of education/study at the graduate school become more advanced, the communication between researchers is promoted, and the education at graduate schools is activated. The Atomic Energy Society of Japan has founded a senior network (SNW) whose members are retired employees from nuclear related organizations. SNW promotes dialogues with college students and other activities to make succession of nuclear technologies to young engineers and students who are responsible for next generation and to spread correct understanding of the nuclear energy.

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.

Overview of Article 12

In Japan, consideration for human factors is incorporated in design and operation management of nuclear installations as a factor to ensure safety. NISA establishes regulatory requirements and confirms that they are met through reviews and inspections.

Licensees of reactor operation address not only the hardware side of a nuclear installation such as use of fail-safe concepts or interlock systems, but also make efforts to improve man-machine interface by means of such as introduction of instruments which allow easier visual confirmation. In addition, licensees of reactor operation are improving operation procedures, and provide training for their staff.

1 Regulatory requirements and policies related to human factors

The Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities requires that “the nuclear installation be designed to reflect appropriate preventive considerations against operators’ misoperation”, and its explanatory document requires that “In designing, attention should be given in consideration of ergonomics-oriented factors, to panel layout, operability of operating devices, valves, etc., instrument and alarm indication for accurate and quick recognition of reactor status and prevention of errors during maintenance and check,” and that in designing, measures should be taken so that necessary safety function is maintained without operator’s actions for a certain length after the occurrence of an abnormal condition.

The guide also requires that control room be designed that the situation of operations and principal parameters of reactor and principal related facilities can be monitored and that prompt manual control can be performed, whenever required, to maintain safety.”

In conformity to these requirements, the Regulatory Guide for Reviewing Safety Assessment of Light Water Nuclear Power Reactor Facilities requires that safety analysis be performed in consideration of the following: in case that operator actions are expected at the occurrence of abnormal situations, sufficient time and adequate information be available so that operator may be able to properly judge the situations and take necessary acts with a high degree of confidence.

The Nuclear and Industrial Safety Agency (NISA) uses “Manual for evaluation of human factors in the main control room”, prepared by the Japan Nuclear Energy Safety Organization (JNES) under NISA’s direction, to confirm that these requirements are reflected in the design.

At the Approval of Construction Plan, the Technical Standards as a performance code under the Electricity Business Act request that the main equipment necessary for safe operation of nuclear installation can be monitored at a glance and necessary actions can be taken in the control room without any operational errors.

NISA, with the technical assistance of JNES, clarified the requirements for prevention of operational errors, so that the above mentioned performance code is reflected on the specification code developed as an academic society and association standard. These requirements are shown on Table 12-1.

Table 12-1 Requirements to prevent misoperation in a main control room

Item	Requirements
Environmental conditions of a main control room	Main control room should be in comfortable environmental conditions taking into consideration temperature, lighting and noise so that operators can operate appropriately.
Arrangement and working space of a main control room	(1) Consider that the following to avoid too much burden to operator in any of plant operating conditions. ● Functional allocation between human and machines shall be defined. ● Items that should be intensively supervised and operated in a main control room shall be defined, and clearly discriminated against the functionally allocated among local panels including the vertical back panels installed at the main control room. ● The equipment arrangement shall be designed so that effective information sharing among operators to be expedited. (2) When manual operation is required in an abnormal condition, for plant safety, the operations shall be defined in due consideration of operators' monitoring capability and operability.
Arrangement of devices on control panels	Alarm, display and control devices which are installed on control panels shall be arranged with systematic display so that operator's operational or cognitive error can be prevented.
Display system (including alarm system)	(1) Information function ● Information that displays status of plant system or equipment which is necessary for ensuring safety shall be all included and shall be provided to operators in such a way to be easily understood at suitable position. ● It should be considered that communication defect or judgment error should not arise concerning communication and cooperation with on site emergency station. ● Safety significant information should be displayed in the position where all operators of control room may recognize such information at the same time. (2) Alarm function When an anomaly arises in the plant equipment or process, it shall be noticeable to operators so that suitable action can be made by operators. (3) Operation support When an operation support system is provided, even when the system function is lost, plant facilities should be operable safely.
Control function	(1) The control equipment shall be easy to operate so that operational error becomes as fewl as possible. (2) Systems or equipment controlled from a control room should be designed so that the unsafe operation which may impair plant safety is impossible. (3) During an automatic operation, operators should be able to check the progress of the automatic operation.

With regard to operational safety activities by licensee of reactor operation aiming for the remedy to the factors causing human errors, NISA, in cooperation with JNES, established a guideline for the regulatory body to evaluate the licensee's self-controlled efforts for correcting non-conformance etc., related to direct cause of human errors in February 2008. This guideline presents four viewpoints in terms of evaluation; these are, the viewpoint to confirm the mechanism of the self-controlled efforts, the viewpoint to confirm specific contents of efforts related to individual events, the viewpoint to confirm specific contents of efforts for collection and analysis of data and for the utilization of them as appropriate, and the viewpoint to further promote the licensees' self-controlled efforts. This guideline is used when the licensees' efforts are evaluated during operational safety inspection.

Moreover, NISA instructs the licensees of reactor operation to feedback the countermeasures against human errors to other nuclear installations when itiis necessary. JNES analyzes the human error events in detail and identifies items to be reflected in the safety regulations, compiles them in the collection of lessons learned, and stores them in the database.

2 Considerations in design

Licensees of reactor operation take following considerations on human factors in designing a central control room.

The central control room is designed so that operating conditions of the reactor and other important equipment and principal plant parameters can be monitored at a glance and necessary actions can be taken in the room during normal operation and abnormal transients, and in an accident of a nuclear installation. For example, advanced BWRs (ABWRs) and the latest PWRs are designed by re-examining the instrument layout and applying computer technologies, and also by adopting advanced central control panels, which are improved in visual confirmation capability with higher operability and parameter monitoring. Moreover, a large display screen, which is easy to overlook power station status at a glance and to share information among operators, offers increased opportunity for preventing errors and taking corrective actions.

When remodeling control panels in the central control rooms of existing nuclear installations, extensive use of CRTs has improved monitoring capability and operability of control panels. For digitalized main control panels, JEAG 4615-2005, "Guide for Development and Design of Computerized Human Machine Interface in the Main Control Rooms of Nuclear Power Plants" was established by the Japan Electric Association as one of the academic society and association design standards. This guide refers to related international standards and overseas requirements, and as well it incorporates the Japanese regulatory requirements and the results of design development etc. that reflected latest technical progresses and the operational experiences This guide also defines requirements on functions and designs of the central control room (information display, control and operation equipment, alarm devices etc.) and standardized development and design processes of the human machine interface.

3 Considerations in operation management

Licensees of reactor operation perform appropriate operation management during normal operation and in accidents in order to operate nuclear installations in a safe and stable manner for a long time.

(1) Operational management

a Organizations for operation

The manager of power generation division, who is responsible for the operation of a nuclear installation, controls operating shifts in charge of the operation and their supporting groups.

The shift supervisors have authority and responsibilities to take measures required for ensuring safety. They shall be selected from those who conform to the criterion specified by the Minister of METI, and have suitable experiences and suitable competence.

b Shift of operators

Operators work in shifts as nuclear installations are operating continuously for 24 hours/day. Work plan is formulated in such a manner that a part of the operation team who works on shift can leave the operation shift for a certain period of time in order to attend education and training courses. In this way, operators receive regular training, and thus maintain and improve their capability.

When turning over shift duties, the shift supervisor is required to make sure to pass on the supervisor logbook, keys, and precise description of operations to the succeeding supervisor. Each operating staff also transfers information of plant operation to the succeeding operating staff.

c Operation manuals

The licensees of reactor operation prepare operation manuals which cover operational actions not only under normal operation, but also at the time of accidents and failures so as to maintain safety of power stations. These operation manuals reflect experiences of accidents and failures, and modification of equipment as appropriate, so that operators can reliably perform their tasks. Symptom-based manuals for multiple failures are prepared in addition to scenario-based manuals for design basis events. The symptom-based manuals enable prevention of accident progression without identifying the type of the event.

The licensees of reactor operation also prepared the manuals addressing severe accidents exceeding design basis events, and accident management guidelines for the staff group supporting shift operators in case of accidents and failures. The effectiveness of these manuals is verified by comparison with the results of the analysis of plant transient by the analysis code used in the application for licensing for installment, and also probabilistic safety assessment results. Moreover, operational action training on the basis of symptom-based procedures is conducted using simulators at the operator training facility aiming that operators become proficient in using manuals. Preparation of the manuals for emergency situation is expected to be effective for mitigation of operators’ stress in an emergency.

(2) Maintenance management system

The maintenance department of a licensee of reactor operation controls the work of periodic check, modification works, etc. of a nuclear installation carried out by the plant manufacturer and many affiliated companies. A majority of human errors in the past occurred in the works associated with maintenance and repair works, which means that the maintenance management by the licensee is very important.

When conducting modification works, scope of work, scope of responsibility and authority is clarified so as to assure that the work is performed safely and reliably. Also maintenance of important equipment is carried out with a prior mock-up test, as appropriate.

Chief Engineer of Reactors, Chief Electrical Engineer, and Chief Engineer of Boiler and Turbine perform verification and assessment of regulatory inspections by attending the regulatory inspections or confirming inspection records. They also perform verification and assessment, as appropriate, of the plans and results of regular checks or modification works to prevent human errors in maintenance and management works.

4 Evaluation and measures for human factors

Licensees of reactor operation are responsible for reporting to NISA those accidents and failures in nuclear installations which are designated to be reportable by law. Among these reported incidents, if the incidents are identified as caused by human error, licensees are requested to consider the remedy to those events including improvement of facilities. In addition, licensees are required to analyze the direct cause of human errors and correct non-conformance in pursuant to the guidelines established by NISA.

Licensees of reactor operation confirms that degradation of organizational climate has not occurred by introducing management review by which the president periodically examines appropriate execution of management system, taking into consideration of the significant influence due to organizational and management issues to safety operation of nuclear installations.

At the jobsites of nuclear installations, various information such as methods of work and risks associated with work is shared among workers during tool box meetings held before the work starts. These efforts result in promotion of work safety. Also, licensees of reactor operation analyze various failures including human errors at the jobsites, and organically reflect the experiences at the jobsites by conducting training for anticipating near misses with the intention of periodically sharing the recurrence prevention measures among workers.

These activities, recognized as effective in ensuring work safety, are conducted at every licensee’s nuclear installation, with the differences of frequency according to each licensee’s situation.

Article 13 Quality Assurance

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

Overview of Article 13

The concept of quality assurance as part of regulatory requirements for ensuring safety of a nuclear installation was first introduced in October 2003, and the Nuclear Safety and Industrial Agency (NISA) requires the licensees of reactor operation to introduce a quality management system in the operational safety activities.

NISA endorsed the Code of Quality Assurance (JEAC 4111) which had been developed based on the ISO9001 and GS-R-3 as standards to be applied to the quality management system for a nuclear installation. Accordingly, licensees establish the quality management system in accordance with JEAC 4111.

During this reporting period, the Ordinance for Commercial Nuclear Power Reactors concerning the Installation, Operation, etc. which defines the regulatory requirements of quality assurance was revised, and the JEAC 4111-2003 was revised to the JEAC 4111-2009 so as to correspond to the GS-R-3 which was revised in 2006, and to incorporate ISO9001: 2008.

1 Regulatory requirements and policies

In February 2002, the Study Group on the Way of Inspection was established under the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy to discuss inspection of a nuclear installation. In the process of discussion, significance of quality assurance for nuclear safety gained renewed recognition. The Study Group suggested that the quality assurance concept based on ISO9001:2000 should be introduced to the safety regulations, considering the necessity of conforming to international quality assurance standards.
NISA revised the ministerial ordinance based on the Reactor Regulation Act in October 2003, and stipulated the quality assurance requirements for nuclear safety in concrete terms.
On the basis of these developments, the Quality Assurance Subcommittee of the Nuclear Standards Committee of the Japan Electric Association started to prepare the Code of Quality Assurance for safety operation of nuclear power plant (JEAC4111) which realized the quality assurance requirements, in March 2003. JEAC 4111-2003 has the following characteristics:

- Modification was made considering applicability in nuclear power plants based on ISO 9001:2000 as its basis.
- Not only conforming to ISO 9001:2000 as its basis, ensure consistency with the existing guideline by incorporating the contents of the IAEA Safety Standard 50-C/SG-Q (1996) relating to quality assurance, on which the Guide of Quality Assurance had been based.
- Definitions were added to the unique terms which are different from those used in ISO9000:2000, for example, clarification of statutory requirement to the top management, stipulated in ISO9001:2000.
- Interpretation was rearranged so that concepts such as “products”, “customers” and “quality” stated in ISO 9001:2000 can be applied to nuclear power plants.

Subsequently, JEAC4111-2009 was issued after the quinquennial periodic review. The key changes are as follows:

- Requirements and notes were added in accordance with revision of the Ministerial Ordinance for Commercial Nuclear Power Reactors concerning the Installation, Operation, etc.
- Statement for safety culture was added in order to address IAEA GS-R-3 which was revised in 2006.
- Contents of ISO 9001:2008 were incorporated.

In June 2009 NISA endorsed the JEAC4111-2009 “Code of Quality Assurance for

Safety of Nuclear Power Plants" are technically adequate as standards to satisfy the regulatory requirements.
The key points of the quality assurance activities are:

1) To involve top management;
2) To be based on international standards on quality assurance;
3) To improve the activities continuously by Plan-Do-Check-Act cycle for planning, performing, and evaluating the operational safety activities; and
4) To implement the full scope by the internal independent audit organization.

As legislative measures, the ministerial orders based on the Reactor Regulation Act (Ministerial Ordinance for Commercial Nuclear Power Reactors concerning the Installation, Operation, etc.) require that the quality assurance program shall be established and stated in the operational safety program as a quality assurance system for necessary measures of operational safety. The items to be defined in the quality assurance program are as follows:

1) Organization for Implementation of quality assurance;
2) Planning of operational safety activities;
3) Implementation of operational safety activities;
4) Evaluation of operational safety activities; and
5) Improvement of operational safety activities.

NISA requires the applicant for license to submit appropriate quality assurance program at each stage of safety regulation.
When licensing for the installation of a nuclear installation, NISA requires the applicant to attach the "Basic Policy for Quality Assurance" to the license application so as to review the basic policy of the licensee's quality assurance activities at the stage of installation.
In application of the construction plan of a nuclear installation, NISA requires the licensee to attach the "Description concerning to the Quality Assurance" which the licensee should implement at each stage of design, manufacturing, installation and functional test. For the confirmation of quality assurance of fuel assemblies, NISA requests the licensee of fabricating activity to attach the "Description concerning to the Quality Assurance" to the application of the approval of fuel assembly design.
In case of import of fuel assemblies, NISA requires the licensees to submit "Description concerning to the Quality Assurance" etc. when they apply for inspection. When fuel assemblies contain uranium-plutonium mixed oxide fuel, NISA requires the licensees to submit the "Description concerning to the Quality Assurance Program" approximately 1 month before starting manufacturing fuel assemblies and the "Description concerning to the Quality Assurance" approximately 1 month before starting marine transport of fuel assemblies.

NISA commissions JNES to review as a periodic safety management review that the periodic Licensee's inspection is appropriately conducted during the periodic outage inspection of a nuclear installation in order to confirm the in-service quality assurance activities. In addition, NISA performs inspection on licensee's quality assurance through the Operational Safety Inspection based on the Reactor Regulation Act and confirms the licensee's implementation situation of the quality management system in a timely manner. As a quality assurance activity for the Operational Safety Inspection itself, nationwide inspectors from Nuclear Safety Inspectors Offices meet together at "Nuclear Inspectors Meeting", and participate in the effort aiming to level nuclear-safety-inspection methods and information sharing by Nuclear Safety Inspectors, by performing " model Operational Safety Inspection".

2 Implementing status for quality management of the integrated management system

Licensees of reactor operation establish the quality assurance program for the operational safety activities based on JEAC4111-2009, and carry out the quality assurance activities. JEAC 4111-2009 is a revision of JEAC 4111-2003 which was prepared with reference to 50-C-Q, and thus conforms to GS-R-3. In other words, we recognize that licensee in Japan appropriately implement the quality management system of the safety standard GS-R-3, by establishing and operating the quality management system based on JEAC 4111-2009.

When issuing JEAC 4111-2009, JEAC 4111-2003 was compared to GS-R-3 and ISO 9001: 2008. The results of which are shown in Annex.

3 Management system

JEAC 4111-2009 requires the licensees to establish, document, implement and maintain the quality management system, and to continue to improve its effectiveness, as a general requirement. This rule also specifies the concrete requirements when actually developing the quality management system. These requirements are classified into "Responsibility of Top Management," "Management and Control of Resources," "Planning and Implementation of Work" and "Evaluation and Improvement."

As a requirement for human resources, the rule stipulates that personnel who are involved in the work which can affect achievement of nuclear safety must have competence in terms of education, training and experience. The licensees of reactor operation are required to clarify the necessary competence, and if needed, to take measures such as providing education and training so that personnel can attain intended competence.

As a requirement for procurement control, the licensees of reactor operation are required to procure by clarifying the requirements for approval of products, procedures, processes and equipment, the requirements for confirmation of eligibility of personnel, and the requirements for the quality management system. The licensees are also required to inspect whether the procured products satisfy the pre-established requirements for procurement, and to verify at the vendors' site, as appropriate.

Licensees choose the vendors of products and services based on the predetermined standards as procurement control in the quality assurance program, established in pursuant to JEAC4111-2009. When procuring, they present specifications to the vendors and confirm that products and services satisfy the requirements, for example, by inspecting items delivered in case of products, and by results of tests and performance in case of services.

Specifications define not only the requirements for products and services, but also the requirements for reporting non-conformance and actions.

4 Audit

The quality assurance activities are audited in accordance with the quality management system in relation to operation of a nuclear installation. Generally, the department of the headquarters, which is responsible for audit and independent from the departments directly involved in operation of a nuclear installation, implements audit so as to ensure independency. Frequently, the department responsible for audit directly belongs to the president in terms of organization structure so that information for improvement obtained through audit reaches the president in a timely manner.

In procurement control, generally, the licensees of reactor operation directly audit the vendors for confirming that the product and service vendors satisfy the requirements defined in the specifications.

Concerning products, specifications which clearly state the requirements are presented to the vendors when order is placed, and it is confirmed at the time of delivery that the products satisfy the requirements. When confirmation is necessary during the manufacturing process of products, the licensees sometimes visit the vendor and directly confirm the manufacturing process.

Concerning services, specifications which clearly state the requirements are presented to the contractors who receive the order so as to ensure that individuals with necessary skills engage in the concerned service. The requirements include the confirmation of presence of technicians who can perform the work requiring special skills such as welding.

As a party who made the order, the licensee of reactor operation requests the contractor who received the order to submit the quality assurance program and confirms that the contractor satisfies the requirements made by the licensee. This serves as a mechanism to prevent issuing an order to the contractor whose quality assurance system is inappropriate.

Thus, the licensees of reactor operation in Japan firmly recognize that the quality assurance program of the vendors, to whom they order products or services, is an essential element for maintaining the licensees' own quality assurance system, and a mechanism has been built in which the licensees directly audit vendors or contractors who received the order, as appropriate.

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.

Overview of Article 14

Safety assessment of a nuclear installation is divided into assessment of installment of a reactor and assessment of operation of a reactor. When installing a reactor, the licensee of reactor operation implements safety assessment. Then this assessment is reviewed by the regulatory body in the process of examining application for reactor installment license.

Subsequent to the start of operation, safety of a nuclear installation is confirmed by the regulatory body through inspections such as periodic inspection and operational safety inspection, and by the licensee itself through patrol and other activities.

As an assessment related to safety, the Japanese government has been committed to tackling aging degradation of a nuclear installation. NISA required the licensees of reactor operation to implement aging technical evaluation, and to develop a long-term maintenance program in 2003, and established the Guidelines in Implementing Measures for Aging Management at Commercial Nuclear Installations and the Standard Review Procedures on Measures for Aging Management on Commercial Power Reactors in 2005.

During this reporting period, NISA decided that the long-term maintenance management policy based on the results of aging technical evaluation shall be included in the operational safety program in response to the revision of inspection system, and NISA introduced a mechanism to reflect aging technical evaluation in the maintenance activities of nuclear installations.

Article 14 (1) Assessment of safety

1 Regulatory requirements for safety assessment

Safety assessment before construction of a nuclear installation is conducted in response to the application for reactor installment license. The Reactor Regulation Act specifies that a reactor license applicant must submit to the competent minister the results of evaluation, which prove that the basic design or the basic design policy of a nuclear installation is sufficient for ensuring safety, along with the installment license application document. Then, the competent minister examines them from following five view points. Those are, that the reactor will not be used other than for peaceful purposes, that licensing will not disrupt systematic nuclear development and utilization, that the applicant has sufficient financial basis and technical capability, that at the same time, it has sufficient technical capability required for appropriately operating a reactor, and that the location, structures and facilities of a nuclear installation will not disturb prevention of disaster caused by the matters contaminated with nuclear fuel material or by a reactor. The Ministerial Ordinance for the Installation, Operation, etc. of Commercial Power Reactors specify that the installment license application document for a commercial power reactor must state the basic design or the basic design policy of a nuclear installation for which the license is applied, and must be attached with the explanation evaluating the situation of climate, foundation soil, hydraulic properties, earthquakes, and social environment of the site where a nuclear installation is planned to be installed, and also the safety design of a nuclear installation, radiation exposure control and radioactive waste disposal, and types, extent and effects of reactor accidents. The procedure of licensing for reactor installment is stated in Article 18.

After the license for reactor installment is granted, a construction plan is developed and pre-service inspection is conducted based on the Electricity Business Act, also approval of fuel assembly design and fuel assembly inspection is conducted for those fuel assemblies which are to be loaded in the reactor. The Rules for the Electricity Business Act require that when applying for permission of the construction plan, detailed design of a nuclear installation must be submitted. Moreover, explanation of seismic resistance and strength, and explanation of the safety design specific to the equipment, about which application is made, must be attached as safety evaluation conducted by the licensee of reactor operation based on the detailed design. The Rules for the Electricity Business Act require that when applying for fuel assembly design approval, explanation of performance such as thermal, radiation and corrosion resistance of fuel assemblies, and the strength of fuel assemblies must be attached. In addition, the licensees must conduct the inspection on welding at the welded section of the pressure boundary and containment, and must undergo examination of JNES for the system concerning implementation of the inspection on welding (safety management review on welding). Moreover, the licensees must receive authorization for operational safety program which compiles those matters that should be conformed to for the safety of nuclear installation before they start the operation of reactor facilities. Construction plan, pre-service inspection, approval of fuel assembly design, fuel assembly inspection and safety management inspection on welding are explained in Article 19.

Comprehensive verification of safety of a nuclear installation is carried out through operational safety inspection, periodic inspection, and periodic safety management review as safety evaluation during its lifetime, and also through the periodic evaluation, periodic operator's inspection, surveillance tests based on the operational safety program, investigation of incidents and failures and measures to prevent recurrence, and on-site inspection conducted as necessary. These inspections and surveys are reported in Article 19.

Article 14 (2) Verification of safety

1 Arrangements for safety verification

Concerning regulatory requirements for ensuring safety of nuclear installations in Japan, the Electricity Business Act specifies the pre-service inspection and periodic inspection to be conducted by the Ministry of METI, while the Reactor Regulation Act specifies the inspection of compliance to the operational safety program to be conducted by the Ministry of METI, and patrol and maintenance management of nuclear installations to be conducted by the licensees.

Concerning maintenance management conducted by the licensees of reactor operation, the Ministerial Ordinance for the Installation, Operation, etc. of Commercial Power Reactors provides for the policies related to maintenance management of nuclear installations, its objectives and its implementation plan, and requires the licensees to implement maintenance management according to the plan. The Rules also require the licensees of reactor operation to appropriately evaluate the objectives and plans and reflect them in maintenance management.

The licensees of reactor operation establish various type of check plans so as to operate nuclear installations safely. Regular self-controlled check, patrols in the site carried out by the operating shift is among the activities of those check plans. The frequency and items to be implemented are specified in the detailed provisions such as the operational safety program or the procedures developed on the basis of operational safety program.

As self-controlled check, each equipment of important to safety related systems, such as emergency core cooling system and emergency diesel generators, is actuated once a month and is confirmed its operability. In the operators' site patrol, walkdown and check of the designated points of a nuclear installation is performed once in every operating shift. Operating condition of active components such as pumps, and presence of leak from sealed sections is checked in detail and recorded. Generally, the results of patrol are reported by an operation shift to the next shift. However, if measures such as repairs and servicing are judged to be necessary, information is sent from the operating shift to the maintenance and repair division for taking timely measures. If a trouble discovered during patrol is judged to be dealt with by shutting down the reactor, measures including manual shutdown are taken at the discretion of a shift supervisor.

As stated above, management system such as patrol with appropriate content and frequency is established, and timely measures including reactor shut-down are taken.

The operational safety program is a necessary rule for the licensee of reactor operation to ensure safety of a nuclear installation, and thus it must be suitable for the nuclear installation. For example, change of operational action due to equipment modification should be appropriately shared among the design division in charge of the concerned modification and the division in charge of the operational safety program.

It is possible that the operation specified in the operational safety program may not be efficient in terms of operation management of a nuclear installation. In this case, it becomes important to share information in the operations division. Information sharing between divisions or within a division and proper updating of the operational safety program are reviewed as a part of appropriate document control in the licensee's quality management system.

2 Measures for aging management

Among currently operating nuclear installations in Japan, the oldest installations started to operate in 1970 and has been operating for 40 years. Not a few reactors started to operate in the 1970's, and thus measures for aging management are considered to be highly important. The numbers of units of operating nuclear installations in Japan according to years of operation at the end of March 2010 are shown in Fig. 14-1.

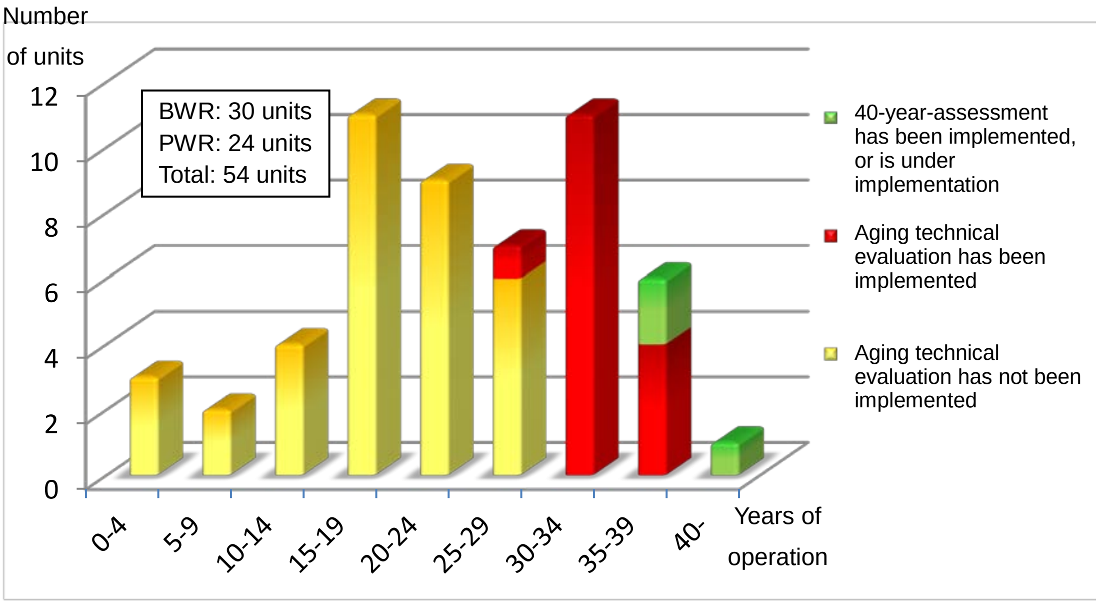


Fig. 14-1 Distribution of number of units according to years of operation

NISA revised the “Ministerial Ordinance for the Installation, Operation, etc. of Commercial Power Reactors” in October 2003, and provided the periodic assessment of nuclear installations. These rules require the licensees to conduct aging technical evaluation and to develop a long-term maintenance program. Moreover, NISA launched the Coordination Committee on Technical Information in JNES, in order to reinforce the measures for aged plants, and in order to share domestic and overseas technical information for effective utilization among the industrial world, academic and governmental institutions. Furthermore, JNES established an ad-hoc committee that consists of NISA, universities, research organizations, electric utilities, nuclear plant manufacturers, plant engineering companies, etc. under the Atomic Energy Society of Japan. From July 2004 through March 2005, the ad-hoc committee had prepared a road map on measures for aging management and long life-time safe operation of light water reactors.

The Aging Countermeasure Examination Committee under the Nuclear and Industrial Safety Subcommittee prepared and issued the "Enhancement of Measures for Aging Management at Commercial Nuclear Installations" in August 2005. In response to the report, NISA established the “Guidelines in Implementing Measures for Aging Management at Commercial Nuclear Installations” and the “Standard Review Procedures on Measures for Aging Management of Commercial Power Reactors (bylaws)” in December 2005. And, JNES prepared and published the "The Compilation of Technical Information concerning Measures for Aging Management", which disclosed the standards, viewpoints and evaluation points when NISA and JNES assess and review licensee's technical evaluation reports and long-term maintenance programs.

In response to the “Enhancement of Measures for Aging Management at Commercial Nuclear Installations” issued by NISA, the licensees of reactor operation reported to the Aging Countermeasure Examination Committee, the status of consistent efforts for the measures for aging management for the following matters:

(1) Ensuring transparency and effectiveness;
(2) Preparing technical information infrastructure;
(3) Preventing deterioration in corporate culture and organization climate, and keeping and improving technical capabilities; and
(4) Accountability on measures for aging management.

The aging technical evaluation reports for Unit 3 of the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Co., Inc., Unit 1 of the Hamaoka Nuclear Power Station of Chubu Electric Power Co., Inc., and Unit 3 of the Mihama Power Station of the Kansai Electric Power Co., Inc. have already been submitted in this framework. NISA assessed the technical evaluation report and the long-term maintenance program for Unit 1 of the Hamaoka Nuclear Power Station of Chubu Electric Power Co., Inc. on January 31 2006. Then, NISA reported the results to the NSC in May 2006 that the system for implementing the technical evaluation is appropriate, that the technical evaluation implemented for aging, the technical evaluation for ensuring seismic safety, and conservation measures are appropriate, and that the long-term maintenance program based on the technical evaluation is appropriate. The same assessments were carried out for the other two nuclear reactors mentioned above.
Conventionally, NISA had evaluated adequacy of aging technical evaluation and long-term maintenance programs prepared by the licensees of reactor operation. However, NISA revised the Rules for the Installation, Operation, etc. of Commercial Power Reactors associated with revision of inspection system. It was decided that from January 2009, the long-term maintenance management policies based on the aging technical evaluation and its results shall be included in the operational safety program. Accordingly, the program such as maintenance management per operation cycle, which embodies the long-term maintenance management policies, has become included in the maintenance activity program of a nuclear installation.
Under the current system, the licensees of reactor operation steadily conduct the measures for aging management based on the maintenance plan, and NISA confirms the implementation situation of each licensee through periodic inspection, Periodic Safety Management Review, and Operational Safety Inspection.
NISA focuses on the safety research for aging management of nuclear installations as one of its important research programs on the Nuclear Safety, and is carrying out the research on clarification of aging phenomena, development of prediction methods of aging process, development of methods for early detection of cracks and deterioration and fine measurement approach, and development of structural integrity evaluation.

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.

Overview of Article 15

Radiation protection standards in Japan are established by respecting the recommendations of the International Commission on Radiological Protection (ICRP). The regulatory requirements concerning facilities such as the area control in a nuclear installation are specified by the ministerial orders and notices based on the Reactor Regulation Act, while the regulatory requirements concerning worker protection, which include measures for preventing health damage such as measurement of work environment and health examination are specified by the Industrial Safety and Health Law.

In Japan, radiation dose of workers are unitarily controlled at the Radiation Worker's Registration Center. So, a system is provided to control the history of the personal dose for each worker who works in more than one nuclear installation.

It has been recognized recently that reduction of collective dose of the workers in Japanese nuclear installations is not in progress in comparison to the cases in European and American nuclear installations partly because the Japanese operating cycle is relatively short. This is a matter that was suggested to be addressed at the 4th review meeting. NISA is committed to carrying forward the study of policy for reducing the collective dose during this reporting period.

1 Legislative and regulatory arrangements for radiation protection

(1) Legislative arrangements for radiation protection

The Government of Japan clearly specifies the radiation protection standards for nuclear installations by laws such as the Reactor Regulation Act, the Electricity Business Act, and the Industrial Safety and Health Law, and the subordinate legislation based on these laws and guidelines. The standards for radiation protection were established by respecting the recommendations of the International Commission on Radiological Protection (ICRP) and incorporated in laws and regulations. The Radiation Review Council checks consistency of these technical standards for the prevention of radiation hazards.

As a legislative framework, regulatory requirements for area control for radiation protection, requirements for exposure control of radiation workers, and concentration monitoring of the released radioactive material regarding gaseous and liquid waste control are specified in the ministerial ordinance based on the Reactor Regulation Act, such as the “Ministerial Ordinance for Commercial Nuclear Power Reactors concerning the Installation, Operation, etc. (Commercial Reactor Ministerial Ordinance)”. The Ministerial Ordinance for Commercial Power Reactors provides that the licensee of reactor operation is required to report immediately to NISA when a concentration of radioactive materials in the air outside the peripheral monitoring area exceeds the allowable limit in discharging gaseous radioactive waste, or when the concentration of radioactive materials in the water at the outer boundary of the environmental monitoring area exceeds the allowable limit in discharging liquid radioactive waste, and report the status of the event and measures taken against it within ten days. Also, the “Notification for Dose Equivalent Limits on the Basis of the Ministerial Ordinance for Commercial Power Reactors (Dose Notification)” quantitatively prescribes dose limits and concentration limits of radioactive materials both inside the control area and outside the environmental monitoring area, dose limits of radioactive materials for radiation workers, and dose limits for workers in emergency activities.

The Industrial Safety and Health Law provides that employers take measures to prevent damage to the health of radiation workers, including radiation exposure, throughout their period of employment, and it requires that they shall be educated on issues of health and safety, work environment monitoring and medical examination of workers. On the basis of the law, the Ministry of Health, Welfare and Labor has enacted ‘the Ministerial Ordinance for Prevention of Hazards from Ionizing Radiation’, which prescribes the requirements for controlled areas, dose limits and measurement, protection from external radiation, and prevention of radioactive contamination.

The Ministerial Ordinance for Prevention of Hazards from Ionizing Radiation require employers to measure the dose due to external and internal exposure of workers who are engaged in radiation work or in emergency work, or enter temporal access into the radiation controlled area. The ministerial ordinance also require employers to monitor and check daily the dose due to external exposure, if it is expected to exceed the specified value of 1 mSv at 1 cm dose equivalent, and to calculate, without delay, the dose of the personnel engaged in radiation work using the method prescribed by the Minister of Health and Labor, and to keep these records for a period of thirty years.

Regulations similar to the Reactor Regulation Law are applied to the activities involving the use of radioisotopes etc. in nuclear installations, based on the “Law Concerning Prevention from Radiation Hazards due to Radioisotopes, etc.”

As a measure to ensure that the licensees comply with these legislative requirements regarding radiation protection, “The Ministerial Ordinance for the Installation, Operation, etc. of Commercial Power Reactors” requires each licensee to prescribe in the Operational Safety Program, 1) radiation controlled area, access controlled areas, and environmental monitoring area and access control to these areas, 2) monitoring equipment at air ventilation and water discharge, 3) monitoring of the dose, the dose equivalent, the concentration of radioactive materials and the density of the surface radioactive materials of objects contaminated by radioactive materials, and the decontamination, 4) maintenance of radiation monitoring equipment.

The Regulatory Guide for the Annual Dose Target for the Public in the Vicinity of Light Water Nuclear Power Reactor Facilities is one of the guidelines used for reviewing licensing of reactor installment. The guide provides specific indicators for reducing effects of radiation caused by installment of a nuclear installation to environment as low as reasonably achievable. It also states the quantitative dose target guide for keeping the dose of the general public in the vicinity at low level. The licensees of reactor operation define the release control value of liquid wastes and gaseous wastes in the operational safety program based on this guide.

The 1990 Recommendation of the ICRP (Publication 60) has been, after examination by the Radiation Council, incorporated into national legislations and regulations on radiation protection, by revision of related ministerial orders and notifications in April 2001 with the following additional considerations. First, the radiation controlled area is defined where the dose may exceed 1.3 mSv/3 months, corresponding to 5 mSv/year which is a special dose limit to the public. Second, the occupational dose limit for female workers is set at 5 mSv/3 months, an allocated value for a shorter period, reducing possible dose of a potential embryo. The dose limits in emergency work remain 100 mSv/year as before, considering the IAEA BSS.

The Radiation Council is an organization established under MEXT for the purpose of coordinating technical standards on prevention of radiation hazards. The Radiation Council submits reports related to inquiries from related administrative organizations, or advises them as necessary.

The Radiation Review Council has been discussing in order to incorporate the ICRP 2007 recommendation to domestic laws and regulations since 2008.

Concerning the specific dose limits, the Ministerial Ordinance for Commercial Power Reactors and the Dose Limits Notification requires licensees to establish a radiation controlled area including the reactor room, spent fuel storage facility and radioactive waste disposal facilities, where the dose of external radiation may exceed 1.3 mSv for three months, or where the concentration of radioactive materials in the air or the surface density of radioactive materials may exceed the values specified in the Notification, respectively, and to establish necessary

measures to be taken in these areas.
The Dose Notification specifies the dose limits for radiation workers and general public as listed in Table 15-1.

Table 15-1 Dose limits for the radiation workers and the public

Item	Limit
A Radiation workers	
(1) Effective dose limits	100 mSv/5 years, but do not exceed 50 mSv/year.
(2) Female	Besides conforming to (1), do not exceed 5 mSv/3 months.
(3) Pregnant female	Besides conforming to (1), do not exceed 1 mSv for internal exposure from notification of pregnancy to delivery.
(4) Equivalent dose limit for eye lens	150 mSv/ year
(5) Equivalent dose limits for skin	500 mSv/ year
(6) Equivalent dose limits for abdominal region of pregnant female	2 mSv/ from notification of pregnancy to delivery.
B Dose limits for radiation workers involved in emergency work	
(1) Effective dose limits	100 mSv
(2) Equivalent dose limits for eye lens	300 mSv
(3) Equivalent dose limits for skin	1 Sv
C General public	
(1) Effective dose	1 mSv/year
(2) Equivalent dose for eye lens	15 mSv/year
(3) Equivalent dose for skin	50 mSv/year

(2) Involvement of regulatory body in radiation protection activities

NISA is also involved in radiation protection activities from regulatory aspect based on the Reactor Regulation Act, etc.

In the stage of licensing for establishment, waste management including radiation exposure control and discharge of radioactive material outside the nuclear installation is reviewed in the safety review of the basic design.

In the stage of approval of construction plan, the concrete design of instrumentation devices for radiation control, ventilation facilities, and biological shielding devices are examined. Further, it is confirmed by the pre-service inspection that these facilities are constructed in pursuant to the approval.

During operating life of a nuclear installation, it is confirmed by the compliance inspection of the operational safety program that the ministerial ordinance provided in the operational safety program, such as access control to controlled area, etc., monitoring equipment at air ventilation and water discharge, monitoring of the dose, the concentration of radioactive materials and the density of the surface radioactive materials, and the decontamination, are observed.

In case of a nuclear disaster, such as the release of significant amount of radioactive materials to the environment in association with an accident in a nuclear installation, nuclear emergency measures provided by the Act on Special Measures Concerning Nuclear Emergency Preparedness for Nuclear Disaster are implemented. Nuclear emergency preparedness is explained in Article 16.

2 Radiation protection program of the licensees

(1) Record of individual dose

The average individual effective dose of radiation workers at the commercial nuclear installations during this reporting period was 1.0 to 1.1mSv per year.

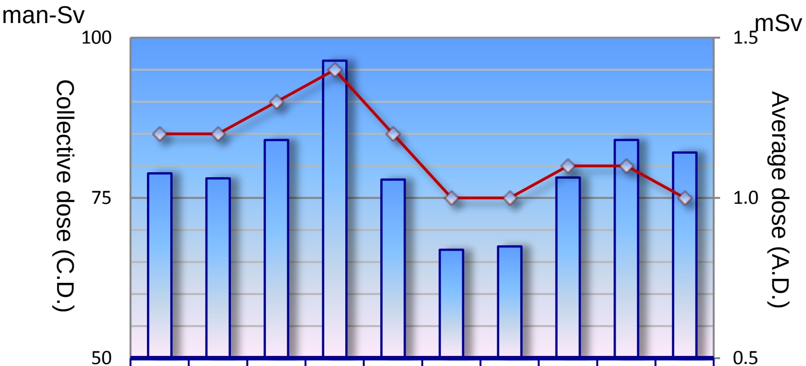
In FY 2009, the effective dose of radiation workers was under the dose limit prescribed by regulation (50 mSv/year).

In FY 2009, the number of radiation workers who had been exposed over 20 mSv was 0, and 15 to 20 mSv was 258. The total number of radiation workers at the commercial nuclear installations was 83,489.

(2) Record of collective dose

The total collective dose at the commercial nuclear installations was 82.08 man-Sv in FY 2009.

The trend of collective dose and average dose in the past 10 years is shown in Figure 15-1.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
C.D.	78.83	78.05	84.03	96.41	77.86	66.91	67.43	78.18	84.04	82.08
A.D.	1.2	1.2	1.3	1.4	1.2	1.0	1.0	1.1	1.1	1.0

Fig. 15-1 Trend of collective dose and average dose

(3) Dose target and discharge control to reduce dose of the public in the vicinity

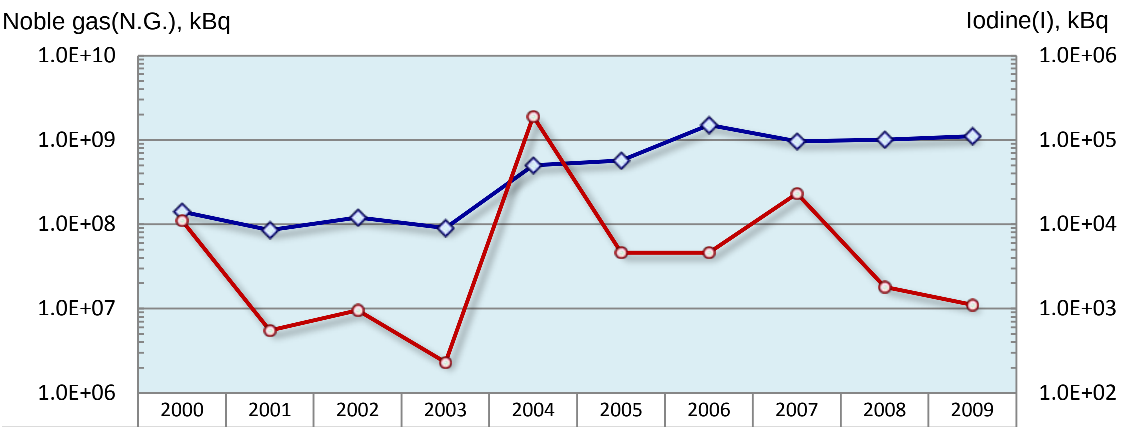
In the Regulatory Guide for the Annual Dose Target for the Public in the Vicinity of Light Water Nuclear Power Reactor Facilities, the NSC has prescribed a numerical guide of 50 micro Sv, one twentieth of the dose limit to the public, in order to reduce the dose for the public due to discharge of radioactive material to the environment during normal operation of a nuclear installation as low as reasonably achievable.

The licensee of reactor operation, in order to achieve the target, establishes an annual numerical discharge control guide, which corresponds to the annual discharge amount evaluated at the safety review and assessment, and makes the effort to keep the discharge of radioactive effluents below the numerical discharge control guide. NISA acknowledges the numerical discharge control guide and receives the report from the licensee.

(4) Discharge data and the measures taken to reduce the amount of the discharge

The discharge records of radioactive gaseous and liquid waste from the nuclear installations (BWRs and PWRs) over the past seven years are shown in Figure 15-2 and Figure 15-3. The discharge quantities are substantially below the discharge control targets, the noble gas discharge from the PWR being only one 1000th of the discharge target. This is due to the fact that the licensees of reactor operation have carried out the radiation management of the nuclear installation in line with the ALARA principle, including the following measures.

Gaseous waste is discharged from the ventilation stack, while being measured and monitored, after particles are removed by a high efficiency particulate air filter, noble gas and iodine are decayed in a holdup tank or activated carbon type noble gas hold-up device.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
N.G.	1.40E+08	8.50E+07	1.20E+08	9.00E+07	5.00E+08	5.70E+08	1.50E+09	9.60E+08	1.00E+09	1.10E+09
I	1.10E+04	5.50E+02	9.50E+02	2.30E+02	1.90E+05	4.60E+03	4.60E+03	2.30E+04	1.80E+03	1.10E+03

Fig. 15-2 Trend of released gaseous waste (noble gas and iodine)

All liquid waste is collected and treated in a disposal facility. The equipment drain is processed in a filter and demineralizer system. The floor drain is recovered after being processed in a concentrator and demineralizer. Floor drain is reused in general, though part of it may be discharged through the discharge outlet after the radioactive concentration is measured. The recovered liquid waste from the resin is reused after being treated in a concentrator and demineralizer. Concentrated liquid waste generated in this process is treated as solid waste. Low-level laundry wastewater, etc. are usually discharged into the environment after being treated through a filter and then it is monitored.

In addition to the measures shown in the paragraphs above, a very low level of gaseous discharge and liquid radioactive waste was achieved through the following efforts; the number of fuel leak occurred during this reporting period were only two in the BWRs (total of three fuel assemblies), and one in the PWRs (total of one fuel assembly), ventilation during the work such as periodic inspection is filtered by a local high efficiency filter, and efforts are made to reduce the amount of liquid waste, except tritium, as low as reasonably achievable. Due to the strict control described above, the amount of discharged liquid and gaseous radioactive waste has been kept at a very low level compared to international standards.

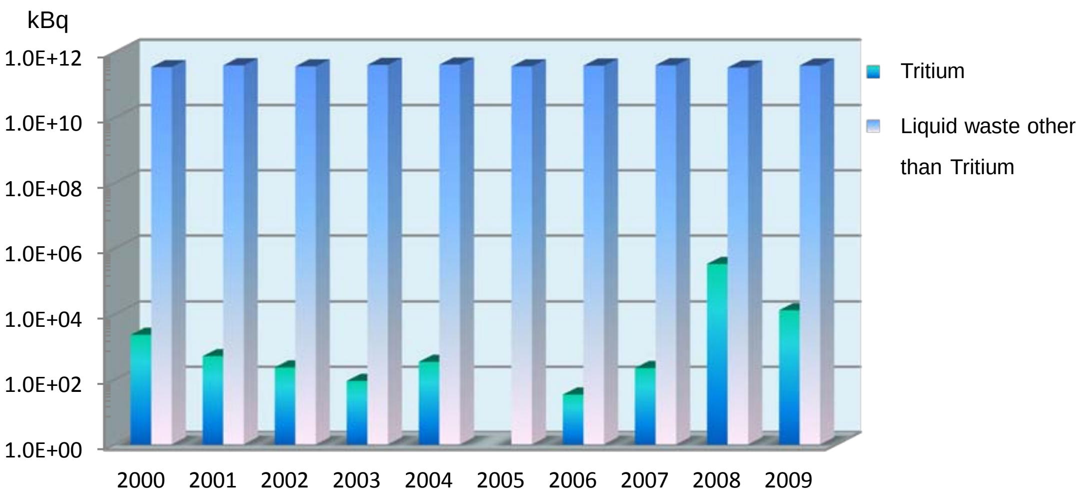


Fig. 15-3 Trend of released liquid waste

(5) Measures to reduce exposure

In nuclear installations, the licensees of reactor operation take measures such as to reduce the radiation of system components in nuclear installations, to keep offset distance from radiation source, and to install shielding in order to reduce exposure of radiation workers as low as reasonably achievable. For management of facilities, they take measures such as to discuss work procedure before starting work so as to shorten the time required to complete the radiation work. The radiation exposure at nuclear installations in Japan is below the regulatory dose limits. The licensees' ongoing efforts stated above should be highly valued as self-controlled efforts for further reduction of radiation dose, and it is desirable for such efforts to be continued.

Generally, the radiation workers involved in repair works in nuclear installations receive orders from more than one licensee and carry out radiation work in the controlled areas in multiple nuclear installations. Considering the importance of unitary management of personal exposure of radiation workers who work in multiple nuclear related facilities, the Radiation Workers' Registration Center of the Association of Radiation Impact was established in November 1977 to reduce such workers' exposure. This Center unitarily collects and manages personal exposure dose of each radiation worker who works in nuclear installations in Japan. This system enables any licensee to know the history of exposure dose record of radiation workers if they work in multiple nuclear installations, and helps the licensees to implement appropriate exposure control.

The trend of collective dose in Japan after 1990s has generally continued to be flat or a gradual increase, while that of Western countries has gradually decreased.

Though the decreasing trend is observed after 2004 with the decrease of modification work, the trend through the whole period still remains at a higher level as compared with that of Western countries.

In view of the recent situation, NISA carried out a study of radiation exposure at nuclear installations in both Japan and Western countries and the efforts for dose reduction based on the ALARA principle were also investigated in order to clarify the reasons of difference between Japan and Western countries and also to identify the issues for dose reduction (from fiscal year 2004 to 2009).

Concerning differences of the collective dose between Japan and Western countries, the factors such as differences in workload during plant outage (amount of construction/modification work and the number of workers), length of operation cycle and difference of maintenance policy seem to be related. Also, the results of investigation on the efforts for dose reduction identified the importance of the subjects for the optimization of collective dose management, such as the need for medium and long term dose reduction strategy, further information sharing with regard to ALARA, enhancement of the licensees' self-controlled activities, and involvement of regulatory bodies towards such efforts.

At present the individual dose (average annual dose of recent years: about 1 mSv, maximum individual dose: about 20 mSv/year) is below the dose limits (100 mSv/5 years and 50 mSv/year), and so the collective dose level itself (about 1.4 man-Sv) is not a matter of concern. However, it is important to promote activities for collective dose reduction in a continuous and self-controlled manner based on the ALARA principle.

The regulatory body will carry forward the study of solid control measures of collective dose, focused on the exposure dose reduction processes in order to stimulate the licensees' activities.

(6) Environmental monitoring

The licensee conducts radiation monitoring at the site vicinity during normal operation, assesses the impact upon the environment of the discharge of radioactive materials from the nuclear installation, and feedbacks the results in improving discharge control and facility management.

Local governments (prefectures where nuclear installations are located) also monitor the radiation level independently at the site vicinity to protect public health and safety.

The NSC decided the fundamentals of planning and implementation of the monitoring and the evaluation of radiation dose in the Guide for Environmental Radiation Monitoring, in order to improve and to standardize the monitoring technology. Local governments and licensees implement the above-mentioned monitoring in accordance with this guide. The Guideline for Environmental Radiation Monitoring was established in March 2008, by integrating the Guide for Environmental Radiation Monitoring and the Guide for Environmental Radiation Monitoring in Emergency.

Environmental monitoring data is open to public on the website of the Disaster Prevention and Nuclear Safety Network for Nuclear Environment operated by the Ministry of Education, Culture, Sports, Science and Technology (http://www.bousai.ne.jp/eng/) and can be checked 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 in 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 Article 16

Nuclear emergency preparedness and response activities of Japan are carried out based on the Act on Special Measures Concerning Nuclear Emergency Preparedness. Though the framework of the nuclear emergency response has not been changed from the last report in essence, an improvement has been made in consideration of the findings obtained from such drills as the Integrated Nuclear Emergency Response Drill held annually under the initiative of the National Government.

The improvement during this reporting period is a measure taken to provide emergency information to the public. The NISA started an emergency information mailing service in July 2008, and established a system by which to provide emergency information to e-mail addresses registered beforehand quickly. Concerning the information distribution to foreign citizens staying in Japan, the NISA conducted the emergency communication exercise for a French community in the Integrated Nuclear Emergency Response Drill held in October 2008, with the cooperation of the French Embassy in Japan. In this manner, the NISA has been taking measures to improve the response to diversifying recipients of information.

Article16 (1) Emergency plans and programs

1 Development of Laws and Rules for Nuclear Emergency Preparedness

For Japan who was promoting the use of nuclear energy under the basic premise of ensuring safety, the JCO criticality accident which occurred in September 1999 was the first serious accident of its kind, and it was so serious that local residents were instructed for sheltering or evacuation. Lessons learned from this accident clarified the special characteristics of a nuclear emergency, which would require quick initial responses, close coordinated cooperation between the National Government and local governments, strengthening of the national emergency response system and the clarification of licensee's responsibilities. The Act on Special Measures Concerning Nuclear Emergency Preparedness (hereafter referred to as “Nuclear Emergency Preparedness Act”) was enacted in December 1999 and it was enforced in June 2000, addressing the special characteristics of nuclear emergencies as mentioned above.

The Nuclear Emergency Preparedness Act was enacted so as to harmonize with the existing legal framework established by the Basic Act on Disaster Control Measures, which had defined the roles of the National Government, local governments, etc. in an emergency such as floods, earthquakes, tsunamis, and eruptions. The “Nuclear Emergency Preparedness” in the Basic Plan for Emergency Preparedness based on the Basic Act on Disaster Control Measures was extensively revised in accordance with the Nuclear Emergency Preparedness Act, clarifying roles and responsibilities of the National Government, local governments, licensees, etc.

The NSC, in May 2000, also taking into consideration the Nuclear Emergency Preparedness Act and the lessons learned from the JCO criticality accident, revised the " Regulatory Guide: Emergency Preparedness for Nuclear Facilities " on technical and special matters of nuclear emergency preparedness and response, to include:

- Responding to the mechanism of the new Nuclear Emergency Preparedness Act;
- Responding to research reactors, nuclear fuel facilities, and radioactive waste facilities as target facilities in addition to the usual nuclear power stations, reprocessing facilities, etc.;
- Responding to release of nuclear fuel materials and criticality accidents in addition to the measures against radioactive noble gas and iodine; and,
- Newly describing a concept of establishment of an Off-Site Center and a basic concept of emergency preparedness during transport of nuclear fuel materials, etc.

In May 2007, further clarification was made on the purpose of the Regulatory Guide, target facilities, etc. in consideration of the international trend as seen in the actions of the International Atomic Energy Agency, etc. and description was added on the effectiveness of preventive protective measures. In addition, the sections that overlapped with the provisions of the Nuclear Emergency Preparedness Act and Regulatory Guide of the NSC were organized.

As the Nuclear Emergency Preparedness Act provides that its enforcement situation is subject to review five years after its enforcement, the enforcement situation was investigated by MEXT and METI. Results of the investigation were reported to the Special Committee on Nuclear Disaster, the NSC in March 2006. The Nuclear and Industrial Safety Agency checked the enforcement situation concerning four issues that were presupposed to respect (clarification of a licensee's responsibilities, ensuring of quick initial responses at the time of disaster, close cooperation among the National Government, local governments, licensees, etc. and strengthening of the role of the National Government that has professional knowledge of nuclear energy) when the Nuclear Emergency Preparedness Act was enacted, and reported the following:

- Non-scenario-based drill and the like should be carried out as means to check the quickness of initial responses, and the effort should be continued;
- Concerning enhancing the cooperation among the National Government and local governments, the "Integrated Nuclear Emergency Preparedness Network", which is a large-scale system and preparation of a fast unified network of communication among them, should be made;
- Concerning enhancing the emergency response system of the National Government, necessary renewal of materials and equipment of the Emergency Response Center should be promoted; and,
- In relation to clarification of the licensees' responsibilities, the effectiveness should be verified and improved so that nuclear emergency response staff may achieve their required functions in an emergency.

There are two types of nuclear disasters under the provision of the Nuclear Emergency Preparedness Act: the Specific Event and the Nuclear Emergency. The Specific Event includes a case in which a radiation dose detected near the site boundary is 5 micro Sv/h or more at one point for more than 10 minutes continuously. Related government ministries and agencies in Tokyo convene a meeting for emergency response, and related local organizations get together at the local Off-Site Center to respond.

The Nuclear Emergency includes a case in which a radiation dose detected near the site boundary is 500 micro Sv/h or more at one point for more than 10 minutes continuously. Like the Specific Event, related organizations respond in Tokyo and at the local Off-Site Center while the Prime Minister declares a nuclear emergency situation, and an emergency response such as an evacuation of residents is made. See Table 16-1 for criteria concerning the Specific Event and the Nuclear Emergency.

Table 16-1 Specific Initial Event and Nuclear Emergency Specified in the Special Law of Emergency Preparedness for Nuclear Disaster

Events	Criteria for Specific Event	Criteria for Nuclear Emergency
a) Radiation dose near the site boundary	5 micro Sv/h or more at one point for more than consecutive 10 minutes	500 micro Sv/h or more at one point for more than consecutive 10 minutes
	5 micro Sv/h or more at two or more points simultaneously	500 micro Sv/h or more at two or more points simultaneously
b) Detection of radioactive materials in usual release points such as exhaust pipes	When the concentration of radioactive materials equivalent to 5 micro Sv/h or more continues for 10 minutes or more, or radioactive materials equivalent to 50 micro Sv/h or more are released	When the concentration of radioactive materials equivalent to 500 micro Sv/h or more continues for 10 minutes or more, or radioactive materials equivalent to 5 mSv/h or more are released
c) Detection of radiation or radioactive materials by fire, explosion, etc (outside the control zone)	Radiation dose of 50 micro Sv/h or more	Radiation dose of 5 mSv/h or more
	Release of radioactive materials equivalent to 5 micro Sv/h or more	Release of radioactive materials equivalent to 500 micro Sv/h or more
d) Individual events of each nuclear installation		
Failure of reactor scram	When the nuclear reactor shutdown cannot be performed by usual neutron absorbers	When all reactor shutdown functions are lost in a case where emergency reactor shutdown is necessary
Loss of reactor coolant	When leakage of nuclear reactor coolant occurs, which needs operation of the emergency core coolant system (ECCS)	When water cannot be injected into the nuclear reactor by any ECCS
Loss of all AC power supplies	When power supply from all AC power supplies is failed for 5 minutes or more	When all functions for cooling a reactor are lost with loss of all AC power supplies
Decrease in water level of the spent fuel pool at reprocessing facilities	When water level is decreased to the point where a fuel assembly is exposed	

⇩	⇩
- The competent minister sends staff with expertise on request of local governments. - The resident Senior Specialist for Nuclear Emergency Preparedness carries out necessary work. - - - - - - - - - - - Related ministries and agencies organize a joint task group for the incidents in Tokyo. - Related local organizations organize a joint local task group in the Off- SiteCenter.	- The competent minister reports the nuclear emergency to the Prime Minister immediately after confirming the situation. - The Prime Minister declares "Nuclear Emergency" and takes the following responses: - to lead, advise or direct related local governments on necessary measures such as sheltering or evacuation; - to establish the Nuclear Emergency Response Headquarters and Local Nuclear Emergency Response Headquarters; and - to establish the Joint Council for Nuclear Emergency Response for information exchange among the National Government and local governments

2 Response and measures for nuclear emergency

(1) Nuclear emergency response concerning nuclear installation

Quick initial response and closely coordinated cooperation among relevant organizations are important in a nuclear emergency. See Fig. 16-1 for the outline of the organizations relating to nuclear emergency situation responses based on the Nuclear Emergency Preparedness Act.

- The Nuclear Emergency Preparedness Act requires licensees to immediately report to the competent minister and heads of local governments when an event stipulated in Article 10 of the law occurs at nuclear installation;
- The competent minister, receiving the notification, triggers activities according to the procedure stipulated by law. Staff with expertise in emergency measures will be sent to local governments on request. The Senior Specialist for Nuclear Emergency Preparedness collects information and coordinates activities preventing expansion of the events;
- When the competent minister recognizes that the Specific Event exceeds the predetermined level and has developed into an emergency, the minister immediately reports it to the Prime Minister;
- The Prime Minister declares a “Nuclear Emergency” and directs relevant local governments on emergency response measures to be taken by them such as sheltering or evacuation and preventive stable iodine administration;
- The Prime Minister establishes the "Nuclear Emergency Response Headquarters" in Tokyo, which he will head, and the " Nuclear Emergency Response Local Headquarters" at the concerned Off-Site Center;
- In a nuclear emergency, the NSC convenes with the “Technical Advisory Organization in an Emergency” that is composed of commissioners and the Advisors for Emergency Response. The Organization gives technical advice to the Prime Minister;
- Local governments establish their own emergency response headquarters; and,
- In order to share information between the National Government and related organizations such as local governments, licensees, etc., and, if necessary, to coordinate emergency measures to be implemented by the respective organizations, the "Joint Council for Nuclear Emergency Response" is to be established at the Off-Site Center.

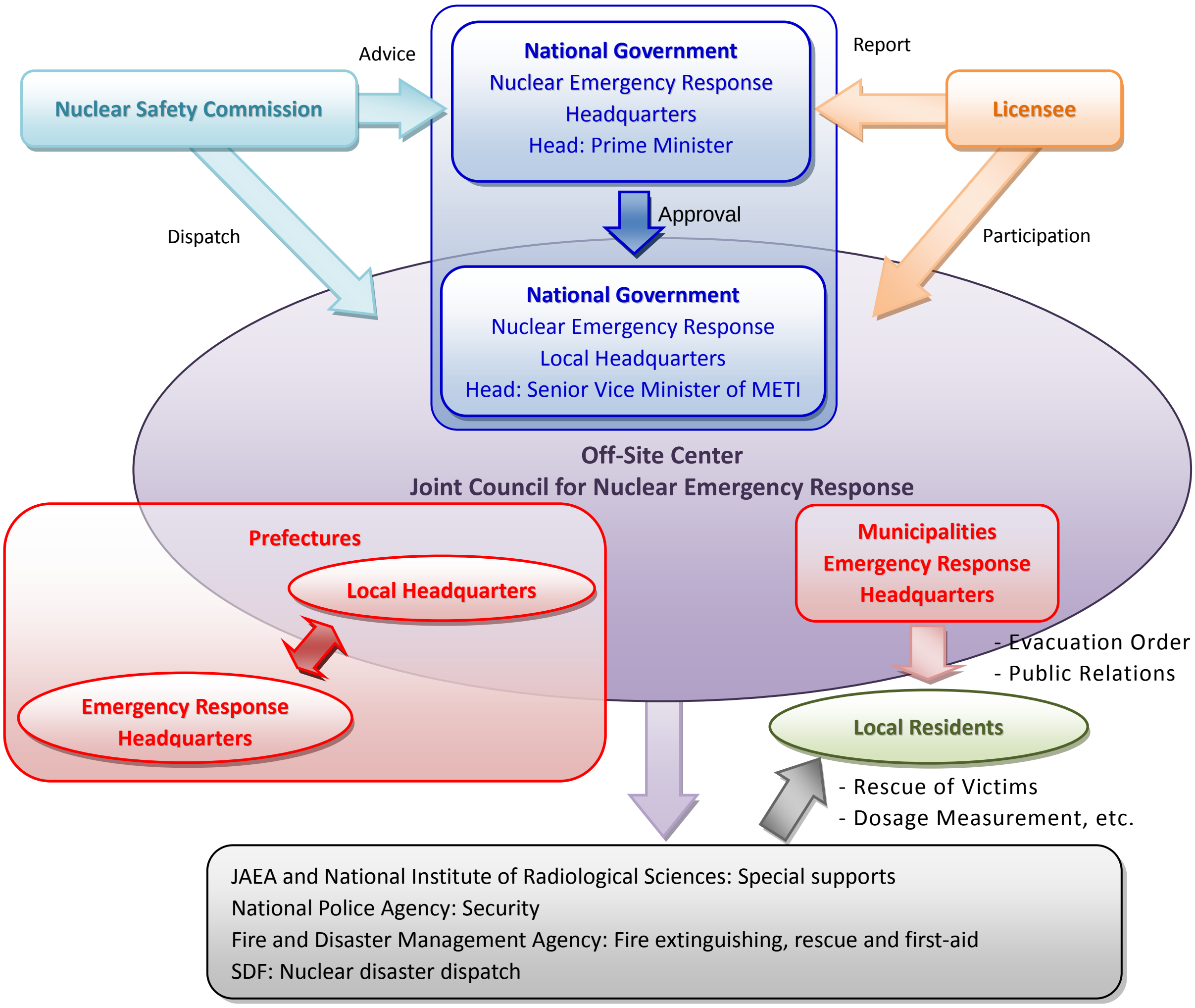


Fig. 16-1 Outline of the organizations relating to nuclear emergency responses

(2) Plan for nuclear emergency preparedness

The plan at the highest level in nuclear emergency preparedness of Japan is the Basic Plan for Emergency Preparedness formulated on the basis of the Basic Act on Disaster Control Measures. Concerning nuclear emergency measures relating to nuclear installations, the following are stipulated in the Basic Plan for Emergency Preparedness as preparation for disaster prevention, emergency response measures, and emergency restoration:

a Disaster prevention

- To ensure safety of facilities, etc.;
- To prepare for quick and smooth emergency response measures and emergency restoration;
- To disseminate knowledge of emergency preparedness and response;
- To promote research on nuclear emergency preparedness and response, etc.;

- To implement measures to prevent recurrence; and,
- To prepare for quick and smooth emergency response measures for accidents during transportation of nuclear fuel materials, etc. outside nuclear sites.

b Emergency response measures

- To ensure an information collection and communication system, an emergency contact system, and communications;
- To establish an action mechanism;
- Protective activities such as sheltering and evacuation;
- To maintain social order including crime prevention;
- To ensure traffic routes for emergency transportation, and emergency transportation activities;
- Rescue and first aid activities, and medical and fire fighting activities;
- Activities for appropriate communications with related personnel, etc.; and,
- Quick and smooth emergency response measures for accidents during transportation of nuclear fuel materials, etc. outside nuclear sites.

c Emergency restoration

- Procedure for canceling the declaration of a nuclear emergency situation; and,
- Measures for reducing harmful rumors, restoring subsidization of small/medium-sized enterprises, etc.

Administrative organs formulate emergency preparedness action plans based on the Basic Act on Disaster Control Measures and the Basic Plan for Emergency Preparedness. In the METI emergency preparedness action plans, nuclear disaster measures are to be taken based on the provisions of the Basic Act on Disaster Control Measures, the Nuclear Emergency Preparedness Act, and the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (Reactor Regulation Act).

Local governments work out their respective regional disaster prevention plans based on the Nuclear Emergency Preparedness Act and the Basic Plan for Emergency Preparedness, establish systems for emergencies, responsibilities for carrying out emergency preparedness and response activities, etc. It is stipulated that local governments shall carry out the environmental radiation monitoring in an emergency, and that they issue an advisory or an instruction on eviction for sheltering or evacuation to local residents, etc. based on a direction, advice, an instruction, etc. given by the Prime Minister.

In consultation with local governments, licensees shall formulate the Nuclear Operator Emergency Action Plan concerning measures to prevent a nuclear disaster, emergency response measures, and measures for restoration from

nuclear emergency for each nuclear site, including not only on-site measures, but also an off-site cooperation system.
The Nuclear Operator Emergency Action Plan is required to include the following matters:

- Matters relating to duties of a Nuclear Emergency Preparedness Manager, a Deputy Nuclear Emergency Preparedness Manager, and nuclear disaster prevention staff;
- Matters relating to a person who takes care of the duties of a Nuclear Emergency Preparedness Manager or a Deputy Nuclear Emergency Preparedness Manager;
- Matters relating to the formation of an on-site organization for nuclear emergency preparedness;
- Matters relating to the assignment of nuclear disaster prevention staff, and education on disaster prevention for nuclear disaster prevention staff;
- Matters relating to the installation and maintenance of radiation measuring equipment and other equipment for emergency preparedness;
- Matters relating to the furnishing, and maintenance and check of materials and equipment for nuclear disaster prevention;
- Matters relating to implementation of a emergency response drill;
- Matters relating to the reporting by a Nuclear Emergency Preparedness Manager to the competent minister, a governor of a prefecture where the nuclear site is located and a mayor of a municipality where the nuclear site is located, governors of related neighboring prefectures, a police agency, and other relevant organizations when a Specific Event occurs, and relating to the reporting of the status of the Specific Event to these organizations;
- Matters relating to the reporting of emergency measures to be taken to prevent a nuclear disaster or its expansion when a Specific Event occurs, and a summary of these measures;
- Matters relating to the implementation of emergency response measures;
- Matters relating to the implementation of dispatch of nuclear disaster prevention staff, lending of materials and equipment for nuclear disaster response, and other necessary measures when emergency response measures are taken;
- Matters relating to the implementation of measures for restoration from nuclear emergency;
- Matters relating to the implementation of dispatch of nuclear disaster prevention staff, lending of materials and equipment for nuclear disaster response, and other necessary measures when measures for restoration from nuclear emergency are implemented;
- Matters relating to cooperation with other licensees;
- Matters relating to the preparation of documents or drawings specifying major facilities and equipment on a nuclear site; and,

- Matters relating to work to be carried out by an on-site organization for nuclear emergency preparedness and response to prevent a nuclear disaster or its expansion on a nuclear site in addition to the matters mentioned in each subparagraph above.

(3) Responsibilities of relevant organizations concerning nuclear emergency preparedness and response, and related measures

The National Government, local governments, and licensees prepare the necessary emergency preparedness and are ready to take measures in an emergency:

a The National Government

- The competent minister stations a Senior Specialist for Nuclear Emergency Preparedness in the vicinity of each nuclear installation, who guides and advises the licensee in preparing its emergency action plan and, in an emergency, takes the necessary measures in preventing expansion of the emergency.
- The competent minister designates a base facility in the vicinity of a nuclear installation as an Off-Site Center to be used in an emergency. In the case of an emergency, the National Government, the local governments and the licensee establish the "Joint Council for Nuclear Emergency Response" at the Off-Site Center, in order to share information and to coordinate their activities. Off-Site Centers are built on the areas indicated in Fig. 16-2, and have necessary facilities and equipment capable to communicate with the Prime Minister’s Official Residence, the Cabinet Office, the Emergency Response Center of NISA, the Emergency Operation Center of MEXT and related local governments. Each Off-Site Center is equipped with means by which to monitor environmental radiation levels and the plant status. The real-time environmental radiation levels, other than emergency environmental radiation monitoring data measured in an emergency situation, can be monitored at every moment since the monitoring equipment is connected on line with the monitoring posts located in the vicinity of the nuclear installation. The plant status can be predicted by means of an Emergency Response Support System (ERSS), which predicts progress of an abnormal condition of a nuclear installation using plant information sent from the licensee on-line. Each Off-Site Center is also equipped with a System for Prediction of Environmental Emergency Dose Information (SPEEDI) by which to quickly predict an impact of radioactive materials on the environment by calculating an atmospheric concentration of radioactive materials in a surrounding environment and an exposure dose based on the information on a source of release such as a prediction value of a released amount by an ERSS, weather

conditions, and topographic data.

- The National Government establishes a response system necessary for quickly putting response capabilities into the site in emergency.
- In a nuclear emergency, the NSC organizes the "Technical Advisory Organization in an Emergency" which consists of the NSC Commissioners and the Investigators for Emergency Response, and gives technical advice to the head of the Nuclear Emergency Response Headquarters on designation or alteration of regional areas that necessitate emergency measures to be taken, and technical matters on the implementation of emergency response measures and dissolution of a nuclear emergency.
- The national government conducts the comprehensive Integrated nuclear emergency Response drill based on the program established by the competent minister.

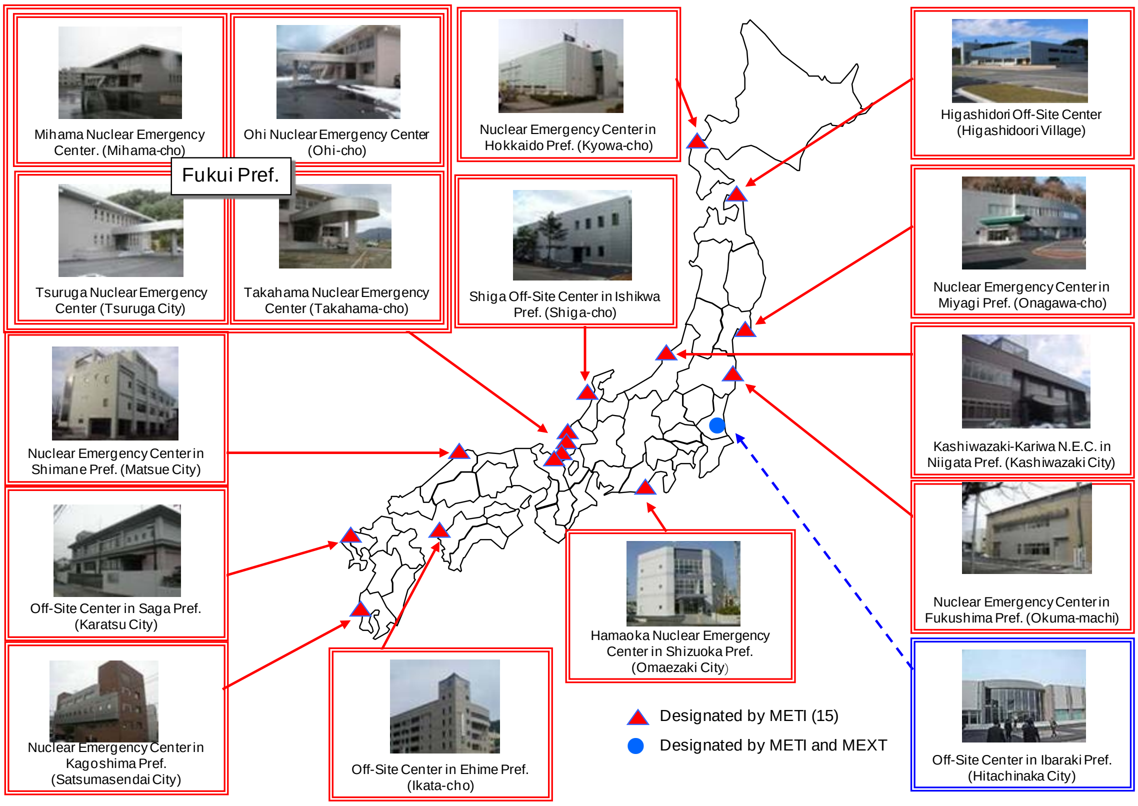


Fig. 16-2 Off-Site Center

b Local governments

- Local governments formulate and implement their respective regional disaster prevention plans;
- Prefectures support the duties for emergency preparedness carried out by municipalities and perform overall coordination; and,
- Local governments conduct an on-site Inspection to check whether or not

preventive measures for a nuclear disaster are taken by licensees in an appropriate manner.

c Licensee

- Each licensee shall develop its Nuclear Licensee Emergency Action Plan after consulting with relevant local governments, and submit it to the competent minister before its nuclear related activity;
- Each licensee shall establish an on-site organization for nuclear emergency preparedness and response, and designate a Nuclear Emergency Preparedness Manager who administers the organization;
- The Nuclear Emergency Preparedness Manager shall immediately report the National Government, the prefecture where the nuclear site is located, etc., when a Specific Event occurs; and,
- Each licensee shall install and maintain radiation measuring equipment on the nuclear site for making a reporting decision, prepare radiation protection equipment, emergency communication equipment, and other materials and equipment necessary for the on-site organization for nuclear emergency preparedness to carry out its work, and perform maintenance and check of them.

d Nuclear Emergency Assistance and Training Center

The Nuclear Emergency Assistance and Training Center (hereinafter referred to as NEAT) was established by the Japan Atomic Energy Agency in Ibaraki Prefecture and Fukui Prefecture in March 2002 for the purpose of conducting specialized technical support activities such as the environmental assessment and radiation protection activities for the Off-Site Centers across the nation that serve as bases of operation in an emergency or local governments.

NEAT's main activities in an emergency are, on the request of the National Government or local governments, to efficiently collect and organize accident information from various fields, and analyze and assess the information as a nuclear research institute, and to dispatch experts and mobile type special vehicles such as whole body counter vehicle and body surface monitoring vehicle to the concerned site, as needed.

The main activities at normal times include conducting training on nuclear emergency responses for related parties such as the National Government, local governments, police, fire departments, and licensees. Also, as research and development on nuclear emergency preparedness and response, NEAT collect domestic and overseas information on nuclear emergency preparedness and response, etc., and develop the database in order to provide necessary data quickly.

Furthermore, as an international contribution in nuclear emergency and preparedness and response field, NEAT endeavor to share knowledge with Asian nations through the activities of the IAEA Asian Nuclear Safety Network.

(4) Emergency preparedness and response activities by licensees

Licensees equip and maintain radiation measuring equipment on nuclear sites that is necessary in reporting of a Specific Event, and also prepare radiation protection equipment such as an anticontaminant suit, a respiratory oxygen tank, and a protective mask, emergency communication equipment such as a cell phone and a facsimile machine, measuring equipment such as a fixed measuring instrument or dose meter and a portable measuring instrument for measuring radioactive materials released outside a building, and other materials and equipment for nuclear disaster response.

A mechanism has been established by which information necessary for cognizing operational status of a nuclear reactor such as operation parameters is transmitted in real time to the Off-Site Center and the NISA's Emergency Response Center set up at the headquarters of METI in Tokyo.

(5) Nuclear emergency response drill

Nuclear emergency response drills are implemented to confirm the effectiveness of the nuclear emergency response system based on the Nuclear Emergency Preparedness Act. The purpose of the nuclear emergency response drill is 1) to enhance understanding of, and adequate actions for, nuclear emergency response by responsible personnel of the National Government, local governments, the licensee, and residents, and 2) to verify whether emergency response measures function in a predetermined way, and whether information sharing and cooperation among related organizations are adequate. The National Government, local governments, designated public organizations and the licensee cooperate and participate in the drill, which cover communication, monitoring, decision on emergency measures to be taken, sheltering or evacuation etc. In Japan, various forms of the drill, ranging from a large scale national drill to the licensee's on-site drill, are performed. These are explained below.

a Drills Planned by the National Government

Nuclear emergency response drills used to be planned and conducted by local governments with support and coordination of the National Government before the JCO criticality accident in 1999. The Nuclear Emergency Preparedness Act stipulated the drills to be planned and conducted by the National Government. The drill planned by the National Government has been conducted once a year as the Integrated Nuclear Emergency Response Drill in collaboration with the National Government, local governments, licensees, etc. The Integrated Nuclear Emergency Response Drill is open to the public. Visitors to the Off-Site Centers can observe the training freely so long as they don't interfere with the drill. This is effective in ensuring opportunities for the public to be familiarized with nuclear emergency response activities, and plays a certain role in disseminating

information on nuclear emergency preparedness and response.
Drills conducted in this reporting period (2007 to 2009) are as follows:

- On October 24, 2007, a drill was conducted jointly by the National Government, Aomori Prefecture, related municipalities, Japan Nuclear Fuel Limited, and relevant organizations involved in emergency preparedness and response, assuming an accident at the reprocessing plant of Japan Nuclear Fuel Limited (Rokkasho Village, Aomori Prefecture), in which about 1,800 people including local residents participated. This was the first drill for reprocessing facilities, in which fire fighting training was conducted, assuming release of radioactive materials, and efforts were made to improve public relations activities including improvement of information transmission to overseas media.
- On October 21 and 22, 2008, a drill was conducted with the participation of the National Government, local governments including Fukushima Prefecture, TEPCO, and other relevant organizations, assuming an accident at Unit 3 of Fukushima Dai-ichi Nuclear Power Station of TEPCO, in which about 4,000 people including local residents participated. In this drill, efforts were made to improve the quickness of initial responses, and as part of public relations activities, emergency information was transmitted to the French Embassy in Japan with the cooperation of the Embassy.
- On December 21 and 22, 2009, a drill was conducted by the National Government, local governments including Ibaraki Prefecture, the Japan Atomic Power Co., other relevant organizations, local residents, etc., assuming an accident at Tokai Dai-ni Power Station of the Japan Atomic Power Co., in which about 3,100 people participated. In this drill, a study was made on the evacuation of residents using private cars, and on the protected area utilizing the “Basic Form of Evacuation Plan” based on the regional disaster prevention plan of Ibaraki Prefecture. That year again, emergency information was provided to the French Embassy in Japan. Emergency information was also provided to the Pakistan Nuclear Regulatory Authority (hereinafter referred to as PNRA), through the Pakistani Embassy in Japan on the request from the PNRA of Pakistan.

Proactive information transmission to not only domestic but also overseas recipients is characteristic of the recent Integrated Nuclear Emergency Response Drill.
The result of the drills is assessed, and good practices, challenges, etc. are extracted. They are reflected in the drill items and methods of next drill. Three kinds of methods, a participant’s questionnaire, check by an independent assessment agency, and observation by external experts, are taken for the drill

assessment.

b Drills planned by the NSC

The NSC conducts notification drills several times a year using automatic simultaneous notification equipment, and a drill for nuclear disaster per year from the viewpoint of maintaining and improving the nuclear emergency response capabilities of the Commissioners, the members of the Emergency Technical Advisory Body, the personnel of the Secretariat, etc

c Drills planned by local governments

The regional emergency preparedness plan prescribes the local drills to be planned and conducted by each local government, which the NISA and the NSC support by dispatching expert staff. Drills reflecting the framework of the Civil Protection Law are also conducted in part of those drills.

d Drills planned by licensees

Each licensee implements an on-site drill once a year including establishment of an emergency response headquarters, reporting and communication, emergency environmental radiation monitoring, etc. based on the Nuclear Licensee Emergency Action Plan defined for each nuclear site. Each licensee also implements a drill in order to confirm effectiveness of the organization implementing the accident management. When the said nuclear site is subject to the drill conducted by the local government, the on-site drill has been implemented at the same time with the local drill implemented by the local government etc.

e Participation in international exercise

Japan is a contracting party to the Convention on Early Notification of a Nuclear Accident, and to the Conventions on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Emergency Convention). Japan has continuously participated in the Convention Exercise (ConvEx) organized by the IAEA in order to ensure implementation of notification in an emergency based on the provisions of the Convention.

Article 16 (2) Information to the public and neighboring countries

1 Measures to provide information to the public

The measures to disseminate disaster prevention plans to the public taken in Japan include the participation of local residents in the Integrated Nuclear Emergency Response Drill conducted by the National Government and nuclear emergency response drills conducted by local governments. In these drills, evacuation, radiation surveys, etc. are actually conducted for residents of areas to be evacuated. Prior to the drills, the disaster prevention plans are explained to the residents by local governments.

There are a number of means prepared for providing emergency information to residents in the neighborhood of reactor facilities in an emergency. A local government wireless system for emergency preparedness and response is installed in municipalities where nuclear installations are located, for sending emergency information to residents. The local government wireless system for emergency preparedness and response is useful as an information providing tool, but because there may be a case where power is not supplied to the system or the apparatus is out of order, municipalities where nuclear installations are located provide information using publicity cars as well to ensure the distribution of information to residents. Furthermore, emergency information is provided to areas to be evacuated, etc. by fire departments using their vehicles.

The NISA established an emergency information mailing service in July 2008. This is a system by which to provide emergency information to e-mail addresses registered beforehand quickly in an emergency.

Starting from the drill in 2008, information has been provided to foreign embassies in Japan on a trial basis in order to explore the possibility of providing emergency information to foreigners staying in Japan and to foreign countries in foreign languages. In the Integrated Nuclear Emergency Response Drill in October 2008, emergency information was provided to the French Embassy in Japan. In the 2009 drill, information was provided to the French Embassy in Japan and the Pakistani Embassy in Japan. The method of providing emergency information to foreign embassies in Japan can be effective to ensure safety of the public in an emergency without discrimination in Japan, where there is a linguistic constraint in communication with foreigners residing in Japan. Mass media also play a part in providing information to residents in the event of a nuclear disaster. Information is released timely from the local Off-Site Centers that serve as the front line base for emergency response and the Emergency Response Center in Tokyo, and the information is provided to residents through TV and radio.

There is also a method of providing information through web pages as means to provide emergency information.

2 Providing emergency information to neighboring countries

Japan, located in the East Asian region, is an island country across the ocean from the continent that does not border on any other country in land areas. However, Japan’s neighboring countries across the sea such as China, Korea, etc., have nuclear installations, and sharing of emergency information in a nuclear disaster is a mutually important theme. Japan, China and Korea set up a meeting by senior regulators in August 2009, in which an agreement was made on the establishment of an early notification system for emergency information. In the past, information exchange has been made between persons in charge of these three countries as needed, and the mechanism of information sharing by the three countries which is newly agreed on is going to be studied from now on.

Apart from the above mechanism among the three countries, Japan is proactively utilizing websites concerning the Emergency Convention (ENAC Web) operated by IEC of the IAEA as an existing information sharing system. The NISA has established standard procedures for notification of information to the ENAC Web, and has been making efforts to speed up the provision of information. In the Surugawan-oki Earthquake in August 2009, the Hamaoka Nuclear Power Station adjacent to the epicenter was affected by the earthquake, and the nuclear reactors in operation were scrammed. This earthquake occurred early in the morning, but the NISA held an urgent call out of the crisis management staff and established an initial response system to collect information. As a result, the first information was transmitted to the ENAC Web only about two and a half hours after the occurrence of the earthquake.

3 Response in a case of a nuclear accident in neighboring countries

Japan is a state party to the Convention on Early Notification of a Nuclear Accident, and to the Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency. To implement the response system as expected in the provisions of the Conventions, the Ministry of Foreign Affairs is designated as the Notification Warning Point (NWP), and the National Competent Authority Abroad (NCA(A)) in the case of a nuclear accident and a radiation emergency situation that have occurred outside Japan’s territory. A system has been established by which the Ministry of Foreign Affairs receives notification when a radiation emergency situation occurs outside Japan’s territory including neighboring countries, and immediately transfers it to the relevant organizations including the National Competent Authority Domestic (NCA(D)) to share information and take necessary measures. Concerning the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Japan’s relevant organizations have been registered to IAEA Response Assistance Network (RANET) as assisting capabilities.

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 Article 17

In siting reactor facilities, it is obligated to conduct an environmental impact study on the site as it is required to conduct for general large-scale industrial facilities. An assessment on radiation effects due to the installment of the nuclear installation is conducted within the procedure for a reactor installment license. A re-evaluation of the site is conducted as needed.

Article 17 (1) Evaluation of site related factors

1 Site-related factors that affect the safety of nuclear installation

An evaluation of site-related factors that affect the safety of nuclear installation is conducted in the process of reviewing an application for a reactor installment license. An applicant is required to attach document that explains the evaluation results on the conditions such as weather, soil, hydraulic status, earthquakes, and social environment, etc. concerning the site where the applicant intends to install nuclear reactor, to an application document for a reactor installment license. The NISA conducts an evaluation of site-related factors, too. A reactor installment license is explained in Article 18.

2 Design provision used for external events

The Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities established by the NSC is adopted in the safety review conducted by NISA, too, as judgment criteria for the safety review concerning a reactor installment license. In this Guide, the following points are set forth as what should be considered for natural phenomena in designing the facilities:

- Structures, systems and components with safety functions shall be assigned to appropriate seismic design categories, with the importance of their safety functions and possible safety impacts of earthquake-induced functional loss taken into consideration, and they shall be designed to sufficiently withstand design seismic forces defined as appropriate.
- Structures, systems and components with safety functions shall be so designed that the safety of the nuclear installation will not be impaired by other postulated natural phenomena than earthquake. Structures, systems and components with safety functions of especially high importance shall be of the design that reflects appropriate safety considerations against the severest conditions of anticipated natural phenomena or appropriate combinations of natural forces and accident-induced loads.

Regarding to external man induced events, the following are specified as matters to be considered in designing:

- Structures, systems and components with safety functions shall be so designed that the safety of the nuclear installation will not be impaired by postulated external man-induced events.
- The nuclear installation shall be so designed that structure, systems and components with safety functions are protected by appropriate means against any unjustifiable access by third persons.

Concerning the consideration to crashing of aircraft, a standard assessment method is provided in the Assessment Criteria of the Probability of Aircraft Crashing on Commercial Power Reactor Facilities (bylaw) established by NISA as internal rule in July 2002, together with general criteria for determining whether or not design considerations should be given as “possible external man induced events.”

Article 17 (2) Impact of nuclear installation on individuals, society and environment

1 Environmental impact assessment

An environmental impact assessment is required for starting a business of over a certain scale, including the installment of a nuclear power station. Procedures for an environmental impact assessment are specified in the Environmental Impact Assessment Act, while the procedures for an environmental impact assessment unique to power stations are set forth in the Electricity Business Act. Whether an environmental impact assessment is required or not is determined depending on the kind and size of a power station, but it is mandatory required for the installment of a nuclear power station.

(1) Review of scoping items and methods for an environmental impact assessment

A licensee shall prepare a document (Environmental Assessment Procedure) describing items of an environmental impact assessment and methods for investigation, prediction and assessment, and forward it to the Minister of METI and relevant local governments. The licensee shall also publish the document, make it available to the public, and seek opinions from the relevant local governments, local residents, etc.

Taking into account the opinion of the prefectural governor based on the local governments’ opinions, and also giving consideration to the opinions of the local residents, etc., the Minister of METI review the Environmental Assessment Procedure, and may make recommendations on the items and methods for the environmental impact assessment.

(2) Review and recommendations by the Minister of METI for a draft environmental impact statement

A licensee shall take into account the opinion of the prefectural governor, respect the opinions of the local residents as well, make necessary consideration on the items and methods for the environmental impact assessment based on the recommendations of the Minister of METI, and prepare a document (a draft environmental impact statement) describing the results of the environmental impact assessment for the business concerned. The licensee shall forward the document to the Minister of METI and relevant local governments, publish the document, and make it available to the public. The licensee shall hold an explanatory meeting and seek opinions from the relevant local governments, local residents, etc.

Taking into account the opinion of the prefectural governor based on the local governments' opinions, and giving consideration to the opinions of the local residents, etc., the Minister of METI review the draft environmental impact statement after hearing the opinion of the Environment Minister and may make necessary recommendations.

(3) Alteration order by the Minister of METI to an environmental impact statement

A licensee shall take into account the opinion of the prefectural governor, respect the opinions of the local residents, etc., make necessary consideration on the descriptions of the draft environmental impact statement based on the recommendations of the Minister of METI, prepare an environmental impact statement, and forward it to the Minister of METI.

The Minister of METI may order alteration of the environmental impact statement, if especially necessary, to ensure appropriate environmental considerations. When the Minister of METI recognizes that alteration order is not necessary, the licensee is notified to that effect.

On receiving the notification to the effect that alteration is not necessary, the licensee shall forward the environmental impact statement to the relevant local governments, publish the document, and make it available to the public.

(4) Development of a construction plan in line with results of the environmental impact assessment

By specifying in the requirements for approval of a power station construction that the plan should be in line with the environmental impact statement, and by not approving the construction plan if this is not complied with, the results of the environmental impact assessment will be reflected in the business without fail.

(5) Consideration to environmental preservation

With giving appropriate environmental considerations, a licensee shall construct a power station, carry out alteration of construction work, and perform maintenance and operation of the power station in line with the descriptions of the environmental impact statement.

2 Evaluation of nuclear reactor siting as an element for a reactor installment license

The Regulatory Guide for Reviewing Nuclear Reactor Siting Evaluation and Application Criteria, however, requires the following site conditions in principle to ensure public safety in case of rare accident.

- There have as yet been no event liable to induce large accident and no such event is expected to occur in the future.

- There have also been very few events deemed liable to expand disaster.
- In relation to their safety guarding facilities, nuclear reactors shall be located at a sufficient distance from the public.
- The environment of the nuclear reactor site including its immediate proximity shall be such that appropriate measures for the public can be implemented as required.

The followings are set forth as the conditions that satisfy these requirements:

- Regarding the area surrounding a nuclear reactor, within “the range in a specified distance” from the nuclear reactor shall be the non-residential area. Here, “the range of specified distance” means a range of distance where person may be exposed to radiation hazard, if they remain at the point of that distance under a Major Accident, and “non-residential area” means the area where the public do not reside in principle.
- The region within the range in specified distance from the nuclear reactor and outside the non-residential area shall be the low population zone. Here, “the range in specified distance” means that wherein the public may be exposed to significant radiation hazard in the case of a Hypothetical Accident unless certain countermeasures are provided. “The low population zone” means the region where appropriate countermeasures can be provided to prevent significant radiation hazard (for instance, a low population density zone).
- The nuclear reactor site shall be separated by specified distance from the dense population zone. Here, the specified distance means the distance where the cumulative value of whole-body dose in case of a hypothetical accident shall be small enough to be deemed acceptable based on the viewpoint of collective dose.

In examining an application for a reactor installment license, the regulatory body examines whether or not the basic design of nuclear installations for which a license is applied conforms to the provision of the Reactor Regulation Act, and also to the requirements of the guidelines formulated by the NSC. The result of the examination by NISA is reviewed by the AEC and the NSC. Thus in the process of granting a license for installment, review criteria concerning licensing are appropriately used in the system in which the regulatory body conducts an examination, and the AEC and the NSC double-check the result of the examination by the regulatory body as a third party (secondary review).

Article 17 (3) Re-evaluation of site related factors

1 Activities on the re-evaluation of a site

All the factors related to site selection must be re-evaluated at the time of alteration of installment license, such as additional nuclear installation construction at the existing site, so as to ensure the continuous safe operation of the nuclear installation. And also the adequacy of the safety design is re-evaluated referring to new findings and new experiences having impact on the safety design.

2 Result of the re-evaluation

As nuclear installations in Japan hold a large area, they are generally thought to be insusceptible to change in siting conditions due to population change in the vicinity, land development, etc.

Article 17 (4) Consultation with other countries having potential to be affected by the installation

Japan, located in the East Asian region, is surrounded by the sea on all directions, and does not border on neighboring countries directly. Nuclear installations in Japan are located along the coastline to use sea water for cooling, and all of sites are far enough away from neighboring countries. And installments of the facilities and their operation have no impact on neighboring countries. Therefore, it is not deemed necessary to take the procedure or make an arrangement to obtain neighboring countries' consent, etc. in siting the facilities.

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; and,

(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 Article 18

In Japan, a mechanism by which the regulatory body reviews the design consists of three procedures: licensing for reactor installment in which basic design and safety assessment concerning siting of nuclear installations are reviewed, approval of a construction plan in which detailed design, that is, specific design of facilities, is reviewed, and approval of fuel assembly design in which design of a fuel assembly used in nuclear installations is reviewed. Concerning the construction of nuclear installations, the regulatory body examines whether or not nuclear installations are constructed or manufactured as approved by means of a pre-service inspection and a fuel assembly inspection.

Article 18 (1) Implementation of protection in depth

1 Regulatory procedures concerning design and construction of nuclear installations

The licensing process in the stages of design and construction of nuclear installations in Japan is shown in Fig. 18-1.

(1) Licensing for reactor installment

In accordance with the provision of the Reactor Regulation Act, the person who intends to install a nuclear reactor shall obtain a license for reactor installment after undergoing a review of the basic design or basic design policy of the nuclear installation by the regulatory body. The reactor installment license applicant is required to submit to the competent minister an application describing the purpose of use, type, thermal power, and number of units of the reactors, name and address of the factory or place of business where the reactors are to be installed, location, structure and equipment of the reactors and their associated facilities, spent fuel disposal method, etc. The applicant is required to attach to the application a description on safety design of the nuclear installation, a description on types, extent, impacts, etc. of reactor accidents, and so on. The applicant is also required to perform a safety assessment for the siting of the nuclear installation, and attach the result to the application.
The NSC Regulatory Guide used in the secondary examination is utilized in the safety assessment conducted by the applicant and the safety review conducted by the regulatory body as well. The Regulatory Guide for Reviewing Nuclear Reactor Siting Evaluation and Application Criteria specifies the following as principal siting conditions:

- there have as yet been no event liable to induce large accident and no such event is expected to occur in the future. There have also been very few events deemed liable to expand disaster;
- in relation to their safety guarding facilities, nuclear reactors shall be located at a sufficient distance from the public;
- the environment of the nuclear reactor site including its immediate proximity shall be such that appropriate measures for the public can be implemented as required.

As basic objectives to ensure the safety of the public at the time of an accident in the installed nuclear installations, the Guide specifies:

- not to cause radiation damage to the neighboring public, even when assuming a serious accident (Major Accident) that is deemed to have a possibility of occurrence under the worst scenario from technological point of view, by considering the events in the site vicinity, the characteristics of the nuclear reactor and related safety guarding facilities,
- to prevent significant radiation hazard to the neighboring public when an

accident (here after termed “Hypothetical Accident”), which exceeds the Major Accident level and is not expected to occur from technological point of view. is hypothesized,

- in case of a Hypothetical Accident, effect on the collective dose shall be sufficiently small.

The Guide specifies that, in evaluating the suitability of the siting conditions, at least the following three conditions shall be met in achieving the above basic objectives:

1. the area surrounding a nuclear reactor, within the range in a specified distance from the nuclear reactor, shall be the non-residential area,
2. the region within the range in specified distance from the nuclear reactor and outside the non-residential area shall be the low population zone,
3. the nuclear reactor site shall be separated by specified distance from the dense population zone.

Tentative judging criteria to apply the Regulatory Guide for Reviewing Nuclear Reactor Siting Evaluation and Application Criteria are provided as follows:
- as for “the range of a specified distance” in the above 1, a dose level of 1.5Sv for the thyroid gland (child), and 0.25Sv for the whole body shall be used.
- as for “the range of a specified distance” in the above 2, a dose level of 3Sv for the thyroid gland (adult), and 0.25 SV for the whole body shall be used.
- as for “separated by specified distance” in the above 3, examples in foreign countries, such as 20,000man-Sv, shall be referred to.

(2) Approval of a construction plan

A commercial power reactor licensee who has obtained a license for reactor installment shall do the detailed design of the nuclear installation as the next step, and obtain approval of the design from the Minister of METI in accordance with the provision of the Electricity Business Act. When nuclear installations are to be newly constructed, the licensee shall describe, in the application for approval of a construction plan, the matters concerning detailed design of facilities specified in the Rules for the Electricity Business Act, including the reactor, reactor cooling system equipment, instrumentation and control system, fuel equipment, radiation control system, disposal equipment, reactor containment, ventilation stack, steam turbine, auxiliary boiler, fuel system of auxiliary boiler, smoke processing facility of auxiliary boiler, and attach explanations specified in the Rules to the application. When modifications to the existing nuclear installation are to be carried out, the licensee shall obtain approval for modifications concerning the modifications to the already approved matters. When examining the application for approval of a construction plan, the regulatory body uses the standards of academic societies and associations endorsed beforehand as criteria in determining whether or not the plan satisfies the performance criteria specified by the law.

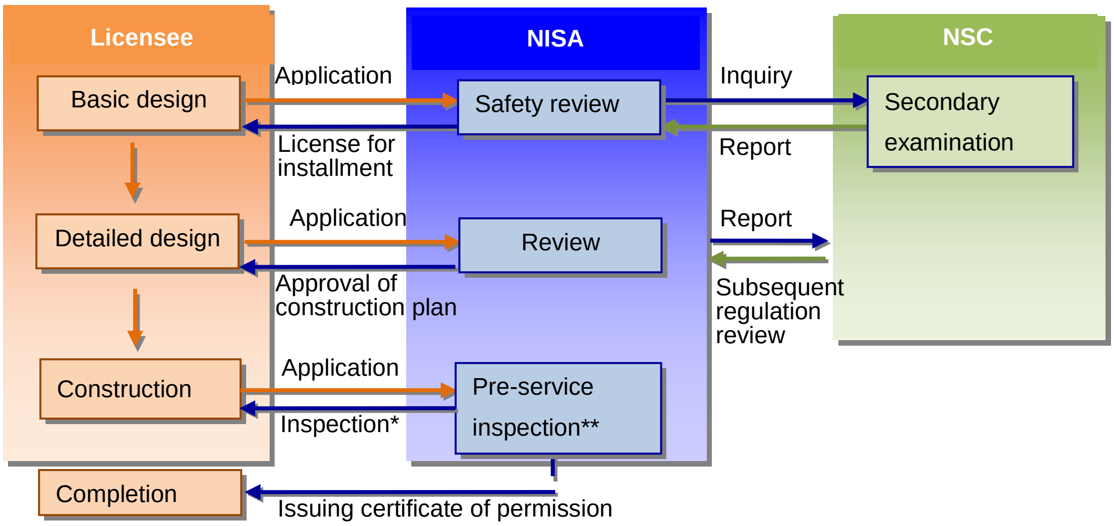
The licensee carries out construction work of the nuclear installation after the detailed design has been approved. The pre-service inspection conducted by the regulatory body verifies whether or not the construction work is being performed as approved beforehand..

(3) Pre-service inspection

In accordance with the provision of the Rules for the Electricity Business Act, a pre-service inspection is conducted for each construction phase. The specific inspection items for each construction phase are shown in the Annexes.

In manufacturing fuel assemblies used in the nuclear installation, fuel manufactures shall obtain approval for the design from the Minister of METI beforehand, and unless the fuel assemblies pass a fuel assembly inspection to verity that they are manufactured as approved, they cannot be used in the nuclear installation as fuel.

The licensee of reactor operation is also obligated to perform a welding inspection for welded portions of important equipment such as a containment under the Electricity Business Act. The system for performing the welding inspection (the organization, methods, etc.) is required to undergo examination by the Japan Nuclear Energy Safety Organization.



*: Part of the inspection is conducted by the Japan Nuclear Energy Safety Organization at the direction of the Minister of METI, and the result is forwarded to the Minister of METI.

**: In parallel with the pre-service inspection, the fuel assembly inspection and the safety management inspection on welding are conducted.

Fig. 18-1 Main procedures in the design and construction stages of nuclear installations

2 Regulatory requirements concerning design of nuclear installations

Nuclear installations in Japan are operated based on the same concept of "protection in depth" as prescribed in the Nuclear Safety Standards (NUSS) of the IAEA. Original design of light water reactors in Japan was introduced from the United States of America. Later on, design of reactors has been improved so that the installations have become safer and easier in maintenance management through series of Improvement and Standardization Programs led by METI (then MITI), reflecting the

operating experiences of licensees of reactor operation who have obtained license for reactor installment, and knowledge obtained in research and development program of nuclear power industries.
The principle of "protection in depth" is as follows:

- Prevention of deviating from normal operation conditions by means of conservative design, manufacturing and construction of the nuclear plant in accordance with the appropriate quality level and engineering practices,
- Detection of the occurrence of an abnormal event at an early stage and taking preventive measures against its progression into an accident,
- Control of the progression of accident and mitigation of its consequences, even if assuming that progression to an accident might not be prevented at the preceding stage.

In order to apply these fundamentals to design of nuclear installations, the Regulatory Guide for Reviewing Safety Design that was established by the NSC stipulates the following items.
The first protection is preventive measures for the occurrence of an abnormal event. More specifically, the first protection implies such measures of designing with a safety margin, implementing strict quality control in fabrication, inspecting the facilities and component to be fabricated as required by the design, and preventing degradation of performance through monitoring, check and maintenance during the operation. Each component, equipment and system of nuclear reactor facility is to be designed considering the importance of its safety function, and the quality control during design and manufacturing is to be conducted corresponding to the importance of safety function.
The second protection is to prevent expansion of abnormalities. More specifically, the second protection implies the early detection of the abnormal condition, its correction or taking measures in advance to prevent the progression into an accident.
The third protection is to mitigate the consequence of an accident. More specifically, the third protection implies taking measures to ensure the safety of the public in the vicinity by mitigating the consequence of the accident.
In Japan, through these measures, it is possible to reduce the potential for the occurrence of a severe accident to the extent that its actual occurrence would be technologically inconceivable, and to maintain the risk of the nuclear installation at a sufficiently low level. Therefore, preparation of the accident management can be regarded as a measure to reduce this low risk further.
From the viewpoint of confining radioactive materials, nuclear installations are designed, constructed and operated, in such a way as to confine radioactive materials within a series of physical barriers. These physical barriers are the fuel pellet, the fuel cladding, the reactor coolant pressure boundary and the reactor containment. The requirements for these physical barriers in the Regulatory Guide for Reviewing Safety Design etc. and the outcome of the design improvements in them are as follows:

- Fuel and claddings

  The fuel assembly shall be so designed that;

  - the integrity will be retained under the various conditions that could occur in the nuclear reactor in service;
  - the safety protection system will actuate the reactor shutdown system, etc. so that the allowable design limit of the fuel shall not be exceeded at abnormal transients during operation;
  - the reactor core cooling will not be impaired by a reactivity insertion accident and, more specifically, the maximum fuel enthalpy by analysis will not exceed the specified value; and the emergency core cooling system will be capable of preventing major damage to the fuel in a loss of coolant accident, and the fuel cladding metal water reaction will be limited to sufficiently small amount.

These requirements are stipulated in the Regulatory Guide for Reviewing Safety Design, and the requirements for safety assessment are stipulated in the Regulatory Guide for Evaluating Reactivity Insertion Events of Light Water Nuclear Power Reactor Facilities and the Regulatory Guide for Evaluating Emergency Core Cooling System Performance of Light Water Nuclear Power Reactors.

- Reactor coolant pressure boundary

  Concerning the reactor coolant pressure boundary, the Regulatory Guide for Reviewing Safety Design specifies the following:

  - the reactor coolant pressure boundary shall be so designed that its integrity will be ensured during normal operation and abnormal conditions,
  - the reactor coolant pressure boundary shall be designed not to exhibit brittle behavior and develop any quickly propagative failure during normal operation, maintenance, testing, and abnormal conditions,
  - the leakage of the reactor coolant, if any, from the reactor coolant pressure boundary shall be designed to provide for quick and proper detection,
  - the reactor coolant pressure boundary shall be designed to be capable of being tested and inspected to verify its integrity throughout the service life of the nuclear reactor,
  - pressure on the reactor coolant pressure boundary shall not exceed the specified value during reactivity insertion events.

- Reactor containment

  Concerning the reactor containment, the Regulatory Guide for Reviewing Safety Design specifies the following:

  - the reactor containment shall be designed to withstand the load resulting from the postulated events for reactor containment design and an appropriate seismic load and prevent the specified leakage rate from being exceeded with the aid of properly operating isolation functions,
  - the reactor containment shall be so designed that the leakage rate of the entire containment can be measured under a specified pressure on a periodic basis,
  - the reactor containment boundary shall be designed not to exhibit brittle

behavior and develop any quickly propagative failure during normal operation, maintenance, testing and abnormal conditions, and the pipelines that penetrate the reactor containment walls shall in general be fitted with containment isolation valves.

Concerning design of nuclear installations, the Regulatory Guide for Reviewing Safety Design specifies that systems with safety functions of an especially high degree of importance shall be designed to have redundancy, diversity or independence. Classifications of the structures, systems and components that make up nuclear installations and their safety functions are shown in Table 18-1. Definitions and functions with respect to classifications of importance of safety functions are shown in the Annexes.

Table 18-1 Classifications of importance of safety functions

<table>
<tr><td colspan="2" rowspan="2">Classification by function
Classification by importance</td><td colspan="2">Structures, systems and components with safety functions</td><td rowspan="2">Structures, systems and components without safety functions</td></tr>
<tr><td>With functions to prevent an occurrence of abnormalities (PS)</td><td>With functions to mitigate an impact of abnormalities (MS)</td></tr>
<tr><td rowspan="3">Structures, systems and components related to safety</td><td>Class 1</td><td>PS-1</td><td>MS-1</td><td></td></tr>
<tr><td>Class 2</td><td>PS-2</td><td>MS-2</td><td></td></tr>
<tr><td>Class 3</td><td>PS-3</td><td>MS-3</td><td></td></tr>
<tr><td colspan="2">Structures, systems and components not related to safety</td><td></td><td></td><td>Those that perform only a function other than safety functions</td></tr>
</table>

Redundancy or diversity and independence are required for design of MS-1, part of PS-1, and part of MS-2 on the table. Part of PS-1 is a valve that serves as part of the reactor coolant pressure boundary by being open during normal operation and closed at the time of an accident. Part of MS-2 is a system having a function to cognize the state of a plant at the time of an accident, which is a minimum system required for monitoring the conditions of the three most important functions in ensuring safety, that is, reactor shut-down, core cooling, and radioactive material confinement.

In the safety design assessment of nuclear power reactor facilities, postulated event groups are defined for "abnormal transients during operation" and "accidents", respectively, based on the Regulatory Guide for Reviewing Safety Assessment, as mentioned later, then the safety is evaluated by conducting safety analysis. These event groups almost conform to the classification defined in the Nuclear Safety Standards (NUSS) of IAEA.

The person who intends to install a nuclear reactor conducts the safety analysis for these postulated event groups, compares the analysis results with each criterion, and confirms that the safety design is appropriate.

On the other hand, NISA examines the safety analysis of the person who intends to

install a nuclear reactor, and confirms its validity, getting an independent analysis report performed by the Japan Nuclear Energy Safety Organization, if necessary. The postulated events for the safety assessment are selected and evaluated in the following manners:
Malfunctions and operational errors of the systems or components, which are applied in the basic design, are analyzed, and the event which results in the severest case is selected among the events in the similar propagation process as the postulated event group for the safety assessment. Depending on the possibility of occurrence and the degree of its impact at the time of occurrence, these postulated events are classified into "abnormal transients during operation" or "accident" as provided in the Regulatory Guide for Reviewing Safety Assessment, and the safety of those postulated events are also evaluated based on the criteria defined to each classification.

a Abnormal transients during operation

"Abnormal transients during operation" are defined as events that result in abnormal conditions caused by a single equipment failure, malfunction or single operational error assumable in the lifetime of the nuclear installation, and the external disturbance assumable to occur with similar frequency of the single equipment failure, etc. during the operation of the nuclear installations, and fourteen events and twelve events are selected for PWRs and BWRs, respectively. The safety analysis is conducted for these events based on the criteria of the Regulatory Guide for Reviewing Safety Assessment, the integrity of core and reactor coolant pressure boundary is confirmed, and the adequacy of the safety design of important safety related equipment, such as the safety protection system and the reactor shut-down system is logically clarified.

b Accident

The "accident" is an abnormal condition exceeding the "abnormal transients during operation", which is assumed to occur, although the frequency of occurrence is very small, and a release of radioactive materials from nuclear installations should be evaluated. Ten events and nine events for PWR and BWR, respectively, are selected. The safety analysis is conducted for these events based on the criteria of the Regulatory Guide for Reviewing Safety Assessment, and it is confirmed that the core does not result in a significant damage and a reactor containment boundary is intact. Moreover, no risk of excess radiation exposure to the general public in the vicinity is confirmed. And it is logically confirmed that the safety design of engineered safety features is appropriate.
Specifically in the analysis of the "accidents", for the loss of coolant accidents, the Regulatory Guide for Reviewing Safety Assessment and the "Regulatory Guide for Evaluating Emergency Core Cooling System Performance of Light Water Nuclear Power Reactor" are applied, and for the reactivity insertion events, the Regulatory Guide for Reviewing Safety Assessment and the "Evaluation Guide for Reactivity Insertion Events of Light Water Nuclear Power Reactor Facility", etc. are applied for the verification and evaluation respectively.

3 Main modifications implemented in response to the result of safety assessment

When nuclear installations are to be installed in Japan, designing with a sufficient margin is required in consideration of the prevention of an accident exceeding a design basis accident or the mitigation of the impact of such an accident, and backfitting is not institutionalized. However, voluntary modifications of facilities based on the result of the safety assessment are not restricted, as in the case of a modification for improvement of a seismic resistance margin. An example of this is the construction work for improvement of the seismic safety margin at the Hamaoka Nuclear Power Station.
In Japan, seismic safety of nuclear installations has been re-evaluated since 2006 in accordance with the revision of the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities, and in some nuclear installations, voluntary seismic reinforcing work has been carried out in light of the revision of the Regulatory Guide.
The Hamaoka Nuclear Power Station had ensured seismic safety to withstand an earthquake ground motion (vibration on the bedrock) of 600 gal, taking into consideration the Ansei-Tokai earthquake (magnitude of 8.4) exceeding a possible Tokai earthquake (magnitude of 8.0), and a larger earthquake (magnitude of 8.5), but in light of the deliberations by the national government on the revision of the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities that started in July 2001, the licensee of the reactor operation carried out the seismic margin improvement work voluntarily, recognizing that it is important to improve the seismic safety margin, reflecting the latest findings. Before starting the improvement work, they confirmed the seismic safety margin for a target earthquake ground motion of about 1,000 gal in the buildings, structures, equipment, piping, etc., sorted out necessary items of the improvement work, and carried out planning, detailed review, and prior investigations for the work. They completed the improvement work in March 2008 for Unit 3, and in December 2007 for Units 4 and 5.

Article 18 (2) Incorporation of proven technologies

1 Regulatory requirements concerning technologies to be incorporated

In Japan, such actions as feedback of the operating experience and utilization of the technical knowledge obtained through testing and analysis have been taken, so that the safety and reliability of nuclear installations has been enhanced. The breakdowns are described below. The new knowledge obtained through these actions has been timely incorporated in existing guidelines and used to develop new guidelines.

(1) Feedback of operating experiences from nuclear installations

- From the experience of the secondary system piping rupture accident due to the thinning of the piping at the Mihama Power Plant, Unit 3 in 2004, in which the steam that erupted invaded the main control room, a requirement of airtightness for a main control room was added as an item to be examined at the time of a safety review of new nuclear installations.

- Many fire events have occurred repeatedly in and outside Japan and in the past OSART, review has made recommendations/suggestions on fire protection management. So that, the standards and the guidelines on design and management for fire protection of nuclear installations have been re-examined and improved in Japan. The requirements were clarified for each stage of "fire prevention", "early stage detection and extinguishing of fire" and "fire consequence mitigation". Reflecting these activities, the fire-protection standards for the design is being re-examined and the preparation of standards of academic societies and industrial associations for operation management have been progressing.
- Electric cables currently used in the nuclear installation degrade gradually in normal operating conditions by oxidation due to environmental factors such as temperature and radiation etc., and may occur rapid degradation in the environment of high temperature steam and high radiation at the time of a postulated design base accident. The studies are carried out to evaluate such aging and performance degradation and to confirm the integrity of cables during in-service operation. In order to evaluate the accelerate ageing method, the studies have been conducted using test samples of the safety-related cable currently used in the nuclear installation and obtained the deterioration data of thermal and radiation ageing adopted sequentially and simultaneously. The objective of research is to establish the comprehensive assessment method of the cable aging characteristics and define environmental design conditions appropriately based on the new knowledge obtained in recent years. Thereby the evaluation methods and evaluation test guideline of aged cables will be established on the basis of the normal and accidental conditions in a nuclear installation.

(2) Feedback of the knowledge obtained through test and analysis

Recognizing the importance of assuring safety in development and utilization of nuclear energy, the researches for development of safety standards, guidelines, reference materials for acceptance criteria in safety review and assessment etc., as well as improvement of the safety itself, are promoted in Japan.

The major subjects related to the research are shown in the following:

1) Study corresponding to advanced light water reactor fuels

- Study on the safety of high-burn-up MOX fuel
- Confirmatory test on the safety margin of high burn-up fuels
- Reliability demonstration test of 9X9 type fuel
- Reliability demonstration test of nuclear design methodology for the full MOX core

2) Study on advanced safety assessment technologies

- Research of advanced nuclear and thermal-hydraulic best estimate method
- Improvement of safety analysis codes for nuclear power reactors

3) Study on severe accident

- Improvement of the accident management-related knowledge base for nuclear installations
- Study on sustenance of the containment confinement function at the late stage of a severe accident

4) Seismic safety study of nuclear installations

- Study on the design earthquake ground motion with a consideration of the characteristics of the postulated earthquake
- Test on the seismic-assessment technologies of nuclear installations
- Study on the hazard map for seismic design

2 Measures taken by licensees of reactor operation to incorporate demonstrated technologies

In designing nuclear installations, a licensee of reactor operation is required to ensure their safety. When the licensee of reactor operation is to obtain approval of a construction plan, the technology adopted in the design of nuclear installations is required to have been verified by the licensee.

Licensees of reactor operation conduct research on nuclear safety for the purpose of improving safety and reliability required for their own business, research for the purpose of explaining adequacy for safety regulations, and research for promoting social understanding of nuclear safety. Besides the research conducted by a licensee independently, there is cooperative research of electric power companies conducted jointly by licensees when there are common research needs and large sums of money are required. Concerning the individual research programs, there is research entrusted to reactor manufacturers, fuel manufacturer, general contractors, etc., cooperative research with the JAEA, etc., and research conducted by the Central Research Institute of Electric Power Industry, which is run by benefits from licensees of reactor operation, depending on fields of research needs and research contents.

Article 18 (3) Design for reliable, stable and manageable operation

1 Regulatory requirements concerning reliability, stability and ease of operations management

It is the safety design requirements concerning operating management to make nuclear installation more reliable, more stable and more manageable by taking into human factors and man-machine interface in consideration. These requirements are implemented in design and operation of the commercial power reactors in Japan.

Considerations of the design to an operator behavior, requirements on the design of a control room and concrete design approach for these requirements are described in the report of Article 12.

The regulatory body examines the application for approval of a construction plan submitted by a licensee of reactor operation in accordance with the provision of the Electricity Business Act. And the approval of construction plan is issued after confirming that detailed design of nuclear installations conforms to the licensing conditions for reactor installment under the Reactor Regulation Act, and to the technical requirements established by the Minister of METI.

2 Measures taken by licensees of reactor operation concerning reliability, stability and ease of operations management.

(1) Incorporation of new technology

When new technology is to be incorporated in nuclear installations, the licensee of reactor operation is required to verify the technology.

For example, the application of digital instrumentation and control equipment started initially for a waste processing system in the 1980s or so, and, later, a digital computer was applied mainly for an instrumentation and control system of the non safety grade system.

Based on the operating performance acquired during these applications, the scope of application was expanded in a step by step manner, and the digital computer started to be incorporated in the instrumentation and control system of safety protection system as well. The licensee of reactor operation carries out verification and validation for the incorporation in the safety protection system to ensure the software quality.

(2) Measures for operations management

Good practices and non-compliances identified during periodic inspections, as well as the experiences in design, construction and operation of domestic and foreign nuclear installations, were analyzed, and the results are incorporated in design modification, improvement of construction methods, etc., when they can be recognized to be effective, during the course of licensing for installment, approval of construction plan and pre-service inspection.

For accidents or failures that occurred in the domestic nuclear installations as well as in foreign reactors, the corrective measures are implemented after identifying the cause of failures.

From the standpoint of the comprehensive preventive maintenance of nuclear installations, periodic safety review is performed for each power reactor with the interval of approximately ten years. And its safety and reliability are confirmed, reflecting the situation of operational safety activities and the latest technical knowledge. The situation of periodic safety review is described in Article 19.

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 program 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) programs to collect and analyze 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 Article 19

The regulatory system for ensuring safety in the operation of nuclear installations has not changed much from the time of the last report. Licensees of reactor operation can commence operation of their nuclear installations only after they have passed a pre-service inspection, obtained approval to the operational safety program, and implemented all other procedures provided for by the law. While nuclear installations are in operation, inspections such as the periodic inspection and the operational safety inspection are conducted by the regulatory body, in addition to safety assessments such as periodic assessments, and aging technical evaluations conducted by licensees of reactor operation. Licensees of reactor operation are obligated to report when an important safety related event has occurred in accordance with the law.

Enhancements have been made to the inspection system during this reporting period. The inspection that was conducted in a uniform manner is now performed flexibly considering the characteristics of individual nuclear installation. Also, enhancements have been made to the inspections during operation. The safety management at the time of plant shut-down was also enhanced in response to the comprehensive check of power generation facilities in 2006. These programs were put into practice by the revised Ministerial Order promulgated in January 2009.

Article 19 (1) Initial authorization

In Japan, the person who intends to install nuclear installations and operate them shall obtain a license for reactor installment in accordance with the provision of the Reactor Regulation Act, and then obtain approval to a construction plan on the detailed design of the reactor facilities in accordance with the provision of the Electricity Business Act.
One of the initial approval procedures for operation of a nuclear installation in Japan is a pre-service inspection, the certification criterion of which is that the construction of the nuclear installation to be inspected is being done according the approved construction plan, and meets the technical requirements established by the Minister of METI. It is also necessary to obtain approval to the operational safety program, and approval to the physical protection program before handling nuclear fuel materials in accordance with the provision of the Reactor Regulation Act.

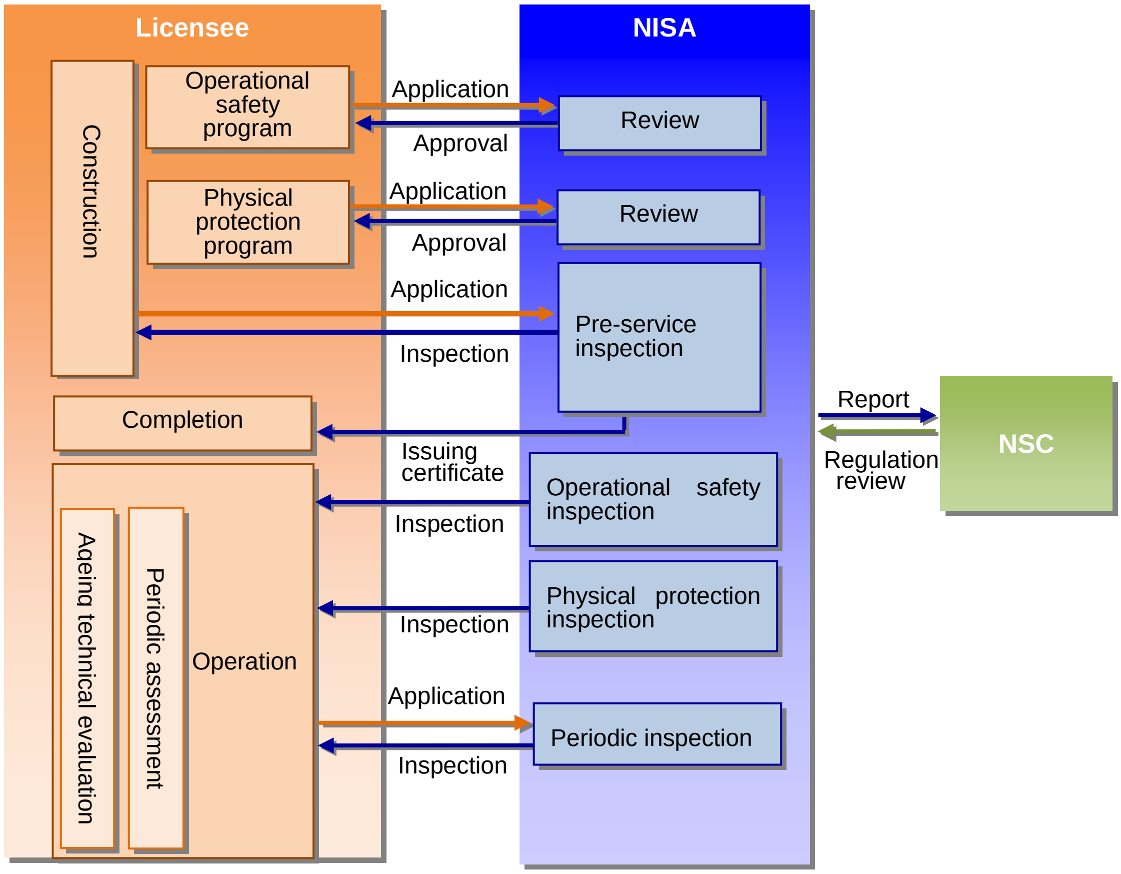


Fig.19-1 Main processes in the operation stage

1 Pre-service inspection

Before commencing construction of a nuclear installation in Japan, licensee of reactor operation is required to obtain approval of the Minister of METI to the design of the nuclear installation in advance. Whether or not the construction is actually performed as approved is verified by pre-service inspection conducted by the Minister of METI. Licensee of reactor operation is required to undergo pre-service inspection and pass the inspection in accordance with the provision of the Electricity Business Act in order to use the nuclear installation. However, licensee of reactor operation may use the nuclear installation without passing a pre-service inspection in the case where the reactor is used for test purposes, or in the case where there is a special reason for having to use a completed part of the nuclear installation, to which the licensee need to obtain approval of the Minister of METI on the period and method of that use, or in the case where the Minister of METI issues an instruction to allow that the nuclear installation may be used without undergoing a pre-service inspection, recognizing that there is no problem from the viewpoint of the conditions about the place of installment of the nuclear installation or the contents of the construction.

After obtaining approval to the construction plan, a licensee submits an application for a pre-service inspection to the Minister of METI. This inspection is conducted in convenience at an appropriate time in each construction phase. Prior to each inspection, such documents as pre-service inspection guidelines are prepared by the regulatory body, and the inspection is conducted according to these documents. On receiving an application for a pre-service inspection from the licensee, NISA gives an instruction on the implementation of the inspection to JNES to delegate part of the inspection work in accordance with the provision of the Electricity Business Act. See the Annex for inspection items of the pre-service inspection for each construction phase in accordance with the provision of the Electricity Business Act.

In the pre-service inspection, inspection items are specified in advance. Those inspection items are determined based on the design of the nuclear installation, and safety performance required of the facilities, and acceptance criteria for them are determined based on the construction plan approved in advance. The safety analysis in the pre-service inspection has previously been conducted in the design phase, and has been approved by the Minister of METI after the regulatory body's review. Therefore, the safety analysis is not conducted at this stage.

NISA is entrusted with matters relating to the pre-service inspection by the Minister of METI, and electric facility inspectors of NISA conduct the actual pre-service inspection work. Inspectors of JNES that conducts part of the inspection work carry out the pre-service inspection according to the instruction of the Minister of METI, and notifies the Minister of METI of the result. NISA puts together the result of the inspection carried out by electric facility inspectors, who are personnel of NISA, and the result of the inspection carried out by inspectors of JNES, and reviews the result of the pre-service inspection in a comprehensive manner. When the inspection result is determined as acceptable as a result of the review by NISA, the Minister of METI issues a pre-service inspection certificate to the licensee.

In the approval of the operational safety program, the regulatory body reviews the application submitted by the licensee of reactor operation. The operational safety program is required to specify measures to be taken under the situation that can have a direct impact on safety, such as the establishment of limiting condition for operation, and measures to cope with deviation from operational limits to ensure safe operation of nuclear installation. It is thought, therefore, that the safety analysis conducted by the licensee in formulating the operational safety program should be reviewed strictly.

2 Operation plan

In accordance with the provision of the Reactor Regulation Act, licensees of reactor operation are required to submit a three-year operation plan for each reactor every year starting from the year when the commissioning is expected to start. The operation plan needs to include a power generation plan, a heat consumption plan, a nuclear fuel loading plan, etc.

Article 19 (2) Operational limits and conditions

1 Regulatory requirements concerning operational limits and conditions

In Japan, licensees of reactor operation are required to establish the operational safety program and obtain approval of the Minister of METI before commissioning in accordance with the provision of the Reactor Regulation Act.

Concerning the limiting condition for operation of nuclear installation, shut-down margins, thermal limits of a reactor, etc. need to be specified in the operational safety program.

In the event that the operational limits are not observed, the Minister of METI may order the licensee of reactor operation to shut-down the nuclear installation in accordance with the provision of the Reactor Regulation Act.

In the event that a nuclear installation has deviated from operational limits, the licensee of reactor operation is required to declare the deviation immediately and report to the regulatory body.

The licensee of reactor operation takes measures to return to normal operation from the deviation of operational limits within the allowable operating time for the deviation, but in the case where the deviation is not resolved within the allowable time, the licensee of reactor operation is required to shut down the reactor.

On receiving a report of the deviation from operational limits from the licensee of reactor operation, the regulatory body investigates the cause, and provides other licensees with feedback when needed.

2 Establishment, implementation and revision of limiting condition for operation

In nuclear installation, operating teams operate and monitor the reactor in shift, and do their duties including observing limiting condition for operation, and taking measures in the event of deviation from the limits. Limiting condition for operation, and measures to be taken in the event of deviation from the limits are documented specifically in the operational safety program, and operators in the shift are required to carry out the procedures appropriately. Operating teams are given a time to leave the reactor on a regular basis, during which they receive training using a plant operation simulator. The training for the measures to be taken for deviation from operational limits, together with training for other operational procedures are effectively used in the actual operation of the reactor.

Limiting condition for operation is the key point for the safe operation of a nuclear installation. They need to be changed in such cases as when a modification is made to the facilities involved. As mentioned above, limiting condition for operation need to be specified in the operational safety program, and their revision requires approval of the Minister of METI. This means that in revising limiting condition for operation, the licensee of reactor operation is required not only to conduct a review including the safety assessment, but also to undergo a review by the regulatory body.

Article19 (3) Procedures for operation, maintenance, inspection and testing

1 Regulation for nuclear installations in operation

The following are the components of regulations for nuclear installations in service:

- Application for alteration in the installment license and application for the construction plan approval

  When the licensee of reactor operation intends to modify or repair the nuclear installation, and matters that have been approved for the nuclear installation are to be altered, the licensee of reactor operation is required to obtain approval of the Minister of METI to the alternation of the installment license. If matters related to the construction plan which have already been approved, such as specific facility design, are to be altered, the licensee needs to obtain approval of the Minister of METI to the construction. However, if the construction is of a routine nature, such as the replacement with the same parts associated with ageing degradation, etc., the construction is permitted by notification only. With regard to the facility for which approval to a construction plan has been newly obtained for its modifications, etc., the licensee needs to undergo a pre-service inspection and pass it before using the facility as in the case of original construction.

- Approval of the operational safety program

In accordance with the provision of the Reactor Regulation Act, the licensee of reactor operation is required to establish and observe the operational safety program for the operation and maintenance of a nuclear installation. The matters to be documented in the operational safety program are provided for in the Ministerial Ordinance for Commercial Nuclear Power Reactors in accordance with the Reactor Regulation Act as follows:

- Matters relating to a system for the observance of the relevant laws and the operational safety program (including involvement of top management)
- Matters relating to a system for fostering safety culture (including involvement of a top management)
- Matters relating to the quality assurance of the nuclear installation (including a method of root cause analysis, a system for performing the analysis, position of operation manuals, etc. in the operational safety program, and matters relating to a periodic assessment of the nuclear installation)
- Matters relating to duties and organization of personnel engaged in the operation and management of the nuclear installation (excluding matters in the next subparagraph)
- Matters relating to the scope and content of duties of a chief engineer of reactors, and authority and position in the organization of a chief engineer of reactors required in conducting supervision of operational safety
- Matters listed below relating to the education on operational safety for personnel engaged in the operation and management of the nuclear installation:
  - Matters relating to an implementation policy of the education on operational safety (including formulation of an implementation plan)
  - Matters listed below relating to the content of the education on operational safety:
    - Observance of relevant laws and the operational safety program
    - Structure, performance and operation of the nuclear installation
    - Radiation control
    - Handling of nuclear fuel materials and objects contaminated by nuclear fuel materials
    - Measures to be taken in an emergency
  - Other important matters relating to the education on operational safety for the nuclear installation
- Matters relating to the operation of the nuclear installation (excluding the matters in the following two subparagraphs)
- Matters relating to the operating period of nuclear installation

- Matters relating to the safety examination for the operation of the nuclear installation
- Matters relating to the designation of radiation controlled areas, access controlled areas and environment monitoring areas, and restriction of access to these areas
- Matters relating to ventilation and drainage monitoring equipment
- Matters relating to monitoring of the dose, the dose equivalent, the concentration of radioactive materials and the surface contamination density of radioactive materials of objects contaminated by radioactive materials, and the decontamination
- Matters relating to the management of radiation measuring instruments
- Matters relating to patrols and checks of the nuclear installation and their associated measures
- Matters relating to receipt, delivery, transport, storage and other handling of nuclear fuel materials
- Matters relating to treatment of radioactive waste
- Matters relating to measures to be taken in an emergency
- Matters relating to the establishment of a system for initial fire fighting
- Matters relating to appropriate recordkeeping and reporting on the operational safety (including an observance status of the operational safety program) of the nuclear installation (including reporting to top management when events of accidents or failures specified in the Article 19-17, or similar events occur)
- Matters relating to the maintenance management of the nuclear installation (including matters relating to a technical evaluation of ageing degradation and a long-term maintenance management policy)
- Matters relating to sharing of technical information on operational safety obtained from licensees of reactor operation that have carried out maintenance and inspection among licensees of reactor operation
- Matters relating to releasing of information on nonconformity in the event that nonconformity has occurred
- Other required matters relating to the operational safety of the nuclear installation

The operational safety program is the rule for the licensee to operate a nuclear installation, and can be revised after the approval by reflecting change in the organization of the licensee of reactor operation, and modifications of the nuclear installation. For altering the operational safety program once approved, the licensee of reactor operation needs to obtain approval of the Minister of METI to the revised operational safety program. Meanwhile, the Minister of METI may order alteration to the operational safety program in accordance with the provision of the

Reactor Regulation Act when the alteration is thought necessary for preventing hazards by objects contaminated by nuclear source materials and nuclear fuel materials, or by the reactor.

Since the operational safety program is a document at the highest rank for the operation of nuclear installation, the licensee of reactor operation prepares various operation manuals, test guidelines, etc. to establish procedures for the actual operation and maintenance of the nuclear installation. These subordinate documents for the operational safety program are managed in an appropriate manner under the quality management system of the licensee of reactor operation, ensuring their consistency among the operational safety program.

- Periodic inspection

Periodic Inspection of a nuclear installation (excluding that under decommissioning) is conducted periodically in order to prevent accidents and failures and to mitigate the consequences in reactor, associated facilities and steam turbine facilities that constitute electric facilities for power generation. This is the inspection conducted for facilities especially important in ensuring safety of a nuclear power generation facility.

Starting from October 2003, JNES carries out part of the periodic inspection on behalf of NISA according to the instruction of the Minister of METI given in accordance with the provision of the Electricity Business Act, and notifies the Minister of METI of the result. NISA compiles the result of the inspection carried out by electric facility inspectors, and the result of the inspection by JNES, and evaluates the periodic inspection. The licensee of reactor operation is required to undergo the periodic safety management review to examine the organization, inspection methods and schedule control involved in the implementation of the periodic operator's inspection, and other matters specified in the ordinance of METI. The periodic safety management review is conducted by JNES, and the result of the review is reported to NISA. NISA evaluates the periodic safety management review based on the report from JNES.

According to the provision of the Electricity Business Act, the periodic inspection is conducted at intervals of 13 months or 18 months specified by the notice of the Minister of METI for a reactor and associated facilities. During the periodic inspection it shall be verified that these facilities are maintained and operated in conformance to the technical requirements defined by the ordinance of METI.

In the periodic operator's inspection mentioned later, electric facility inspectors of the NISA, and inspectors of JNES applying the quality assurance standards, witness the inspection of the facilities particularly important to safety, or check relevant records, and verifies the process of the periodic operator's inspection (appropriateness of inspection procedures, inspection staff, justification of the inspection results, etc.). Starting from January 2009, verification is additionally

conducted for the maintenance program. This is a procedure in which the licensee of reactor operation submits a check and maintenance plan of individual instruments (maintenance program) for each operation cycle, based on the check records, deterioration status of the instruments etc. to NISA. NISA conducts the verification of the maintenance program prior to the periodic inspection. Also, Nuclear Safety Inspectors verifies the implementation status of maintenance activities of the licensee in the operational safety inspection, etc.
Currently, about 60 items are subject to inspection in the periodic inspection. The inspection is conducted with emphasis on the status of conformity to technical requirements relating to nuclear facilities to ensure the integrity of each facility.

- Periodic operator's inspection and periodic safety management review

Licensees of reactor operation have voluntarily verified conformance to Technical Standards of the nuclear power generation facilities heretofore, but in accordance with the amendment of the Electricity Business Act in 2003, this voluntary verification action was defined as the “periodic operator’s inspection” by licensees of reactor operation, and the implementation status of the inspection has been verified by the regulatory body since then.
Specifically, JNES examines the implementing system of this periodic operator's inspection by reviewing documents and on-the-spot examination from the standpoint of the inspecting organization, inspection methods, schedule control, recordkeeping, control of contractors, and appropriateness in education and training, which are the six items specified by the law (periodic safety management review).
NISA establishes the “evaluation committee on the periodic safety management review for nuclear power stations,” and, based on the result of the periodic safety management review by JNES, performs a comprehensive evaluation of the implementing system.
NISA notify the result of the evaluation in either of the following two categories, to the licensee of reactor operation that has undergone the review.

1 The periodic operator's inspection implementing system at the organization that has undergone the review is an appropriate and sufficient one that allows the organization to perform a periodic operator's inspection autonomously and appropriately.
2 The periodic operator's inspection implementing system at the organization that has undergone the review requires verification that corrective measures have been established, or needs to be improved.

When the periodic operator's inspection implementing system is evaluated as appropriate and sufficient, the licensee is encouraged to make further efforts to ensure safety by the adoption of incentive regulation, such as the exclusion of recordkeeping, and education and training from the six items subject to review as specified by the law, effective from the next review.

- Operational safety inspection

The operational safety inspection is the inspection to verify that the licensee of reactor operation complies in the operation and maintenance of the nuclear installation with the operational safety program which was approved by the Minister of METI beforehand. It is conducted four times a year for two weeks or so each time. In the operational safety inspection, the Nuclear Safety Inspector can enter the office, etc., inspect documents, equipment, etc., ask relevant persons questions, and have them submit necessary samples in accordance with the provision of the Reactor Regulation Act,

In addition to the operational safety inspection four times a year, in accordance with the provision of the Ministerial Ordinance for Commercial Power Reactors, the Nuclear Safety Inspector may check the observance status of the operational safety program when the operations mentioned below are conducted, on the occasion of the periodic inspection provided for in the Electricity Business Act:

- Operations relating to start-up or shut-down of a reactor
- Operations relating to the replacement of fuel
- Operations relating to switching of a residual heat removal cooling sea water system of a boiling water light weight reactor
- Operations relating to a decrease of water level in a reactor vessel of a pressurized water light weight reactor, and operations relating to the removal of residual heat conducted while water level in a reactor vessel remains decreased

Under the inspection system introduced in January 2009, licensees of reactor operation are obligated to collect/accumulate ageing degradation data for continuous improvement, and to conduct a degradation assessment due to aging based on the data collected from routine maintenance. Licensees of reactor operation, therefore, have been enhancing the monitoring of conditions of their equipment during operation. NISA checks implementation status of these maintenance activities in the operational safety inspection.

The operational safety inspection four times a year and the periodic inspection are conducted for the 54 units of nuclear installation in operation four times a year for a total of more than 200 times. It has been 10 years since the operational safety inspection was introduced, and licensees' awareness of safety and their actions for ensuring safety have been sophisticated. For this reason, there has been no issue in recent years that may have a significant impact on the operational safety of nuclear installation, and the operational safety of nuclear installations is maintained in a satisfactory manner.

- Maintenance management of nuclear installations

In accordance with the provision of the Ministerial Ordinance for Commercial Power Reactors, the licensee of reactor operation is required to take the measures mentioned below concerning check, testing, inspection, repair, replacement, modification and other necessary measures carried out for the maintenance of a nuclear installation (maintenance management) during operation or shut-down:

- ➢ To establish a policy on the maintenance management of nuclear installation (hereafter referred to as maintenance management policy) so that the performance of the nuclear installation specified in the reactor installment license can be maintained.
- ➢ To establish objectives of the maintenance management to be achieved according to the maintenance management policy (including objectives of the maintenance management to be established quantitatively for a reactor and systems for which the maintenance management is important).
- ➢ To formulate a plan to implement the maintenance management, specifying the following matters, and implement the maintenance management accordingly in order to achieve the objectives of the maintenance management:
  - Matters relating to the commencement and period of the plan to implement the maintenance management
  - Matters relating to methods, frequency, and timing of check, testing, inspection, repair, replacement, modification, etc. (check, etc.) of the nuclear installation
  - Matters relating to measures taken for ensuring operational safety in carrying out check, etc. of the nuclear installation
  - Matters relating to methods for confirming and evaluating the result of check, etc. of the nuclear installation
  - Matters relating to corrective actions for methods, implementation frequency, and timing of check, etc. of the nuclear installation to be conducted, and to preventive measures reflecting the confirmation of the result and the result of evaluation of check, etc. of the nuclear installation
  - Matters relating to records on the maintenance management of the nuclear installation
- ➢ To periodically evaluate plans for the maintenance management policy, the objectives of the maintenance management and the implementation

of the maintenance management of the nuclear installation

- To reflect the result of the evaluation in the preceding subparagraph in the plans for the maintenance management policy,, the objectives of the maintenance management, or the implementation of the maintenance management of the nuclear installation
- To take special measures for the measures in each of the preceding subparagraphs depending on the status of the nuclear installation in the case where the operation of the reactor is suspended for a considerable period of time, or the nuclear installation is in other special conditions from the viewpoint of implementing the maintenance management

When the long-term maintenance management policy mentioned later has been formulated, or altered, the licensee of reactor operation is required to reflect it in the maintenance management policy.

- Periodic Safety Review

In accordance with the provision of the Ministerial Ordinance for Commercial Power Reactors, the licensee of reactor operation is required to evaluate the implementation status of operational safety activities in the nuclear installation, and the situation of reflection of the states of arts technical knowledge in the operational safety activities in the nuclear installation at the interval not exceeding ten years. The periodic safety review had been conducted since 1992 as administrative guidance, but was enshrined into law in the Ministerial Ordinance for Commercial Power Reactors in 2003 as safety measures, and, in 2005, deterioration of organizational climate of the licensee was added as a matter to be evaluated. In August 2008, NISA established a guideline for the implementation of the periodic safety review, and called on the licensees of reactor operation to carry out their periodic safety review based on this guideline. As matters subject to the periodic safety review, the guideline mentions the evaluation of the implementation status of operational safety activities in the nuclear installation, the evaluation of the situation of reflection of the state of the arts technical knowledge in the operational safety activities in the nuclear installation, and the probabilistic safety assessment. Concerning the probabilistic safety assessment, the guideline mentions it is desirable that this assessment be conducted by the licensees of reactor operation on a voluntary basis.

Though the basic framework of the periodic safety review has not changed from the time of the last report, there have been some improvements made for the details in concert with an improvement to the system related to nuclear safety such as the improvement made to the inspection system.

In this system, the licensee is required to examine the need of effective additional measures to further improve safety and reliability of plants based on the result of the periodic safety review.

- Ageing Management Technical Assessment

The licensee of reactor operation is required to conduct technical evaluation no later than 30 years after commissioning of the reactor and re-evaluate every 10 years since then. The ageing management technical assessment (AMTA) of nuclear power plant which is defined by the Minister of METI as important in ensuring safety of nuclear installation, and also of the equipment and structures mentioned below shall be conducted. Based on the result of the evaluation, the licensee of reactor operation must establish a policy for the maintenance management of the nuclear installation (long-term maintenance program) to be implemented for the coming ten years.

- Equipment and structures with a function to generate actuation signals to engineered safety features and reactor shut-down systems
- Equipment and structures with a function to cognize the state of the nuclear installation at the time of an accident
- Equipment and structures with a function to shut down the nuclear installation safely from outside the central control room
- Equipment and structures with a function to contain reactor coolant and those which are not important safety related equipment
- Equipment and structures with a function to circulate reactor coolant
- Equipment and structures with a function to store radioactive materials
- Equipment and structures with a function to supply power and those which are not important safety related equipment
- Equipment and structures with an instrumentation and control function for the nuclear installation
- Equipment and structures with a function to assist operation of the nuclear installation
- Equipment and structures with a function to prevent diffusion of fission products into reactor coolant
- Equipment and structures with a function to clean up reactor coolant
- Equipment and structures with a function to mitigate the reactor pressure increase
- Equipment and structures with a function to control the power increase
- Equipment and structures with a function to make up reactor coolant
- Equipment and structures important in taking emergency response measures, and equipment and structures with a function to cognize abnormal situations

The licensee of reactor operation is required to document the long-term maintenance program in the operational safety program and obtain approval of the Minister of METI. The contents of implementation for each operation cycle that have fleshed out the long-term maintenance program are to be reflected in the check and maintenance plan for individual instruments (maintenance plan) based on the check records and the deterioration status, and verified by NISA. The implementation status of the maintenance plan is verified by the Nuclear Safety Inspectors of NISA in the operational safety inspection, etc. See Fig. 19-2 for the outline of the maintenance activities.

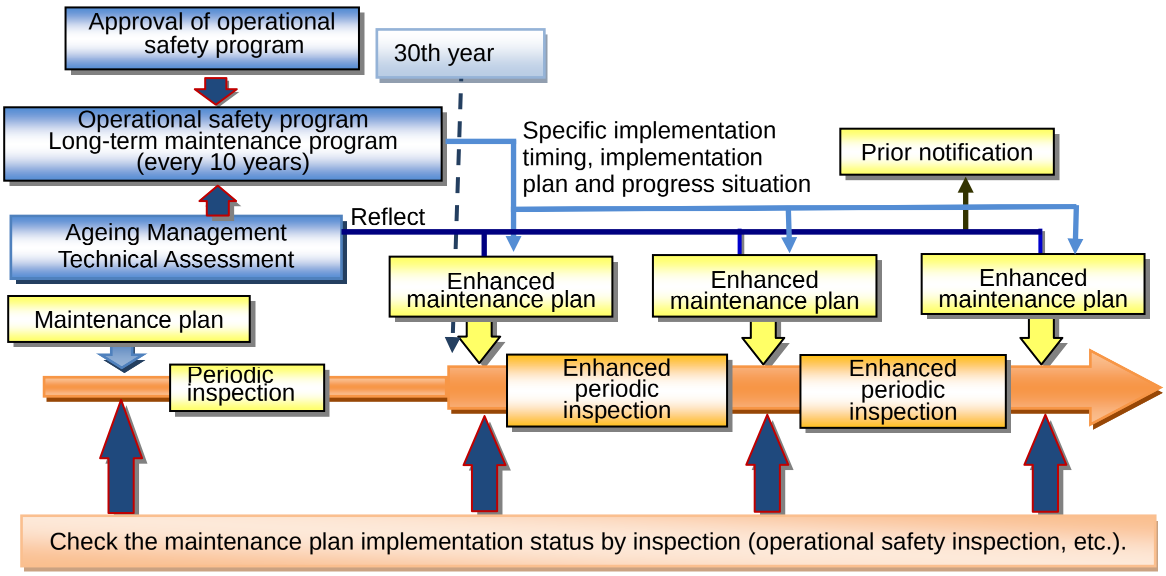


Fig. 19-2 Maintenance activities at reactor facilities

- On-site inspection

In accordance with the provisions of the Reactor Regulation Act or the Electricity Business Act, the Minister of METI may conduct an on-site inspection to the extent that is necessary for enforcing the laws. In the on-site inspection, the Inspector may enter the office, place of business, etc. of the licensee of reactor operation, inspect documents, records and other objects, and ask relevant persons questions.

- Chief reactor engineers and persons responsible for operation

The chief reactor engineers assigned to each nuclear reactor by the licensee of reactor operation need to have their qualification certified by the national examination and the appointment or dismissal of them needs to be reported to NISA. The chief reactor engineers may offer their opinion to the superintendents of the plants when they recognize it is necessary for the safe operation, may give advice or recommendation to respective duty positions, and may take part in establishing plans for safe operation.

The persons responsible for operation are designated by the licensee of reactor operation and assigned to each nuclear reactor. The mission of the persons responsible for operation is to perform the monitoring of the overall operation and supervise/give guidance to operators. They understand the situation of operations and the present condition of the safe operation by periodic patrol to the premises.

The documentation developed and kept by the licensee of reactor operation should include the records relating to fuel assemblies, inspection of the nuclear reactor, operation, radiation management, maintenance, abnormalities and accidents, and the meteorological condition, in accordance with the Reactor Regulation Act. Moreover, subjects, methods, results, etc. of the inspection should be recorded and kept as the result of the periodic operator's inspection in accordance with the Electricity Business Act.

2 Establishment, implementation and revision of operation procedures

Operation procedures established at each nuclear power station are documented through approval process within the power station, and applied to the operation of the respective nuclear installation. In the case where the procedures are altered due to the modification of facilities, etc., the operation procedures need to be revised in an appropriate manner so that operators may not operate the nuclear installation erroneously.

The operation manual covers operations required for operating the nuclear installation. The operation manual is kept in the control room, etc. so that the staff involved in the operation of the nuclear installation can use it readily. In addition to the operation manual, the operational safety program and the quality assurance plan, etc., which are the documents at higher rank, are equipped in the control room so that the relevant staff of the nuclear installation can use them when necessary.

In revising the operation manual, the involvement of the operators who actually engage in the operation of nuclear installation is an important factor. The operators carry out various procedures in their daily operational actions, and in such a case as when the operation manual needs to be revised, it is common practice that they are given an opportunity to offer an opinion based on their operating experiences.

The operation manual is a document established on the basis of the operational safety program and is included in the scope of the application of the quality management system. The operation manual is reviewed periodically, and applied to the operational actions while being revised as needed.

Article 19 (4) Procedures for responding to operational occurrences and accidents

1 Regulatory requirements concerning response to abnormal events

The licensee of reactor operation is obligated to describe "matters relating to the operation of the nuclear installation" in the operational safety program. They include procedures for operation in an accident or an abnormal event in addition to the manual for normal operation so as to cope with accidents and abnormal events smoothly. The matters relating to "measures for abnormal events" include: recognition of the situation; elimination of the cause; measures necessary for preventing propagation; and measures after a reactor scram. Operation procedures in an emergency are one of the operation procedures based on the operational safety program, and the regulatory authority reviews the procedures, the implementation system, etc. in the operational safety inspection.

2 Operation procedures in an emergency

Operation procedures in an emergency are established as a subordinate provision based on the operational safety program. They are formulated, for example, on the basis of events such as earthquakes and fires, or formulated on the basis of change in operational parameters of reactors.

3 Response to severe accidents

Licensees of reactor operation in Japan have voluntarily implemented their own measures for preventing severe accidents and mitigating the impacts based on "Accident management as measures against severe accidents in light water nuclear power reactor facilities (formulated by the NSC on May 28, 1992, and partially revised on October 20, 1997)."
Typical facility modifications for preventing severe accidents and mitigating the impacts are as follows:

PWR:

- Alternative recirculation (installation of alternative recirculation pumps, or core flooding using the containment spray system by installing the tie-line between the containment spray system and the residual heat removal system)
- Containment natural convection cooling (utilization of the nonsafety grade containment recirculation unit)
- Alternative component cooling (utilization of the HVAC chilled-water, etc.)
- Water injection into a reactor containment (utilization of fire pumps)

- Common usage of power supply among units (usage of power from the neighboring nuclear installation through the tie-line)
- Controlled combustion for hydrogen-concentration control (hydrogen combustion by igniters; only for the ice condenser type PWR)

BWR:

- Alternative reactivity control (recirculation pump trip and alternative automatic control rod insertion)
- Alternative cooling water injection (utilization of the condensate water makeup system and the fire protection system)
- Automatic reactor depressurization (automatic depressurization by the reactor low water level signal)
- Heat-removal from a reactor containment (pressure venting for preventing vessel rupture and utilization of drywell cooler, etc.)
- Power supply system (common usage of power supply among the neighboring nuclear installations)

For implementing accident management at operating commercial nuclear installations, the licensees of reactor operation have been developing the accident management measures progressively, substantiating the facilities as mentioned above during the outage of the periodic inspection as well as establishing operational measures such as implementing system, procedures, education of personnel, etc. The accident management measures that were prepared by licensees of reactor operation were reported to NISA in May, 2002, together with the PSA results of internal events for representative reactor types for the purpose of quantitatively verifying the effectiveness of enhancement of the safety. NISA evaluated the effectiveness of the accident management measures, and based on the opinion of specialists of the "Accident Management Workgroup" established under the Nuclear and Industrial Safety Subcommittee, compiled the evaluation report in October 2002, which was submitted to the NSC. The PSA results of the internal events for all commercial power reactor facilities under operation (other than representative reactor types) were reported to NISA by the licensees of reactor operation in March 2004. The development programs of the accident management for commercial nuclear installation under construction were reported to NISA by the licensees of reactor operation for three units in July 2003, and one unit in March 2008. The evaluation results were reported to the NSC by NISA in September 2003 and in October 2008 respectively. The NSC evaluated the reports and concluded that they were reasonable in December 2003, and in January 2009 respectively.

Article 19 (5) Engineering and technical support

In Japan, the reliability verification test and safety research programs on major components and equipment have been carried out to enhance the safety of nuclear installations. Promotion of these tests and research is shown in Article 14.

In Japan, private electric power companies own and operate nuclear installations as licensees of reactor operation, and each of the electric power companies own power stations such as hydraulic and heat power stations, and power grids in addition to the nuclear power stations. Due to this form of business, headquarters operations of electric power companies normally specialize in the business management and its peripheral business in many cases. Meanwhile, electric power companies having research facilities for technological development provide technical support to the respective power stations other than the headquarters operations.

The Central Research Institute of Electric Power Industry is a technical support organization overriding the framework of electric power companies. It is the organization established by donations from electric power companies that is engaged in research, survey and experiment on electric power engineering and economy required for the operation of electricity business, and overall coordination of them. The Institute gives technical support to electric power companies in such a manner that they are entrusted with research services by electric power companies and pass the research results on to them.

In principle, the regulatory body has no regulatory means for the technical support for technological development of electric power companies. However, in the case where alterations of reactor installment licenses, construction plan approvals, etc. those already obtained by the licensee of reactor operation have become necessary as a result of the technical support, the regulatory body conducts a review according to the predetermined procedures for the alterations.

A nuclear installation is a huge system in which the system to control a reactor and generate electric power as the core, and systems to support it are operated. Generally, an operating team that conducts monitoring and operation of the nuclear installation is composed of the personnel of the licensee of reactor operation, but part of a peripheral system, such as management of clothes, etc. used in a controlled area, radiation management, management of waste is conducted by contractors. Also, during the periodic inspection period, contractors carry out maintenance work for reactor facilities based on the contracts with the electric power company.

In the case where the licensee of reactor operation entrusts work to specialized contractors as technical support in the daily operation management of the nuclear installation, the licensee of reactor operation is required to supervise and manage the contractors in an appropriate manner based on their own quality management system. This is the matter to be verified by the regulatory body in the operational safety inspection, etc.

Article 19 (6) Reporting of incidents significant to safety

1 Regulatory requirements

In accordance with the provision of the Reactor Regulation Act, the licensee is obligated to report to the Minister of METI an accident, a failure, etc. of the nuclear installation immediately, and the status and measures taken for them within 10 days.
Further, the licensee is required to report to the Minister of METI immediately if the accident falls under the category of a specific initial event or a nuclear emergency provided in the Act on Special Measures Concerning Nuclear Emergency.

2 Outline of reporting criteria and reporting procedures

Event reporting criteria in accordance with the provision of the Reactor Regulation Act are provided for in the Ministerial Order issued under the Reactor Regulation Act. The licensee is required to report to the Minister of METI according to these event reporting criteria. The event reporting criteria defined by the Ministerial Order are shown in the Annex.
NISA has built a system in which to receive the notification of event reports even in holidays and at night in order to fulfill the responsibility of receiving the event reports to the Minister of METI and respond. When an event to be reported occurs, the licensee is required to immediately provide the first report to the staff of NISA, and keep reporting according to law.

3 Events reported in the past three years

Of the events that occurred in FY 2007, FY 2008 and FY 2009, those reported to the NISA in accordance with the provision of the Reactor Regulation Act are shown in the Annex.
The reported events were 23 in FY 2007, 24 in FY 2008, and 16 in FY 2009. Of these events, seven were rated as level 1 on the International Nuclear Event Scale (INES), and the others were rated as zero (including provisional rating).

4 Provision of documents and official announcement related to the reported events

The licensee of reactor operation is primarily responsible for the events that have occurred at the nuclear installation, and is required to conduct an investigation into the cause and take measures to prevent recurrence in a responsible manner. The regulatory body verifies that the process is carried out in an appropriate manner, or gives guidance so that the process can be carried out in an appropriate manner.

The licensee of reactor operation conducts an investigation of the event, creates documents compiling matters relating to the cause and countermeasures, submits them to NISA, and makes them public.

NISA receives reports from the licensee and officially announces contents of the event, response of NISA, provisional or official INES rating without delay.

NISA holds a meeting of the council established under the Advisory Committee for Natural Resources and Energy in a timely manner to discuss the contents reported by the licensee of reactor operation, and listens to the opinion of experts on the cause and recurrence-preventive measures to verify the adequacy of the licensee's investigation and measures. Based on the licensee's final reports, NISA discusses the INES rating for the event, and after the discussions in an open session of the council, determines the formal INES rating. The document created by NISA showing the grounds for assessment concerning the determination of the formal INES rating is published to the webpage of METI.

Concerning the recurrence-preventive measures for the event, the licensee is required to take appropriate preventive measures against not only the findings obtained from the event that has occurred at the nuclear installation, but also the findings obtained from the event that has occurred at other facilities in accordance with the provision of the Reactor Regulation Act. NISA directs installations other than the installation where the event has occurred to take preventive measures against similar events as needed in writing.

5 INES utilization policy

In Japan, events that occurred domestically had been rated using Japan's own nuclear event scale since July 1989, but since August 1992, accidents and failures have been assessed using the International Nuclear Event Scale. In switching to the new scale, comparison was made between Japan's own nuclear event scale and the INES, and it was found that almost all the events rated as zero to level 1 on Japan's own nuclear event scale for the defense in depth were assessed as zero on the INES. To better adapt the INES to Japan's assessment, level zero on the INES is classified into zero plus (0+) and zero minus (0-) so that accidents and failures are distinguished in more detail. Level zero on the INES is classified into either an event that is not significant in safety but can impact on safety (0+) or an event that does not impact on safety (0-).

See the Annex for the assessment status of accidents and failures by the INES in Japan.

Article 19 (7) Operational experience feedback

1 Regulatory measures concerning operational experience feedback

In accordance with the provision of the Reactor Regulation Act, the licensees of reactor operation are required to report to the Minister of METI without delay when important safety related events occur. NISA makes public news releases and reports to the NSC incidents or failures upon immediate receipt of the information from the licensees. NISA also makes a public news release and reports to the NSC the causes and recurrence-preventive measures when the investigation is completed. The NSC points out issues on the content of the report when necessary. The NSC has established the Special Committee on Analysis and Evaluation of Nuclear Accidents and Failures and investigated and reviewed in and outside Japan. In March 2007 this committee summarized the guidance to use the incident and failure information of nuclear installations.

NISA assesses each incident or failure in detail to extract the lessons learned with respect to the safety, being advised by subcommittee members of the Advisory Committee on Nuclear and Industrial Safety, who are experts on operation management, inspection and radiation control. When necessary, NISA requests the licensees of reactor operation to reflect the lessons in their operation and maintenance, or reflects them in the regulatory activities.

Operating experiences, etc. concerning safety of a nuclear installation other than accidents and failures are fed back to licensees of reactor operation for their activities to ensure operational safety. This information is assessed as safety quality information, for which necessary measures are taken in a timely manner, and is shared among licensees of reactor operation through the NUCIA database mentioned later.

JNES has the system to collect and analyze safety information in and outside Japan. JNES provides collected safety information and the results of analysis for NISA for quick sharing with NISA. JNES and NISA have jointly established the “Safety Information Review Meeting” to evaluate and to take adequate regulatory measures. The “Safety Information Review Meeting” is held periodically.

2 Measures taken by licensees of reactor operation to utilize operating experiences

The licensees of reactor operation and the Japan Nuclear Technology Institute (hereafter referred as to JANTI) perform overseas information exchange through the Institute of Nuclear Power Operation (hereafter referred as to INPO) and the World Association of Nuclear Operators (hereafter referred as to WANO) Tokyo Center. Furthermore, each licensee of reactor operation utilizes individual agreements on information exchange with overseas utilities and manufacturers. There are many examples of utilizing the feedback of operational experiences by licensees of reactor operation, which are reflected in preventive maintenance and planned repair and replacement of parts. Examples for BWR are replacements of the core shroud and the in-core monitoring housing, etc. An example for PWR is replacement of the upper head of reactor vessel.

Meanwhile, the licensees of reactor operation established the specialized organization named, “Japan Nuclear Technology Institute”, on March 15, 2005 in order to develop the technical infrastructure and promote the voluntary operational safety activity for the purpose of contributing to the activation of nuclear power industry. Concerning the safety information of domestic nuclear installations, they developed a system named “NUCIA” that is a nuclear information publication library, with which information including minor events can be shared all over Japan, and it is posted on the internet site of JANTI. In February 2009, JANTI reexamined the criteria to register the incidents and events to NUCIA.

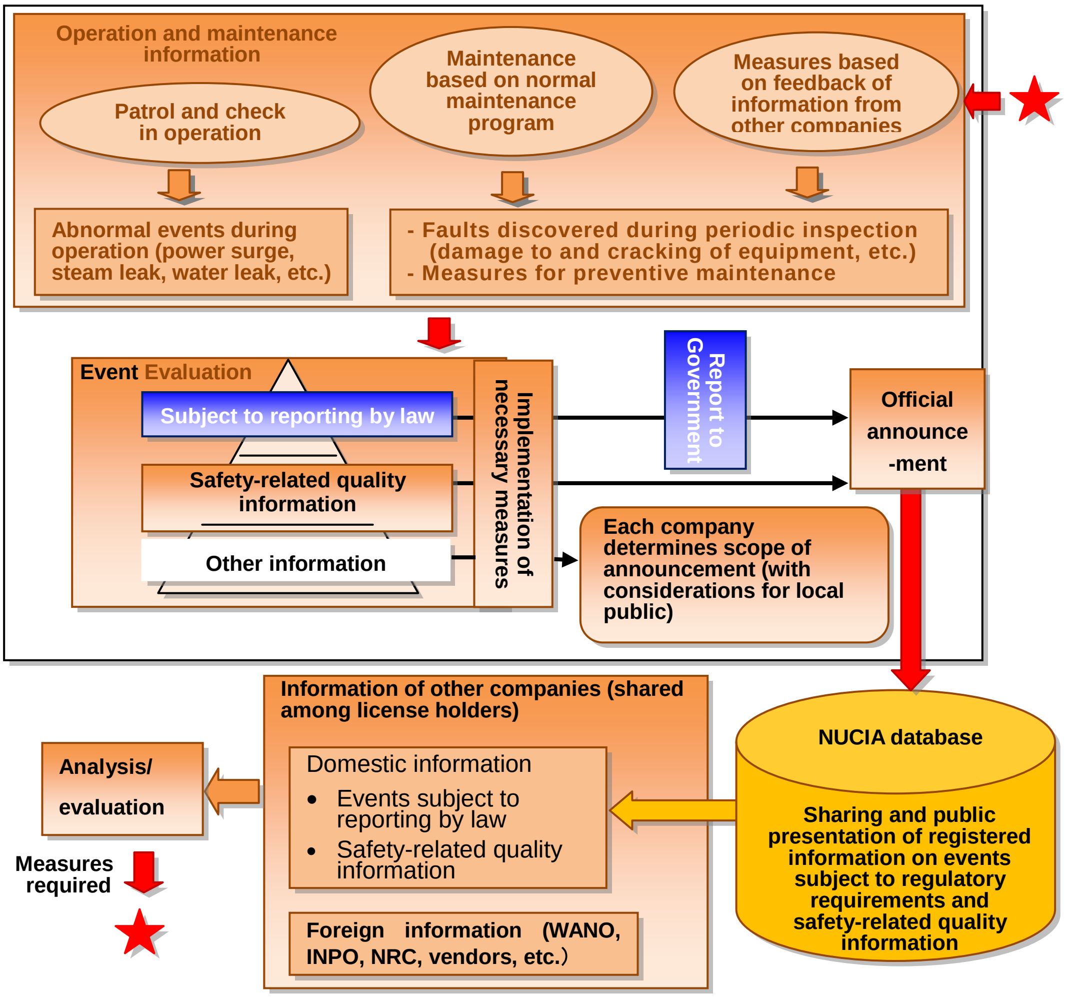


Fig. 19-3 Outline of the operating experience feedback through the NUCIA

The scope of the operational experience feedback encompasses all fields including nuclear installations and personnel training. The specific feedback to be utilized differs depending on individual operational experiences. An example of the feedback applied to a wide scope is the re-examination of fire-fighting facilities from the experience of the Niigata-ken Chuetsu-oki Earthquake in which piping for water for fire fighting ruptured and this interfered with fire fighting efforts. In addition to the re-examination of the fire-fighting facilities, the feedback led to the establishment of an In-house Fire Brigade System and conducting of training for communication of information.

The feedback is made as the guidance by the regulatory body, but there are also efforts taken by the licensees of reactor operation autonomously through the NUCIA database as mentioned above.

For the purpose of sharing information, Japan BWR Owners Group was formed by Tohoku Electric Power Co., Inc. Tokyo Electric Power Co., Inc. Chubu Electric Power Co, Inc. Hokuriku Electric Power Co., the Chugoku Electric Power Co., Inc. the Japan Atomic Power Company, Electric Power Development Co. Toshiba, and Hitachi-GE Nuclear Energy in April, 2006, and Japan PWR Owners Group was set up by Hokkaido Electric Power Co., Inc. the Kansai Electric Power Co., Inc. Shikoku Electric Power Co., Inc. Kyushu Electric Power Co., Inc. the Japan Atomic Power Company, Mitsubishi Heavy Industries, and Mitsubishi Electric Corporation in October, 2005.

3 International sharing of operational experiences

Japan thinks that it is important to widely share operational experiences of nuclear installations internationally, and that sharing of them is the responsibility of Japan having many operational experiences of nuclear installations in improving international nuclear safety. Concerning international sharing of information by NISA and JNES, there is a system by which to share accident and failure information with international organizations such as the IAEA and the OECD/NEA, and as bilateral cooperation.

With regard to sharing operating experiences with international organizations, information is proactively provided to the Incident Reporting System (IRS). In Japan, domestic operating experiences are collected and compiled into a database by JNES, and this information is provided to the IRS.

The bilateral information sharing has been made through the periodic information exchange meetings.

Concerning the information that is particularly required to be shared with the international community, NISA provides the information to relevant recipients individually. One of the examples is the provision of information about the experiences at Kashiwazaki Kariwa Nuclear Power Station when the Niigata-ken

Chuetsu-oki Earthquake struck in July 2007. NISA not only transmitted the information to the international organizations, etc., but provided the information at various international conferences. Also, NISA cooperated with the investigation by the investigation team from the IAEA.

Article 19 (8) Management of spent fuel and radioactive waste on site

1 Management of spent fuel on site

Storage of spent fuel at a nuclear installation is done by dry storage casks in addition to spent fuel pools. For the storage of spent fuel, necessary measures need to be taken for cooling in accordance with the provision of the Rules for the Installation, Operation, etc. of Commercial Power Reactors, and the storage facilities need to be designed in such a manner to ensure their sub-criticality. That the storage facilities are constructed as designed is verified in the pre-service inspection. Also, that the integrity of the storage facilities is maintained during the in-service period is verified by the periodic operator's inspection conducted by the licensee.
Since the management of spent fuel on site is positioned as part of the measure for the safety of the nuclear installation under the safety regulations, its implementation status is verified by the operational safety inspection

2 Management of radioactive waste on site

In accordance with the provision of the Reactor Regulation Act, the licensee of reactor operation is required to take appropriate measures for transport, storage and processing of radioactive waste in plants as measures necessary for safety. When processing of radioactive waste in plants, the licensee of reactor operation is required to ensure that the processing is carried out under the supervision of the person who has necessary knowledge of the processing and the radiation protection involved in the disposal.
Concerning the disposal of radioactive waste, measures to be taken are specified for each state of the waste. Radioactive waste in the gaseous state is required to be discharged by the ventilation facility, or stored in a waste gas tank for disposal.
Radioactive waste in the liquid state is required to be discharged by the discharge facility, to be stored in a waste liquid tank, to be enclosed in a containment, or solidified integrally with a containment and stored in the storage facility, or to be incinerated in the incineration system.
Radioactive waste in the solid state is required to be incinerated in the incineration system, enclosed in containment or solidified integrally with containment, and stored in the storage facility. The radioactive waste such as large machinery which is

extremely difficult to dispose of by this method, or the radioactive waste that needs a decrease in the level of radiation over time is required to be stored in the storage facility.

Radiation monitoring necessary for preventing radiation hazards, criteria that containers used for disposal should meet, etc. are specified for each storage method in the Rules for the Installation, Operation, etc. of Commercial Power Reactors, and appropriate handling of radioactive waste is ensured.

The licensee of reactor operation stores radioactive waste generated in the nuclear installation to the storage facility installed on the site until it is transported to disposal facilities.

Radioactive waste is classified into gaseous waste, liquid waste, and solid waste. The gaseous radioactive waste is generated by ventilating equipment or rooms in the radiation management area, and is discharged from a stack while being monitored with an emission monitor.

The radioactive waste in the liquid state is the liquid waste generated in a controlled area, and is not discharged to the environment in principle, but is reused after it is filtered, demineralized, and condensed, exception is the radioactive waste of a very low level which is discharged after monitoring the radioactivity.

The solid waste like the waste materials generated in repair work at the time of the periodic inspection, etc. is enclosed in drums as it is, or volume-reduced by incineration, melting, compression, etc., enclosed in drums, and stored at the radioactive waste storage facility on site.

Though there is no regulation that obligates licensees of reactor operation to minimize radioactive waste generation in Japan, they are making efforts to minimize the amount of radioactive waste voluntarily as there is a limit to the amount of radioactive waste that can be stored on site, and disposal of radioactive waste is costly. Treatments such as evaporative concentration of liquid waste, and compression or melting of solid waste are examples of licensees' voluntary efforts to reduce the amount of waste.

Since the management of radioactive waste on site is positioned as part of the measures for the safety of the nuclear installation under the safety regulations, its implementation status is verified in the operational safety inspection.

3 Procedures for the clearance

Concerning radioactive waste generated from nuclear installations, "materials not requiring treatment as radioactive waste" are divided from the radioactive waste safely, and recycled/reused or disposed of appropriately and reasonably under the clearance system in Japan.

In implementing this clearance system, licensees of reactor operation formulate methods for measurement and assessment of radioactivity concentration level for

materials to be cleared, etc. in accordance with the provision of the Reactor Regulation Act, and the regulatory body is involved appropriately.
NISA is involved in the following two steps:

First step:
NISA checks the adequacy of “methods for measurement and assessment of radiation concentration level” formulated by the licensees of reactor operation and approves it.
Second step:
NISA confirms that licensees’ measurements and assessment are properly done by the approved methods and their wastes are below the clearance level by checking records, etc. (Part of the confirmation is conducted by JNES in accordance with the Reactor Regulation Act.)

This clearance system applies to general radioactive waste not only from nuclear installations, but also from nuclear facilities including nuclear fuel cycle facilities, etc.

D Annexes

1 List of nuclear installations

2 List of incidents reported under the Reactor Regulation Act during the reporting period

3 List of standards of academic societies and associations endorsed by NISA

4 Outline of JEAC 4111-2009: Rules of Quality Assurance for Safety of Nuclear Power Plants

5 List of nuclear emergency response drill during the reporting period

6 Definitions and functions with respect to classifications of importance of safety functions

7 Inspection items of Pre-service Inspection on each construction phase defined by the Electricity Business Act

8 Incident reporting criteria defined by the Ministerial Ordinance

9 References

1 List of nuclear installations (Article 6)

Licensee	Power Station	Unit	Reactor Type	Output (MWe)	Commissioned	Status
Hokkaido Electric Power Co., Inc.	Tomari	1	PWR	579	1989/06/22	In Operation
		2	PWR	579	1991/04/12	In Operation
		3	PWR	912	2009/12/22	In Operation
Tohoku Electric Power Co., Inc.	Onagawa	1	BWR4	524	1984/06/01	In Operation
		2	BWR5	825	1995/07/28	In Operation
		3	BWR5	825	2002/01/30	In Operation
	Higashidori	1	BWR5	1,100	2005/12/08	In Operation
		2	ABWR	1,385		In Planning
	Namie/Odaka		BWR5	825		In Planning
Tokyo Electric Power Co., Inc.	Fukushima Diichi	1	BWR3	460	1971/03/26	In Operation
		2	BWR4	784	1974/07/18	In Operation
		3	BWR4	784	1976/03/27	In Operation
		4	BWR4	784	1978/10/12	In Operation
		5	BWR4	784	1978/04/18	In Operation
		6	BWR5	1,100	1979/10/24	In Operation
		7	ABWR	1,380		In Planning
		8	ABWR	1,380		In Planning
	Fukushima Daini	1	BWR5	1,100	1982/04/20	In Operation
		2	BWR5	1,100	1984/02/03	In Operation
		3	BWR5	1,100	1985/06/21	In Operation
		4	BWR5	1,100	1987/08/25	In Operation
	Kashiwasaki Kariwa	1	BWR5	1,100	1985/09/18	In Operation
		2	BWR5	1,100	1990/09/28	In Operation
		3	BWR5	1,100	1993/08/11	In Operation
		4	BWR5	1,100	1993/08/11	In Operation
		5	BWR5	1,100	1990/04/10	In Operation
		6	ABWR	1,356	1996/11/07	In Operation
		7	ABWR	1,356	1997/07/02	In Operation
	Higashidori	1	ABWR	1,385		In Planning
		2	ABWR	1,385		In Planning
Chubu Electric Power Co., Inc.	Hamaoka	1	BWR4	540	1976/03/17	Under Decommissioning
		2	BWR4	840	1978/11/29	Under Decommissioning
		3	BWR5	1,100	1987/08/28	In Operation
		4	BWR5	1,137	1993/09/03	In Operation
		5	ABWR	1,267	2005/01/18	In Operation
		6	ABWR	1,400		In Planning

Licensee	Power Station	Unit	Reactor Type	Output (MWe)	Commissioned	Status
Hokuriku Electric Power Co.	Shika	1	BWR5	540	1993/07/30	In Operation
		2	ABWR	1,358	2006/03/15	In Operation
The Kansai Electric Power Co., Inc.	Mihama	1	PWR	340	1970/11/28	In Operation
		2	PWR	500	1972/07/25	In Operation
		3	PWR	826	1976/12/01	In Operation
	Takahama	1	PWR	826	1974/11/14	In Operation
		2	PWR	826	1975/11/14	In Operation
		3	PWR	870	1985/01/17	In Operation
		4	PWR	870	1985/06/05	In Operation
	Oi	1	PWR	1,175	1979/03/27	In Operation
		2	PWR	1,175	1979/12/05	In Operation
		3	PWR	1,180	1991/12/18	In Operation
		4	PWR	1,180	1993/02/02	In Operation
The Chugoku Electric Power Co., Inc.	Shimane	1	BWR4	460	1974/03/29	In Operation
		2	BWR5	820	1989/02/10	In Operation
		3	ABWR	1,373	2011/12	Under Construction
	Kaminoseki	1	ABWR	1,373		In Planning
		2	ABWR	1,373		In Planning
Shikoku Electric Power Co., Inc.	Ikata	1	PWR	566	1977/09/30	In Operation
		2	PWR	566	1982/03/19	In Operation
		3	PWR	890	1994/12/15	In Operation
Kyushu Electric Power Co., Inc.	Genkai	1	PWR	559	1975/10/15	In Operation
		2	PWR	559	1981/03/30	In Operation
		3	PWR	1,180	1994/03/18	In Operation
		4	PWR	1,180	1997/07/25	In Operation
	Sendai	1	PWR	890	1984/07/04	In Operation
		2	PWR	890	1985/11/28	In Operation
The Japan Atomic Power Co.	Tokai		GCR	166	1966/07/25	Under Decommissioning
	Tokai No. 2		BWR5	1,100	1978/11/28	In Operation
	Tsuruga	1	BWR2	357	1970/03/14	In Operation
		2	PWR	1,160	1987/02/17	In Operation
		3	APWR	1,538		In Planning
		4	APWR	1,538		In Planning
Electric Power Development Co., Ltd	Oma	1	ABWR	1,383	2012/03	Under Construction
Japan Atomic Energy Agency	Fugen		ATR	165	1979/03/20	Under Decommissioning
	Monju		FBR	280		Under Construction

Remarks

In Planning: Plan was announced to public by the electric company and yet not licensed for installation
Under Construction: Licensed for installation and yet not passed Pre-service Inspection
In Operation: Passed Pre-service Inspection
Under Decommissioning: Approved of Decommissioning Plan

2 List of incidents reported under the Reactor Regulation Act during the reporting period (Article 6 and Article19)

Incidents reported in 2007 fiscal year

Nuclear Power Station	Incidents	Date	INES Scale
Sendai Unit1	Deterioration of the Steam Generator Tubes	2007/05/10	0-
Onagawa Unit 1	Reactor Manual Shutdown Due to Low Flow rate of High Pressure Injection System	2007/05/22	0-
Fukushima Daini Unit 2	Erosion of part of the suppression pool wall	2007/06/08	0-
Fukushim Daiichi Unit 1	Damages of an Emergency Diesel Generator	2007/6/25	0-
Hmaoka Unit 5	Power Reduction due to inoperability of the reactor average power monitor	2007/07/05	0-
Kashiwazaki Kariwa Unit 3	Fire of the house transformer, Consequences of “the Niigataken Chuets-oki Earthquake in 2007”	2007/07/16	-
Kashiwazaki Kariwa Unit 6	Leakage of water containing radioactive materials to non-controlled area,	2007/07/16	0-
Kashiwazaki Kariwa Unit 6	Damage of the drive axis universal joint of the overhead crane,	2007/07/24	-
Kashiwazaki Kariwa Units 1-7	Overflow of water to the refueling floor,	2007/07/25	0-
Ohi Unit 1	Reactor Manual Shutdown due to leakage of reactor coolant from the primary coolant pump seal water injection filters	2007/09/03	0-
Tomari Unit1	Reactor Manual Shutdown due to in-operability of EDG	2007/09/19	1
Mihama Unit 2	Flaws Found in the Welding Portion of Steam Generator-A Primary Coolant Inlet Piping Nozzle Stub	2007/09/25	0-
Takahama Unit 2	Malfunction of the Control Rod Drive System	2007/10/02	0-
Tsuruga Unit 2	Flaws Found in the Welding Portion of the Steam Generator Primary Coolant Inlet Piping Nozzle Stub	2007/10/18	0-
Ohi Unit 2	Thinning of the Elbow Portion of the Secondary Main Feed-water Piping	2007/11/07	0-
Onagawa Unit 3	Reactor Manual Shutdown Due to “Off-Gas Dehumidification Cooler outlet Hydrogen concentration high” at the off-gas treatment system	2007/11/10	0-
Hamaoka Unit 4	Manual shutdown due to stoppage of the reactor coolant cleanup system	2007/11/15	0-
Shimane Unit 1	Deformation of the refueling machine’s fuel gripper	2007/11/21	-
Hamaoka Units 1 & 2	A Crack Found in the Pass-through Section of the Common Exhaust Stack	2007/11/27	0-
Takahama Unit 2	Damage to the weld on the primary coolant inlet nozzle stub in the steam generator	2007/12/04	0-
Takahama Unit 3	Damage to the weld on the primary coolant inlet nozzle stub in the steam generator	2008/02/04	0-
Ohi Unit 2	Decrease in power output due to one of the four control rods found to be out of position	2008/03/12	0-
Hamaoka Unit 1	Corrosion in the condensate tank	2008/03/17	0-

Remarks

- : Not applicable for evaluation

*: In Japan there are 0- and 0+ for the events evaluated as INES Scale 0.

Incidents reported in 2008 fiscal year

Nuclear Power Station	Incidents	Date	INES Scale
Tomari Unit2	Damage to welds on the primary coolant inlet nozzle stubs in the steam generators	2008/04/09	0-
Sendai Unit1	Damage to the Charging/High-Pressure Injection Pump	2008/04/18	0-
Ohi Unit 3	Flaws Found in the Welding Portion of the Reactor Vessel Loop-A Outlet Nozzle Stub	2008/05/26	0-
Fukushima Daiichi Unit 5	Deviation from the Limiting Conditions for Operation due to inoperability of high pressure core injection system and reactor core isolation cooling system	2008/05/27	1
Kashiwazaki Kariwa Unit 6	Defective coupling between the Control Rod Drive Mechanism and the Control Rod	2008/06/27	1
Tomari Unit1	Failure of the Charging Pump-A	2008/07/18	0-
Tsuruga Unit 2	Malfunction of Starting Steam Inlet Valve for Turbine Driven Auxiliary Feed-water Pump	2008/07/23	0-
Shimane Unit 1	Deviation from the Limiting Conditions for Operation of Unit1 due to automatic shut-down of High Pressure Core Injection System	2008/08/05	0+
Tokai Daini	Deviation from the Limiting Conditions for Operation due to the malfunction of the Reactor Core Isolation Cooling System	2008/08/07	0-
Tomari Unit1	Damage of the Steam Generator Tubes	2008/09/04	0-
Monju	Corroded Pore in the Outside of the Exhaust Duct	2008/09/10	1
Tsuruga Unit 2	Flaws found at the weld in the upper part of the high pressure turbine casing	2008/09/19	-
Takahama Unit 4	Damage of Steam Generator Tubes	2008/09/22	0-
Takahama Unit 4	Flaws Found in the Weld of the Steam Generator Primary Coolant Inlet Nozzle Stubs	2008/10/03	0-
Hamaoka Unit 5	Reactor Manual Shutdown due to the temperature increase of the charcoal rare-gas hold-up equipment in the off-gas treatment system	2008/11/05	1
Fukushima Daini Unit 3	Excessive Insertion of the Control Rod	2008/11/07	0-
Fukushima Daiichi Unit 1	A Small Amount of Water Oozing from a Valve in the Control Rod Drive Hydraulic Control System	2008/11/26	0-
Tsuruga Unit 1	Corroded pores in the air duct of the main control room HVAC system	2008/12/11	0-
Hamaoka Unit 3	Deviation from the limiting conditions for operation due to the inoperative of the EDG-A	2008/12/24	0+
Hamaoka Unit 5	Reactor Manual Shutdown due to the increase of the hydrogen concentration of the off-gas treatment system	2008/12/30	0-
Fukushima Daiichi Unit 1	Power Reduction due to the turbine bypass valve full closure	2009/02/25	0+
Onagawa Unit 1	Control Rod Insertion without its any Operation during the Reactor Start-up Operation	2009/03/23	1
Shimane Unit 1	Erroneous Insertion of the Control Rod	2009/03/26	0-
Fukushima Daiichi Unit 3	Excessive Insertion of the Control Rod	2009/03/26	0-

Remarks

- : Not applicable for evaluation

*: In Japan there are 0- and 0+ for the events evaluated as INES Scale 0.

Incidents reported in 2009 fiscal year

Nuclear Power Station	Incidents	Date	INES Scale
Fukushima Daiichi Unit 3	Excessive Insertion of the Control Rod	2009/04/06	0-
Hamaoka Unit 4	Occurrence of the Injury of a Worker in the Turbine Building	2009/04/22	-
Hamaoka Unit 4	Reactor Manual Shutdown due to the increase of the hydrogen concentration of the off-gas treatment system	2009/05/05	0-
Tsuruga Unit 1	A flaw in the seat portion of the vent valve for the control rod drive hydraulic system	2009/05/13	0-
Onagawa Unit 3	Excessive insertion of the control rod	2009/05/28	0-
Tokai Daini	Reactor manual shutdown	2009/07/17	0-
Tomari Unit 3	Damage of the emergency diesel generator	2009/08/21	0+
Fugen	Leakage of the radioactive material in the controlled area	2009/10/08	0- interim
Tsuruga Unit 1	Thinning of the sea water piping for cooling the high pressure core injection system diesel engine	2009/10/14	0- interim
Fukushima Daini Unit 4	Power Reduction	2009/10/15	0-
Shika Unit 2	Reactor manual shutdown	2009/11/13	1 interim
Mihama Unit 1	Unexpectedly power change during the generator power increase operation	2009/11/13	0- interim
Hamaoka Unit 3	Leakage of liquid radioactive waste in the radiation controlled area	2009/12/1	0- interim
Tokai Daini	Thinning of the residual heat removal sea water system piping	2010/01/13	0- interim
Takahama Unit 4	Significant signal indications of flaw on the Steam Generator tube	2010/03/16	0- interim
Mihama Unit 2	Flaw on the weld of the air vent piping in the chemical and volume control system	2010/03/23	0- interim

Remarks

- : Not applicable for evaluation

*: In Japan there are 0- and 0+ for the events evaluated as INES Scale 0.

3 List of standards of academic societies and associations endorsed by NISA (Article7)

The Japan Electric Association	
Technical Guidelines for a seismic Design of Nuclear Power Plants: Classification and Allowable Stress	JEAG 4601-S-1984
Technical Guidelines for a seismic Design of Nuclear Power Plants	JEAG 4601-1987
Technical Guidelines for a seismic Design of Nuclear Power Plants: Supplement	JEAG 4601-1991
Guideline for Fire Protection of Nuclear Power Plants	JEAG 4607-1999
Guideline for Design of Radiation Shielding for Nuclear Power Plants	JEAG 4615-2003
Primary Reactor Containment Vessel Leakage Testing	JEAC 4203-2004
Definitions of Nuclear Reactor Coolant Pressure Boundary and Reactor Containment Boundary	JEAC 4602-2004
Definitions of Engineered Safety Features and Related Systems of Nuclear Power Plants	JEAC 4605-2004
Ultrasonic Examination Guideline for In-service Inspection of Light Water Cooled Nuclear Power Plant Components	JEAG 4207-2004
Guideline for Maintenance Management of Nuclear Power Plants	JEAG 4210-2007
Rules of Maintenance Management of Nuclear Power Plants	JEAC 4209-2007
Guideline for the evaluation of drift of safety protection system instruments	JEAG 4621-2007
Technical Guideline for Diagnosis on Nuclear Power Plants Components: Diagnostic Technology for the Vibration of Rotational Components	JEAG 4221-2007
Guidelines for Application of Rules of Quality Assurance for Safety of Nuclear Power Plants (JEAC 4111-2003)- Operation Stage of Nuclear Power Plants	Appendix of JEAG4121-2005 (Amendment 2 2007)
Method of Surveillance Tests for Structural Material of Nuclear Reactors	JEAC 4201-2007
Methods of Verification Tests of the Fracture Toughness for Nuclear Power Plant Components	JEAC 4206-2007
Technical Guideline for Diagnosis on Nuclear Power Plants Components: Diagnostic Technology for Lubrication Oil	JEAG 4222-2008
Technical Guideline for Diagnosis on Nuclear Power Plants Components: Diagnostic Technology for Infrared Thermography	JEAG 4223-2008
Primary Reactor Containment Vessel Leakage Testing	JEAC 4203-2008
Ultrasonic Examination Guideline for In-service Inspection of Light Water Cooled Nuclear Power Plant Components	JEAC 4207-2008
Rules of Quality Assurance for Safety of Nuclear Power Plants	JEAC 4111-2009
The Japan Society of Mechanical Engineers	
Evaluation Guideline on Hydro-Dynamic Vibration of Piping Internal Cylindrical Structure	JSME S012-1998
Standards for Nuclear Power Generation Equipment: Maintenance Standards (revised in 2000)	JSME S NA1-2000
Standards for Nuclear Power Generation Equipment: Welding Standards	JSME S NB1-2001
Standards for Nuclear Power Generation Equipment: Design and Construction Standards	JSME S NC1-2001
Standards for Nuclear Power Generation Equipment: Maintenance Standards (revised in 2002)	JSME S NA1-2002
Guideline for Prevention o f Fluid Induced Vibration of Tube and U-Tube of Steam Generator	JSME S016-2002
Standards for Nuclear Power Generation Equipment: Concrete Reactor Containment Vessel	JSME S NE1-2003

Evaluation Guideline on High Cycle Thermal Fatigue of Piping	JSME S017-2003
Standards for Nuclear Power Generation Equipment: Maintenance Standards (2004)	JSME S NA1-2004
Standards for Nuclear Power Generation Equipment: Design and Construction Standards (2005)	JSME S NC1-2005
Standards for Nuclear Power Generation Equipment: Standards for Piping Wall Thinning Management for Pressurized Water Reactor	JSME S NG1-2006
Standards for Nuclear Power Generation Equipment: Standards for Piping Wall Thinning Management for Boiling Water Reactors	JSME S NH1-2006
Standards for Nuclear Power Generation Equipment: Design and Construction Standards(Amendment of 2007)	JSME S NC1-2007
Standards for Nuclear Power Generation Equipment: Welding Standards(revised in 2007)	JSME S NB1-2007
Standards for Spent Fuel Storage Facility: Structural Standard for Metallic Cask (revised in 2007)	JSME S FA1-2007
Standards for Nuclear Power Generation Equipment: Maintenance Standards (revised in 2008)	JSME S NA1-2008
Standards for Equipment, Maintenance and Case of Nuclear Power Generation Facilities: Alternative Provision for Allowable Defect Angle Restriction for the Defect of Peripheral Direction	JSME S NA-CC-002
Standards for Equipment, Design and Construction and Case of Nuclear Power Generation Facilities: Standard for Protection of Over-pressurization	JSME S NC-CC-001
Standards for Equipment, Design and Construction and Case of Nuclear Power Generation Facilities: Standard: Considerations for Inhibition of Occurrence of Stress Corrosion Cracking	JSME S NC-CC-002
Standards for Equipment, Design and Construction and Case of Nuclear Power Generation Facilities: Application of "Amendment 2005 of Standards for Equipment, Design and Construction," Piping Design (Joints and Flanges) replacing Corresponding JIS	JSME S NC-CC-003
Standards for Equipment, Design and Construction and Case of Nuclear Power Generation Facilities: Application of "Amendment 2005 of Standards for Equipment, Appendix: Figures and Tables of Materials" replacing Corresponding	JSME S NC-CC-004
The Atomic Energy Society of Japan	
Performance Criteria of the Measures for Aging Management for Nuclear Power Plants(2008)	AESJ-SC-P005 : 2008
The Thermal and Nuclear Power Engineering Society	
Guidelines for Accumulation Prevention of Mixed Gas (Hydrogen and Oxygen) inside BWR Piping	JBWR-NCG-01-2005
The Japanese Society for Non destructive Inspection	
Qualification and Certification of Personnel for Performance Demonstration of Ultra Sonic Testing System	NDIS0603:2005

4 Outline of JEAC 4111-2009: Rules of Quality Assurance for Safety of Nuclear Power Plants (Article 13)

JEAC 4111-2009 was established on the basis of ISO 9001, taking into consideration the IAEA Safety Standards Series, which define requirements specific to nuclear power. JEAC 4111-2009 is intended to realize the requirements related to quality assurance of the operational safety activities of nuclear power plants, provided by nuclear safety regulations.

(1) Requirements

a Quality management system

The Rules provide that the licensee shall establish, document, implement and maintain the quality management system and continually improve its effectiveness. The Rules also provide for the items to implement so as to achieve the above mentioned goal, grading of the degree of application of the requirements of the quality management system, operation and management of the processes, and management of outsourced processes.

b Responsibilities of management

The Rules provide for management commitment, emphasis on nuclear safety, quality policy, planning, responsibilities, authorities, communication and management review.

c Resources management

The Rules provide for clarification and provision of resources required for keeping nuclear safety, human resources, nuclear installations and work environment.

d Planning and implementation of work

The rules provide for planning of work, processes related to requirements for work, design and development, procurement, implementation of work, management of monitoring and measurement equipment.

e Evaluation and improvement

The Rules provide for monitoring, measurement, analysis and improvement processes, nonconformity management, data analysis and improvement.

(2) Relationship with GS-R-3

Comparison was made between JEAC 4111-2003 and GS-R-3 in order to revise JEAC 4111-2003. As a result, the following insights were gained:

- As the general structure of GS-R-3 corresponds to ISO 9001: 2000, conceptually GS-R-3 is a same management system as JEAC 4111, which is also based on ISO 9001.
- In GS-R-3, the product is defined as the “results of processes” as in ISO 9001 so that GS-R-3 can be applied to activities in entire stages from site selection to decommissioning, and also to diverse facilities. However, as the goal of GS-R-3 is “emphasis on safety”, it is equivalent that JEAC 4111 is intended for “accomplishment of nuclear safety”.
- GS-R-3 is a management system which integrates factors related to safety, health, environment, security, quality and economic efficiency. On the other hand, JEAC 4111 is a quality management system for safety in the nuclear power plant, and so it does not necessarily require to be integrated. However, as the requirements for work are decided placing utmost priority to the safety of a nuclear power plant, the requirements necessary for accomplishing nuclear safety is incorporated into the system.
- As GS-R-3 is an integrated management system, the subjects which correspond to customers in ISO 9001 are defined as stakeholders. On the other hand, in JEAC 4111, the customers are defined as Japanese people, and nuclear safety regulations which are mandated by Japanese people so that JEAC 4111 can be applied to the operational safety activities. However, there is no difference in the policies regarding customers or subjects.
- GS-R-3 requires the licensees to utilize management system as a tool to foster safety culture. Therefore, safety culture is taken into consideration in the related provisions such as the management review, education and training, self-assessment, and independent assessment. On the other hand, although JEAC 4111 is strongly related to safety culture, there is no explicit requirement for safety culture in JEAC 4111.
- GS-R-3 took over the self-assessment and independent assessment from 50-C-Q and JEAC 4111 incorporates such assessment from 50-C-Q. Therefore, the matters related to the self-assessment and independent assessment had already been addressed.

Other factors specific to nuclear power;

- Grading:

  As JEAC 4111-2003 incorporates the grading system from 50-C-Q, JEAC4111 and GS-R-3 are equivalent.
- ‘Individuals other than the original designer in the design verification shall implement,’ ‘independency of inspection and test personnel’:

  GS-R-3 requires that if independency is necessary, it shall be explicitly stated in the section concerning the “management of processes”, which corresponds to the realization of products in ISO 9001. DS349, which is a guideline to complement, requires independency of design verification with regard to the 'design', thus, the content of regulation for independency remains the same.

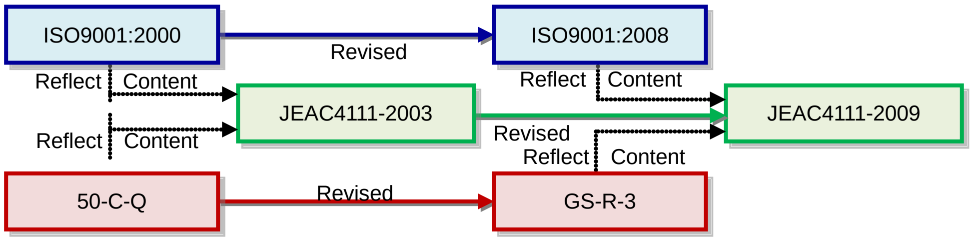


Figure D-1 The Relation between Standards/Codes

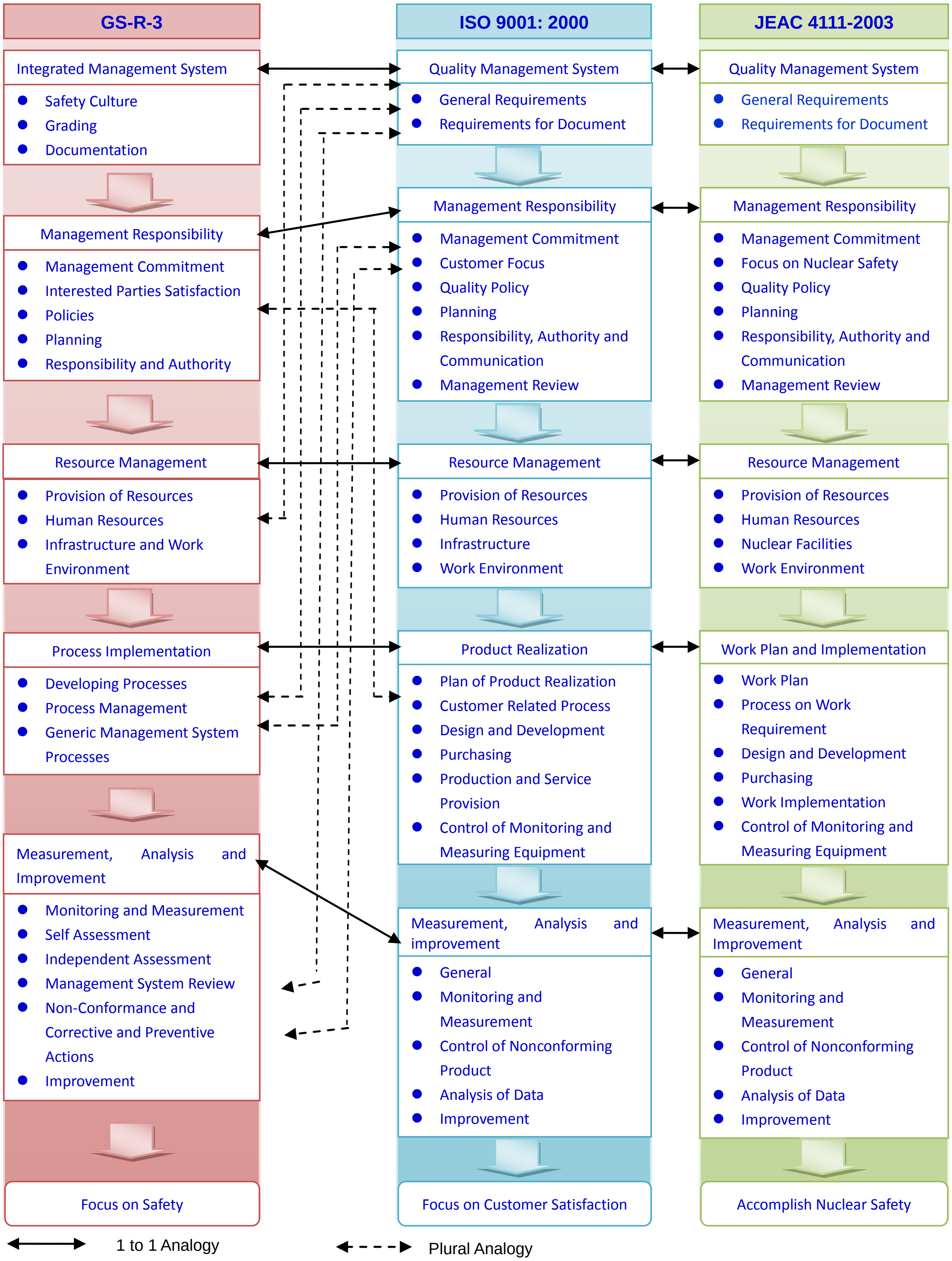


Figure D-2 Relation between Standards and Codes

5 List of nuclear emergency drills during the reporting period (Article 16)

Organized by	Date	Sites
(1) Drills conducted by the National Government		
Government	Oct.24,2007	Japan Nuclear Fuel Ltd., Rokkasho Reprocessing Plant
Government	Oct.21-22,2008	Tokyo Electric Power Co.,Inc., Fukushima Dai-ichi NPS
Government	Dec.21-22,2009	The Japan Atomic Power Co., Tokai Dai-ni PS
(2) Drills conducted by the local governments (Prefecture)		
Shimane	Jan.30,2007	The Chugoku Electric Power CO.,Inc., Shimane NPS
Shizuoka	Feb.1,2007	Chubu Electric Power Co.,Inc., Hamaoka NPS
Fukushima	Feb.6,2007	Tokyo Electric Power Co.,Inc., Fukushima Daiichi NPS
Kanagawa	Feb.6,2007	Gloval Nuclear Fuel Japan, Nuclear Fuel Fabrication Plant
Fukui	Aug.2,2007	The Japan Atomic Power Co., Tsuruga PS
Ibaraki	Sep.28,2007	Japan Atomic Energy Agency, Oarai R&D Center, “Joyo”
Okayama	Oct.11,2007	Japan Atomic Energy Agency, Ningyo-toge Environmental Engineering Center, Prototype Uranium Enrichment Plant
Fukushima	Oct.22-23,2007	Tokyo Electric Power Co.,Inc., Fukushima Daini NPS
Kagoshima	Oct.23,2007	Kyushu Electric Power Co.,Inc., Sendai NPS
Hokkaido	Oct.30,2007	Hokkaido Electric Power Co.,Inc. Tomari PS
Shimane	Nov.2,2007	The Chugoku Electric Power CO.,Inc., Shimane NPS
Ehime	Nov.6,2007	Shikoku Electric Power Co.,Inc., Ikata PS
Fukuui	Nov.18,2007	The Japan Atomic Power Co., Tsuruga PS
Ishikawa	Nov.22,2007	Hokuriku Electric Power Co., Shika NPS
Saga	Nov.25,2007	Kyushu Electric Power Co.,Inc.,Genkai NPS
Miyagi	Jan.23-24,2008	Toholu Electric Power Co.,Inc., Onagawa NPS
Shizuoka	Feb.13,2008	Chubu Electric Power Co.,Inc., Hamaoka NPS
Ibaraki	Sep.30,2008	The Japan Atomic Power Co., Tokai No.2 PS
Okayama	Oct.9,2008	Japan Atomic Energy Agency, Ningyo-toge Environmental Engineering Center, Prototype Uranium Enrichment Plant
Fukui	Oct.25,2008	The Kansai Electric Power Co.,Inc., Takahama PS Unit 3
Aomori	Oct.29,2008	Tohoku Elecric Power Co.,Inc., Higashidori NPS Unit 1
Ehime	Nov.5,2008	Shikoku Electric Power Co.,Inc., Ikata PS Unit 2
Ishikawa	Nov.14,2008	Hokuriku Electric Power Co., Shika NPS Unit 2
Saga	Nov.19-20,2008	Kyushu Electric Power Co.,Inc.,Genkai NPS Unit 2
Miyagi	Jan.23,2009	Toholu Electric Power Co.,Inc., Onagawa NPS Unit 2
Kagoshima	Jan.31,2009	Kyushu Electric Power Co.,Inc., Sendai NPS Unit 1
Hokkaido	Feb.10,2009	Hokkaido Electric Power Co.,Inc. Tomari PS Unit 2
Shizuoka	Feb.12,2009	Chubu Electric Power Co.,Inc., Hamaoka NPS Unit 3
Okayama	Oct.9,2009	Japan Atomic Energy Agency, Ningyo-toge Environmental Engineering Center, Prototype Uranium Enrichment Plant
Aomori	Oct.21,2009	Japan Nuclear Fuel Ltd., Reprocessing Plant
Ehime	Oct.20,2009	Shikoku Electric Power Co.,Inc., Ikata PS Unit 2

Saga	Oct.23-24,2009	Kyushu Electric Power Co.,Inc.,Genkai NPS Unit 2
Hokkaido	Oct.29,2009	Hokkaido Electric Power Co.,Inc. Tomari PS Unit 2
Shimane	Nov.13,2009	The Chugoku Electric Power CO.,Inc., Shimane NPS Unit 2
Miyagi	Nov.18,2009	Toholu Electric Power Co.,Inc., Onagawa NPS Unit 3
Fukui	Nov.22,2009	The Kansai Electric Power Co.,Inc., ihama PS Unit 3
Kagoshima	Jan.19,2010	Kyushu Electric Power Co.,Inc., Sendai NPS Unit 1
Shizuoka	Feb.4,2010	Chubu Electric Power Co.,Inc., Hamaoka NPS Unit 3
Ishikawa	Mar. 17,2010	Hokuriku Electric Power Co., Shika NPS Unit 2

6 Definition and function of each class related to safety function importance (Article 18)

Classification		Definition	Function
Class 1	PS-1	SSCs whose damage or failure may cause events potentially leading to (a) considerable core damage or (b) extensive fuel failure	1) Reactor coolant pressure boundary
			2) Prevention of excessive reactivity insertion
			3) Maintenance of core geometry
	MS-1	1) SSCs capable of promptly shutting down the reactor, removing residual heat and preventing overpressure in the reactor coolant pressure boundary in the event of abnormal conditions, thereby preventing undue radiological influence to the off-site public.	1) Prompt shutting down of the reactor
			2) Maintenance of sub criticality
			3) Prevention of overpressure in the reactor coolant pressure boundary
			4) Residual heat removal after reactor shutdown
			5) Core cooling
			6) Confinement of radioactive materials, radiation shielding and reduction of radioactivity release
		2) Other SSCs essential to Safety	1) Generation of actuation signals to the engineered safety features and reactor shutdown, system
			2) Supporting functions especially important to safety
Class 2	PS-2	1) SSCs whose damage or failure may cause events potentially leading to excessive release of radioactive materials to the outside of the site, but hardly leading to considerable core damage or extensive fuel failure	1) Containment of reactor coolant (except for small-diameter pipes that are excluded from the reactor coolant pressure boundary, such as those for instrumentation, and other pipes and equipment not directly connected to the boundary)
			2) Storage of radioactive materials, not being directly connected to the reactor coolant pressure boundary
			3) Safe handling of fuel
		2) SSCs whose functioning is required during normal operations and anticipated operational occurrences and whose failure may lead to degraded core cooling.	1) Reseating of safety valves and relief valves
	MS-2	1) SSCs capable of sufficiently reducing radiological influence to the off-site public caused by damage or failure of SSCs belonging to PS-2.	1) Water makeup to the fuel storage pool
			2) Prevention of radioactive materials release
		2) SSCs especially important to coping with abnormal conditions	1) Monitoring of plant status in case of an accident
			2) Mitigation of abnormal conditions
			3) Safe shutting down from outside of the control room
Class 3	PS-3	1) SSCs not belonging to PS-1 and PS-2 whose failure may become initiating events of abnormal	1) Retention of reactor coolant (other than PS-1 and PS-2)
			2) Circulation of reactor coolant

		conditions.	3) Storage of radioactive materials
			4) Electric power supply (except for emergency power supply)
			5) Plant instrumentation and control (except for safety protection Function)
			6) Auxiliary functions for plant operation
		2) SSCs capable of maintaining the concentration of radioactive materials in reactor coolant as low as acceptable for normal operation.	1) Prevention of the dispersion of fission products into reactor coolant
			2) Reactor coolant cleanup
	MS-3	1) SSCs capable of mitigating anticipated operational occurrences in conjunction with MS-1 and MS-2.	1) Mitigation of reactor pressure increase
			2) Suppression of reactor power increase
			3) Reactor coolant makeup
		2) SSCs necessary for coping with abnormal conditions	Functions important to emergency management and monitoring of abnormal conditions

7 Inspection items of pre-service inspection on each construction phase defined by the Electricity Business Act (Article 19)

Construction Phase	Inspection Item
A. When each component is installed and ready to be tested on structure, strength and/or leak tightness of reactor, reactor cooling system, instrumentation and control system, fuel handling system, radiation control system, waste treatment system or reactor containment	Inspection to confirm structure, function or performance of reactor, reactor cooling system, instrumentation and control system, fuel handling system, radiation management system, waste processing system or reactor containment, specifically; 1) material inspection 2) dimensional inspection 3) visual inspection 4) assemble and installment inspection 5) pressure test 6) leak test 7) inspection on foundation of reactor containment
B. When installation of bottom half part of turbine casing is completed and when its main part of auxiliary boiler is completely assembled	1. Inspection to confirm structure, function or performance of steam turbine, specifically; 1) material inspection 2) dimensional inspection 3) visual inspection 4) assemble and installment inspection 2. Inspection to confirm structure, function or performance of auxiliary boiler, specifically; 1) material inspection 2) dimensional inspection 3) visual inspection 4) assemble and installment inspection 5) pressure test 6) leak test
C. When the reactor is ready for fuels to be loaded	Inspection to confirm functions or performances which are necessary when reactor fuels are loaded, specifically for; reactor, reactor cooling system, instrumentation and control system, fuel handling system, radiation management system, waste processing system, reactor containment, ventilation stack, steam turbine, generator, transformer, voltage regulator or voltage phase regulator, phase controller, frequency convertor or rectifier, breaker, control system for operation of the power station and standby emergency power generating system.
D. When the reactor is ready for criticality operation	Inspection to confirm functions or performances which are necessary when the reactor attains criticality, specifically for; reactor, reactor cooling system, instrumentation and control system, steam turbine and generator.
C. When all construction work under the Construction Plan has been completed	Inspection to confirm total performance of the nuclear power station at reactor power operation. Inspection necessary to confirm the completion of the construction work.

8 Incident reporting criteria defined by the Ministerial Ordinance (Article 19)

Licensees should report incidents and failures based on the Reactor Regulation Act according to the following criteria.

1. When nuclear fuel material was stolen or lost.
2. When a reactor was shut-down by failure of a nuclear installation or when it became necessary to shut-down a reactor during operation, or when reactor power output fluctuates more than 5%, or when change of reactor power output was required. Except when it was one of the following and the licensee announced officially about the situation of the concerned failure.
   i) When it occurs in the term of the Periodic Inspection provided in Article 54-1 of the Electricity Business Act i.e. the failure in the equipments that the functional and operational conditions of the failed equipment cannot be checked under the reactor shut-down condition.
   ii) When the failure did not cause any deviation from the limit of operation, and there is no change observed related with the concerned failure, and when the licensee performs inspection of the failed equipment concerned.
   iii) When the reactor output change is required to follow the limit of operation.
3. When a licensee checked the equipment and structure important to the safety, and when concerned equipment etc. important to safety was considered that it does not satisfy the standard described in Article 9 or in Article 9-2 of the Ministerial Ordinance of Establishing Technical Standards for Nuclear Power Generation Equipment (Ordinance No. 62 of MITI, 1965), or when it was considered that it does not have function to ensure safety of the nuclear installation.
4. When there was a failure of equipment etc. important to safety by the fire. Except the concerned failure was associated to the measure of fire extinguishing or prevention of the spread of fire.
5. Other than the preceding three items, when deviation from the limit of operation by the failure of a the nuclear installation (except those minor troubles whose impact on operation of nuclear reactor is insignificant) was caused, or when the measure for the concerned deviation defined in the Operational Safety Program was not implemented at the time of deviation from the limit of operation.
6. When the failure of a nuclear installation or occurrence of other un-anticipated situation had caused any trouble to discharge gaseous radioactive wastes through the ventilation facility or to discharge liquid radioactive wastes through the drainage facility.
7. When the concentration of radioactive materials in the air outside the environment monitoring area exceeds the allowable limit in the case of discharge of gaseous radioactive wastes through the ventilation facility.
8. When the concentration of radioactive materials in the water outside the environment monitoring area exceeds the allowable limit in the case of the discharge of liquid radioactive wastes through the drainage facility.
9. When nuclear fuel materials or materials contaminated with nuclear fuel materials (hereinafter referred to as "nuclear fuel materials etc.") leaked out of

the controlled area.

10. When nuclear fuel materials etc. leaked within the controlled area associated to failure of a nuclear installation or occurrence of other undetermined situation. Exceptions are the followings (except the case when new measures such as access control into the leakage-related place and key control have been taken or when the leaked substances have spread outside the controlled area):
    - i) When revealed liquid nuclear fuel materials etc. did not spread out of the floodgate that is installed in the circumference of the equipment of the concerned leakage for prevention of leakage spread.
    - ii) When the ventilation facility of the concerned area of the leakage was working properly at the time when gaseous nuclear fuel materials etc. leaked.
    - iii) When the amount of radioactivity of the leaked nuclear fuel materials etc. is very little and when the degree of the leakage is minor.
11. When the person who enters into the controlled area suffered radiation exposure due to the failure of a nuclear reactor facility or occurrence of other un-anticipated situation, and when the effective dosage of concerned exposure exceeds or could exceeds five mSv for a personnel engaged in radiation work or 0.5 mSv for a person other than the personnel engaged in radiation work.
12. When the dosage of personnel engaged in radiation work exceeds or could exceed the allowable dose limit.
13. When the control rod which is not under insertion or withdrawal operation moves from the original control position (control rod position which is located and indicated at certain interval defined in licensee's document on control rod operation based on the Operational Safety Program.) to or passing other control position, or when fully inserted control rod (control rod inserted to the maximum control position) which is not under insertion or withdrawal operation moves across and over the fully inserted position. Except the case when no fuel in the core.
14. Other than those above items, when personnel are injured or could be injured in the nuclear installation (except when the injury was other than radiation hazard and was not necessary for hospitalization).

9 References

- Framework for Nuclear Energy Policy
  http://www.aec.go.jp/jicst/NC/tyoki/taikou/kettei/eng_ver.pdf

- Nuclear Energy Basic Act
  http://www.nsc.go.jp/NSCenglish/documents/laws/1.pdf

- Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors
  http://www.japaneselawtranslation.go.jp/law/detail/?id=1849&vm=04&re=01

- Electricity Business Act
  http://www.japaneselawtranslation.go.jp/law/detail/?id=51&vm=04&re=01

- Act on Special Measures Concerning Nuclear Emergency Preparedness
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- Issues on Nuclear Safety Regulation (Nuclear Safety Infrastructure Subcommittee of the Nuclear and Industrial Safety Subcommittee, February 2010)
  http://www.meti.go.jp/report/data/g100205aj.html

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  http://www.nisa.meti.go.jp/english/resources/subcommittee/index.html

- Introduction of Inspection based on the Maintenance Program (August 2008, NISA)
  http://www.meti.go.jp/committee/materials2/downloadfiles/g80806a04j.pdf