Provisional Translation

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

August 2004

Government of Japan

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D. Safety of Installations

Annexes

Acronym and Abbreviation Used in this Report

ABWR	advanced boiling water reactor
ACNRE	Advisory Committee for Natural Resources and Energy
AEC	Atomic Energy Commission
AESJ	Atomic Energy Society of Japan
ALARA	as low as reasonably achievable
AOT	Allowed Out of Service Times
ABWR	Advanced boiling water reactor
APWR	advanced pressurized water reactor
ASCOT	Assessment of Safety Culture in Organizations Team
BSS	Basic Safety Standards
BTC	BWR Operation Training Center
BWR	boiling water reactor
Dose Limit Notification	Notification for Dose Limits on the basis of the Rules for Commercial Power Reactors
EIS	Environmental Impact Statement
Regulatory Guide for Safety Design	Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities
Regulatory Guide for Reviewing Safety Assessment	Regulatory Guide for Reviewing Safety Assessment of Light Water Nuclear Power Reactor Facilities
Regulatory Guide for Reviewing Seismic Design	Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities etc
Regulatory Guide for Reactor Siting	Regulatory Guide for Reviewing Nuclear Reactor Siting Evaluation and Application Criteria
Fugen	heavy water moderated boiling light water cooled reactor owned by JNC
FY	Fiscal Year
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
INES	International Nuclear Event Scale
INPO	Institute of Nuclear Power Operations
ISO	International Standards Organization
JAERI	Japan Atomic Energy Research Institute
JAPEIC	Japan Power Engineering and Inspection Corporation

JCO Criticality Accident	Criticality Accident at JCO Co. Uranium Fuel Fabrication Facility
JEA	Japan Electric Association
JEAC(G)	Japan Electric Association Code (Guideline)
JNC	Japan Nuclear Cycle Development Institute
JPDR	Japan Power Demonstration Reactor
JSME	Japan Society of Mechanical Engineers
LCO	Limiting Conditions for Operation
METI	Ministry of Economy, Trade and Industry
Minister of METI	Minister of Economy, Trade and Industry
MEXT	Ministry of Education, Culture, Sports, Science and Technology
Minister of MEXT	Minister of Education, Culture, Sports, Science and Technology
MITI	Ministry of International Trade and Industry (METI at present)
Mj	Japan Meteorological Agency seismic intensity scale
MLIT	Ministry of land , Infrastructure and Transportation
Monju	prototype fast breeder reactor owned by JNC
MOX	Mix Oxide
NISA	Nuclear and Industrial Safety Agency
NPS	nuclear power station
NSC	Nuclear Safety Commission
NS Network	Nuclear Safety Network
NSRR	Nuclear Safety Research Reactor
NTC	Nuclear Power Training Center
NUPEC	Nuclear Power Engineering Corporation
NUSS	Nuclear Safety Standards, IAEA
OECD/NEA	Organization of Economic Co-operation and Development/Nuclear Energy Agency
OSART	Operational Safety Assessment Review Team
PSA	probabilistic safety assessment
PSR	periodic safety review
PWR	pressurized water reactor
QA	quality assurance
Reactor Regulation Law	Law for the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors

R & D reactor	Power reactors at the stage of research and development
RHRS	Residual Heat Removal System
RPS	Reactor Protection System
SCL	Steam Condensation Line
SSC	Structures, Systems and Components
STS	Standard Technical Specifications
Special Law for Nuclear Emergency	Special Law of Emergency Preparedness for Nuclear Disaster
TEPCO	Tokyo Electric Power Company
TNS	Thermal and Nuclear Power Engineering Society
UK	United Kingdom of Great Britain
USA	United States of America
V&V	verification and validation
WANO	World Association of Nuclear Operators

Preface

1.Preparation of the Report

This report was produced in compliance with the Article 5 of the Convention on Nuclear Safety.

This report was prepared by the Nuclear and Industrial Safety Agency (hereinafter referred to as "NISA") in consultation with the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy for the Ministry of Economy, Trade and Industry, with the support of an incorporated administrative agency Japan Nuclear Energy Safety Organization , (hereinafter referred to as "JNES"), and the cooperation of Japan Nuclear Cycle Development Institute and the Federation of Electric Power Companies of Japan. This report was reviewed also by other relevant governmental organizations. Views of the Nuclear Safety Commission (hereinafter referred to as "the NSC") were reflected to this report.

The Summary Report of the Second Review Meeting pointed out some items for which it was recommended to provide further information in next review meeting.

In this report, we tried to respond to them and to questions and comments on our previous report raised by other Contracting Parties during the second review meetings. Description of operating experience, alteration of nuclear power installation and progress in research and development is limited to the three years since the Second Review Meeting. The special topics in this report, that are a series of falsification by Tokyo Electric Power Co. (hereinafter referred to as the "TEPCO falsification issue") and the far-reaching renovation of the legislative and regulatory framework, are summarized in sections 4. and 5. of this preface.

The report on each article of the Convention consists of a) the reference of the convention article encircled in square brackets, b) following the brackets, shown in italic letters are the introduction of the feature of each article report and major changes after the previous reporting, and c) also in the main text of each article, major changes after the previous reporting are shown in italic letters.

Under the legislative and regulatory framework of Japan, nuclear installations in the scope of this Convention (land-based civil nuclear power plants) correspond to commercial power reactors and power reactors at the stage of research and development, and the safety regulation are fundamentally the same to these two types of nuclear installations. Detailed description in this report is on commercial power reactors with plenty of experience with siting, design, construction and operation, etc.

2. Current Status of Nuclear Energy Utilization in Japan

(1) General

Since the oil crises in 1970s, Japan has actively promoted nuclear power generation in order to introduce alternative energy resources to petroleum, aiming for stable supply and price of electricity. In recent years, nuclear power generation has played an important role in order to decrease CO_2 discharge to the environment, in the process of its power generation. Nuclear power generation has been promoted under the premise of safety and nuclear nonproliferation. This has resulted in 52 nuclear power installations that are currently in operation. In the fiscal year of 2002, nuclear power supply reached about 31.2 percent of total generation of electricity.

The first Energy Master Plan was decided by the Cabinet and reported to the Diet in October 2003 in accordance with the Basic Law on Energy Policy. The plan states that nuclear power generation should be promoted as a basic power supply recognizing the excellent characteristics of nuclear power generation in terms of stable supply of electricity and a measure against global warming, and that necessary investment should be encouraged under the environment of electricity market liberalization.

In “The long-term energy supply and demand outlook” published in July 2001, the number of new nuclear power plants to be commissioned by FY 2010 was reduced to 13 units, from 16 to 20 units, reflecting a loss of public confidence on to nuclear power caused by the criticality accident in 1999 at a uranium fuel processing plant of JCO Co., Ltd (hereinafter referred to as the “JCO criticality accident”) and other troubles in nuclear facilities.

In June 2002, NISA asked the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy to initiate a study on the future approach for an effective and efficient regulatory system on nuclear safety. Expedited by the revelation of the TEPCO falsification issue in August 2002, NISA, in compliance with the NSC recommendation, amended the Reactor Regulation Law and the Electricity Utilities Industry Law in December 2002, and renovated safety regulatory systems and related organizations in October 2003.

The Kanazawa Branch of the Nagoya High Court delivered a judgment, on January 27, 2003, and nullified the license for the breeder reactor "Monju" on an administrative litigation lawsuit. The government lost the lawsuit, and appealed to the Supreme Court on January 31. The regulatory body, on January 30, 2004, approved alteration of the design and construction method of Monju in accordance with the Reactor Regulation Law and the Electricity Utilities Industry Law.

(2) Current Status of Nuclear Installations in Japan

As of September 2004, there are 55 units of nuclear installations in Japan; 52 units are in operation, 2 units are under construction after achieving criticality and one unit ceased operation in March 2003 for the preparation of decommissioning. Total licensed capacity of nuclear power generation is about 47.4 GWe.

In FY 2002, the total capacity of 45.7 GWe of nuclear power generation accounted for about 19.6 percent of the nation’s total capacity of electricity generation, and nuclear power generated 294.9 billion kWh of electricity that was about 31.2 percent of 944.7 billion kWh electricity generated in Japan.

While average annual capacity factors of nuclear power plants had exceeded 80 percent from FY 1995 to 2001, that of FY 2003 dropped to 59.7 percent. It was because all of 17 nuclear reactors of TEPCO were shutdown in April 2003 due to the Periodic Inspections conducted earlier than scheduled and due to the prolonged outage to cope with various additional checks that were resulted from the TEPCO falsification issue revealed in August 2002. The reactors of the said company have been reviving operation one by one after verification of safety. Other nuclear power plants continued stable operation during this reporting period and the average frequency of unplanned shutdowns over FYs 2001 to 2003 was as small as 0.2 times per reactor-year.

3. International Activities for Ensuring Safety of Nuclear Installations

Recognizing that international cooperation is essential for ensuring safety of nuclear installations, Japan has actively been participating in various activities of IAEA and OECD/NEA for information exchanges and for discussions on safety related issues.

A news during this reporting period is that Japan acceded to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management in August 2003 and participated in the first review meeting held in November 2003. Japan had opportunities to receive peer-reviews of the contracting parties on the safety of radioactive waste management as well as on the safety of nuclear installations.

Japan has made a positive commitment to a cooperation program for establishing regulatory bodies and enhancing nuclear safety regulations in Asian countries and also with offering extra-budgetary funding to the IAEA.

Japan has been exchanging of regulatory information on nuclear safety with China, France, Korea, Sweden, U.K. and U.S.A. through bilateral arrangements, and has shared its knowledge and experiences with them. Japan makes efforts to enhance the safety of nuclear power plants in Japan and in the world.

Also electric power companies are contributing to maintain high level of safety and reliability of nuclear installations in Asia, through cooperation in managing the WANO Tokyo Center.

Units 3 and 6 of the Kashiwazaki-Kariwa Nuclear Power Station of TEPCO invited the OSART of IAEA in November 2004.

4. TEPCO Falsification Issue

(1) Falsification of Self-Controlled Inspection Records by Tokyo Electric Power Co.

In July 2000, a former employee of an inspection company that contracted self-controlled inspection with TEPCO made an allegation to the Ministry of International Trade and Industry (present METI) that TEPCO falsified self-controlled inspection records. This was the first allegation under the Allegation System established in June 2000 and was transferred to NISA in January 2001. Since the alleged falsification occurred about 10 years ago and since preservation of inspection records was not sufficient, the investigation met great difficulty. In August 2002, it was made public by NISA that falsifications such as tampering with self-controlled inspection records and cover up of cracks in core shrouds were committed at three nuclear power stations of TEPCO from the latter half of 1980's to the 1990's. It took two years for NISA to make it public.

In September 2002, NISA conducted on-site inspections in all nuclear power stations of TEPCO and the headquarters of TEPCO in order to investigate what were the facts. In October 2002, NISA announced to the public that the alleged falsifications were identified, and that although cracks or indications of crack were found on the re-circulation system piping and core shrouds they do not pose any immediate risk to the reactor safety.

NISA conducted special Nuclear Safety Inspections and Periodic Inspections strictly on their nuclear installations, issued a letter of severe warning to TEPCO, and ordered the company to reconstruct its quality assurance system and renovate organizational climate fostering true safety culture. NISA requested TEPCO to report the progress of reconstruction/renovation activities by the end of FY 2002. In response to this, TEPCO submitted to NISA in March 2003 their measures including involvement of the top management with quality assurance of the nuclear power division, clarification of responsibilities and authorities in nuclear power quality assurance program, preparation of manuals, etc. associated with quality assurance, establishment of audit division under the direct control of the president and reinforcement of judicial affairs department.

(2) Instruction to other license holders to make full review on their plants record

NISA instructed other license holders than TEPCO to make full review on their plants to confirm if there were any falsifications in past self-controlled inspection records. Some license holders reported that there had been cracks or indications of crack in re-circulation piping and core shrouds.

NISA confirmed that there were no falsifications in self-controlled inspection records and that they evaluated that the cracks pose no immediate risk to plant safety. NISA judged that the license holders' evaluation on cracks was appropriate. NISA also requested these license holders to implement similar measures implemented by TEPCO such as reconstruction of their quality assurance system, etc. Those license holders submitted reports on their progress in reconstruction.

The NSC requested full reporting from NISA immediately after revelation of the above-mentioned falsification case. In October 2002, the NSC published basic policies and action plans called “The response to the falsifications in self-controlled inspection records of NPPs“ in order to prevent recurrence.

Also, in October 2002, recognizing urgent needs to restore general public’s confidence in nuclear safety, the NSC made a recommendation called “Recommendation on Restoration of Confidence in Nuclear Safety” to the Minister of METI through the Prime Minister. This recommendation, which was based on the provision of Article 24 of the Law for Establishment of Atomic Energy Commission and Nuclear Safety Commission, was for first time since the establishment of the NSC in 1978. The recommendation was reflected to the renovated nuclear safety regulations that were implemented after the above falsifications issue in self-controlled inspection records.

The NSC concluded according to their independent investigation and analysis that the results of the safety evaluation on cracks of re-circulation pipings and core shrouds, conducted by NISA, were adequate.

(3) Falsifications in Reactor Containment Leakage Rate Test and the Administrative Measure Taken

Apart from the case mentioned above, it was revealed in October 2002 that, at the periodic inspections in 1991 and 1992 of the Unit 1 of the Fukushima Daiichi Nuclear Power Station attended by inspectors of regulatory body, the results of reactor containment leak rate tests were falsified by Tokyo Electric Power Co. Inc., in order to show intentionally low leak rate. In that month, NISA considered that this falsification violated the law and NISA took an administrative measure of one year suspension of operation of the said unit. NISA requested to conduct inspections of leak rate test of all reactor containments of TEPCO that resulted in shutdown of all 17 units of TEPCO in April 2003.

The NSC monitored independently NISA’s inspection of the reactor containment leak rate test at the Unit 1 of the Fukushima Daiichi Nuclear Power Station and concluded the leakage rate was within the limit.

(4) Explanation to the Public and Restart of Power Plants

NISA held dozens of explanatory meetings for local governments and the public on the safety assessment of nuclear power stations of TEPCO and on re-construction of regulatory system. The reactors have been restarted one by one after completing pre-start safety checks and after restoring local communities’ confidence in the safety of the nuclear power stations.

The NSC also confirmed the report which showed that the reactor containment leakage rate tests had been properly conducted.

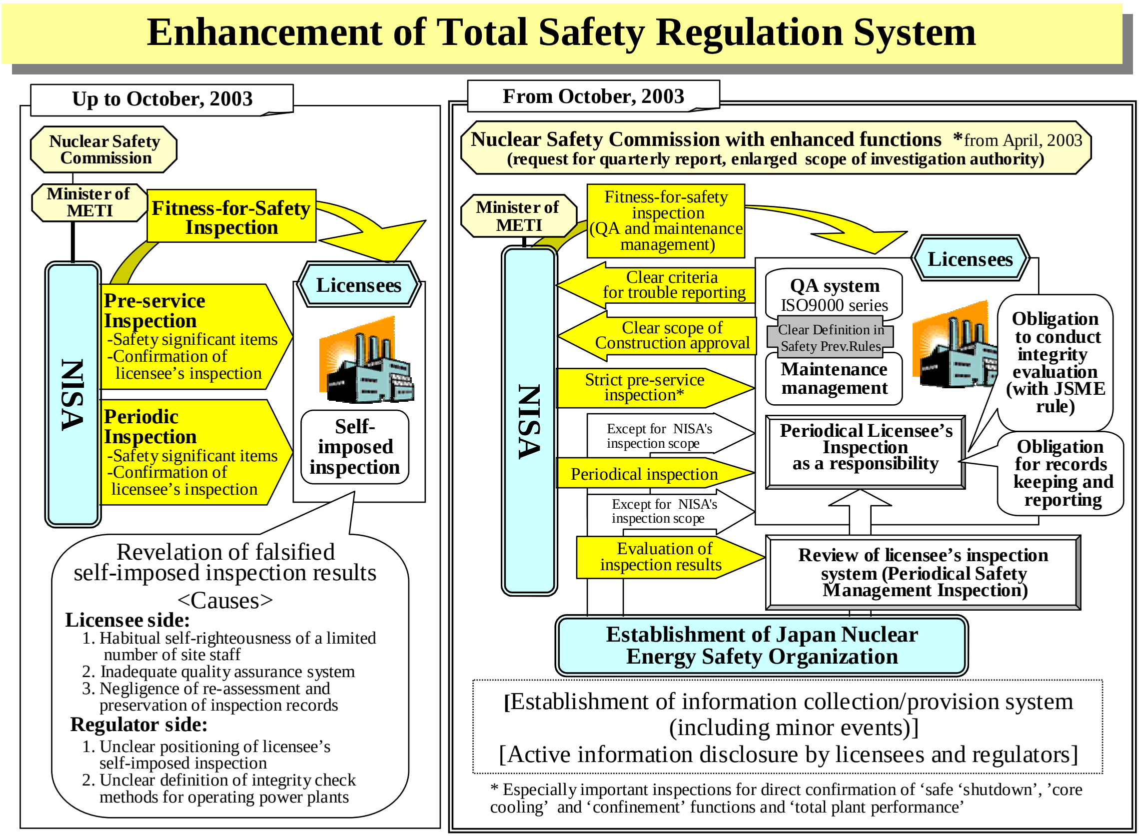
(5) Background of the TEPCO falsification issue

The TEPCO falsification issue has significantly eroded public confidence in nuclear safety. NISA analyzed factors that led to these falsification issues as follows.

In this problem there were three kinds of factors; factors on the license holders’ side, on the regulatory side and common to the both sides. Some of the problems on the license holders’ side were an accustomed and complacent decision making process by limited persons, ineffective audit by top management and divisions other than nuclear power division, and the lack of understanding on the importance of quality assurance system to ensure nuclear safety. Some of the problems on the regulatory side were ambiguity of regulatory procedure on self-controlled inspection by license holders, lack of formulated acceptance criteria of cracks, and insufficient penalty for organizational illegal acts. One of the problems common to both sides was a lack of recognition of importance to the accountability for safety itself as well as the process to achieve safety.

5. Renovation of the Regulatory System of Nuclear Safety

NISA had promoted the study on the future approach for the effective and efficient safety regulatory system, including and not limited to inspection system, license holders' activities for safety operation, quality assurance. Expedited by the revelation of the falsification problem of Tokyo Electric Power Co., NISA renovated his safety regulation, as described below, in order to prevent recurrence of falsifications and to maintain internationally acceptable safety regulation.



(1) Renovation of Quality Assurance System and Maintenance Management System

As the license holders' quality assurance system was found to be inadequate, the Reactor Regulation Law was amended to stipulate that quality assurance should be established and should be included in the Operational Safety Program, and that the compliance with the Program should be confirmed at the Nuclear Safety Inspection.

The Reactor Regulation Law stipulates the following requirements on quality assurance:

1) Establish a quality assurance program, implement quality assurance in accordance with the program, and continually improve the program,
2) Define in the quality assurance program, an organization of quality assurance and a PDCA (Plan-Do-Check-Action) cycle of each item of the activities on safe operation,
3) Clarify responsibilities and authorities within the organization, and top management shall be involved in quality assurance activities, and
4) Clarify relations between each item of the activities on safe operation and the process of JIS-Q9000 (2000).

The Reactor Regulation Law stipulates that maintenance management should be established and should be included in the Operational Safety Program and that the compliance with the Program should be confirmed at the Nuclear Safety Inspection.

The Reactor Regulation Law stipulates following requirements on maintenance management:

1) Establish maintenance management policies and targets,
2) Develop an implementation program and implement maintenance management in accordance with the program,
3) Define, in the implementation program, frequency, time, methods to confirm and to evaluate the results, the corrective measures, if any, and matters concerning records, and
4) Periodically review and revise policies, targets and the implementation program of maintenance management.

NISA has confirmed that the “Rules of Quality Assurance for Safety of Nuclear Power Plants (JEAC 4111-2003)” and the “Rules of Maintenance Management of Nuclear Power Plants (JEAC 4209-2003)”, developed by Japan Electric Association, meet the quality assurance requirements and the maintenance management requirements defined in the Reactor Regulation Law, respectively.

(2) Introduction of the Licensee’s Periodic Inspection

Before the amendment of the Electricity Utilities Industry Law, the regulatory body requested inspection only for the equipment especially important to safety, leaving the other equipment to self-controlled inspection by the license holders.

The amended Electricity Utilities Industry Law stipulates that a license holder shall perform the Licensee’s Periodic Inspection, which replaces the former self-controlled inspection, to the equipment designated by technical standards, at the intervals not exceeding 13 months, shall confirm the inspection results to comply with the technical standards, and shall record the results.

(3) Introduction of the Fitness-for-Service Assessment

Non-destructive examination on cracks by ultrasonic test is made mandatory, and is included in the Licensee’s Periodic Inspection. The Fitness-for-Service Assessment requires an estimation of growth of crack, if found, and structural integrity assessment of the component. The Technical Standards specifies the basic requirements for the Fitness-for-Service Assessment, leaving details of assessment methods and criteria to Rules of Fitness-for-Service for Nuclear Power Plants (2000 and 2002 editions) developed by a corporate judicial person, the Japan Society of Mechanical Engineers.

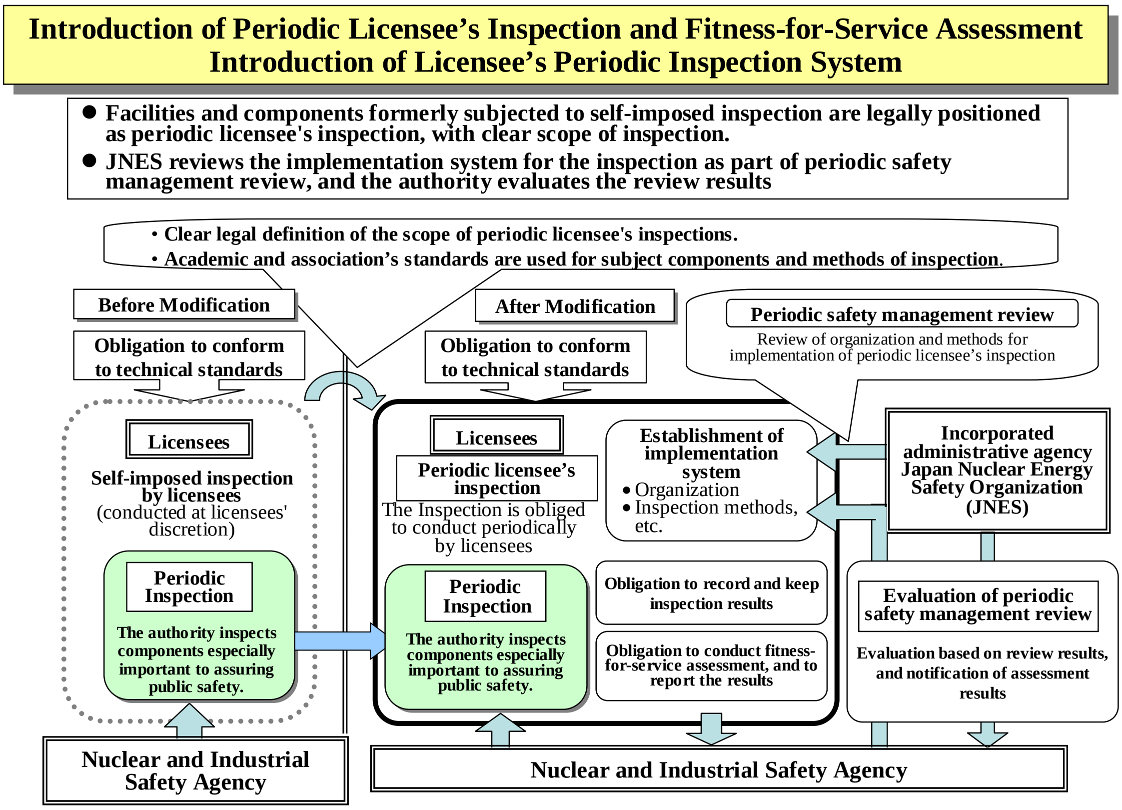
It is also stipulated that the results of the Fitness-for-Service Assessment should be recorded and kept by license holders and that license holders report the results to the regulatory body.

(4) Introduction of the Periodic Safety Management Review

The license holders shall undergo the Periodic Safety Management Review by JNES, either on documents review or on-site review, that includes review on organization for implementing the Licensee’s Periodic Inspection, method of inspection, schedule control, management of contractors, if any, management of inspection records, and education and training on inspection.

To conduct an at-site review more effectively and efficiently, items to be reviewed are randomly chosen without prior notice to the license holder.

JNES reports the review results to NISA. NISA evaluates the review results and informs the evaluation results to the license holder. The numbers of inspection items for the next Licensee’s Periodic Inspection is decided depending on the performance of previous review results.



(5) Clarification of Reporting Criteria for Accidents and Failures

Reporting criteria of accidents and failures are clarified by the amending the Reactor Regulation Law. The reporting criteria for minor events, which had been reported only according to an administrative notification, are now included in the law.

(6) Establishment of a System to Collect and Disseminate Information Including Minor Events

For thorough transparency, appropriate information disclosure of accidents and failures including minor events is very important. For the purpose, it is important to share information of minor trouble and usual operational events among license holders, manufacturers, universities, institutes and regulatory body and to analyze the information for the improvement of safety management activities and safety regulations.

License holders established a public information library "NUCIA" (http://www.nucia.jp) on internet to disseminate collected information on nuclear power station including information of accidents and failures.

(7) Clarification of the Periodic Safety Review (PSR)

Provisions on the PSR, which had been conducted every 10 years, are clarified by the amendment of the Reactor Regulation Law. The Periodic Safety Review is integrated into the Operational Safety Program, and the inspectors of NISA confirm that the PSR is conducted on compliance with the Operational Safety Program. Items of the PSR are as follows:

Items	Before amendment	After amendment
1) Comprehensive evaluation of operational experience	Self-controlled review	Item in the Operational Safety Program
2) Reflection of the latest technical knowledge	Self-controlled review	Item in the Operational Program
3) Probabilistic safety assessment	Self-controlled review	Self-controlled review

The implementation of probabilistic safety assessment (PSA) is asked by NISA, although it remains to be self-controlled review by license holder.

(8) Clarification of the Aging Management Review

License holders shall take following measures for aging management of a plant from the period not later than thirty years after the commissioning. Measures for aging management are integrated into the Operational Safety Program. Measures for aging management include: a) to perform technical review on aging for the safety related structures, systems and components to evaluate the effectiveness of the current maintenance activities on those structures, systems and components to prevent loss of safety functions; b) to establish a Ten-Year Maintenance Program based on above-mentioned technical review on aging; and c) to re-evaluate technical review on aging and the Ten-Year Maintenance Program at least once in ten years.

(9) Improvement of the Regulatory System on Nuclear Safety

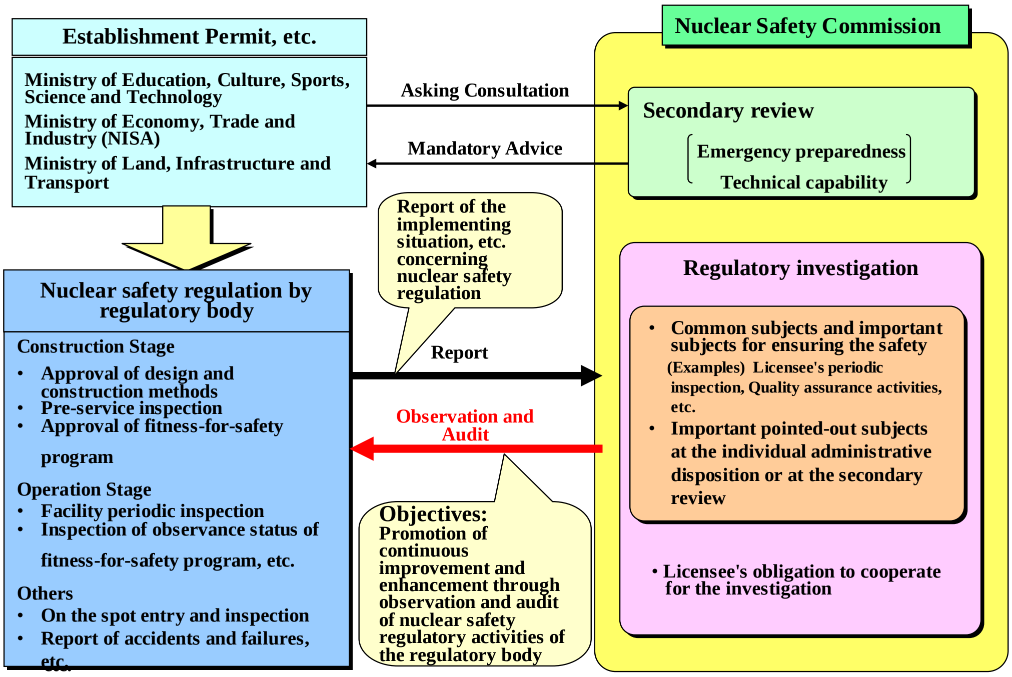
In order to strengthen the supervision and audit functional competence of the NSC, which is independent organization from the regulatory bodies, such as NISA, MEXT, and the MLIT, regulatory bodies shall submit quarterly reports to the NSC on their regulatory activities after issuing establishment license, that are various regulatory activities in construction and operational stages.

The NSC may collect information on regulatory activities from the licence holder and contractor in order to conduct its audit function.

For these improvements, number of staffs was increased in the NSC.

Concerning the renovation of nuclear safety regulation, the NSC advised NISA on Quality Assurance System and Licensee’s Periodic Inspection System with regards to its basic requirements and items to be considered during the system operation.

Observation, Audit, Inspection, etc. of the Safety Regulatory Administration by Nuclear Safety Commission



(10) Establishment of Japan Nuclear Energy Safety Organization

A law for establishing an incorporated administrative agency “Japan Nuclear Energy Safety Organization (JNES)” was enacted in the extraordinary diet session of the autumn of 2002. JNES was inaugurated integrating of a part of former Nuclear Power Engineering Corporation, and former Japan Power Engineering and Inspection Corporation. JNES was established in order to enhance regulatory safety inspection together with NISA.

JNES with about 420 personnel, together with NISA with 300 personnel including 100 site resident inspectors, and five commissioners of the NSC and its secretariat with 100 personnel constitutes the regulatory system on nuclear safety, and it is making efforts ceaselessly to improve the competency of staffs.

(11) Development of Experts Engaged in the Nuclear Safety

NISA prepares training programs for personnel engaged in regulatory activities on nuclear safety. NISA provides, depending on type of jobs and experiences of personnel, a fundamental course and an advanced course for specialized knowledge and skills and highly specialized course for latest technology and expertise. With particular emphasis on quality management of nuclear facilities, “job training program on quality assurance for nuclear facilities” started in the FY 2002.

(12) Enhancement of Public Relations Activities

NISA recognizes it is an important task to play a role of the “representative of the public” in nuclear safety administration, to ensure safety of the public and to give reassurance on nuclear safety to the public, especially to the local residents in the vicinity of nuclear facilities. For this purpose, NISA considers it is necessary to actively disclose information, intensify public dialogue, and to enhance understanding of the public and the local residents.

For example, NISA held a number of dialogue meetings with local residents on the TEPCO falsification issue, collected their opinions, answered to their questions and explained measures to prevent recurrence, in order to restore their confidence.

In April 2004, taking new budgetary steps to enhance the public relations activities further, NISA established the Nuclear Safety Public Relations and Training Division as a responsible division, and decided to station the Regional Public Relations Officers at major sites.

(13) Intensified Penalties to Prevent Recurrence

In order to deter organizational illegal acts, penalties were intensified so that a corporate penalty becomes as heavy as 100 times that of personnel and imprisonment against serious violation such as noncompliance with orders to conform to technical standards, evasion of the regulatory inspection, or noncompliance with orders for license holders to submit reports including reports of contractors for maintenance.

(14) Improvement of Implementation of Allegation System

NISA established “the Committee on Investigation of Alleged Case”, and improved procedures of investigation, so that alleger’s interest should be strictly protected and so that investigation of the alleged case should be conducted and disclosed in due process. The NSC was also designated as the responsible organization to receive and to investigate allegation, based on the Reactor Regulation Law.

A. General Provisions

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.

There are a total of 55 nuclear installations in Japan in the scope of the Convention as of the end of August 2004, including 52 reactors in operation, two in the commissioning stage that attained criticality, and one that terminated operation in March 2003 and is in preparation for decommissioning.

After the previous report, the Unit 5 of the Hamaoka Nuclear Power Station, Chubu Electric Power Co., Inc. attained criticality and enters the scope of the Convention. Tokai Power Station of the Japan Atomic Power Co., which was in preparation of decommissioning, entered decommissioning stage and became out of the scope of the Convention.

Since the descriptions of how the safety of existing nuclear installations has been ensured are given in the reports for other articles, the repetition is avoided. Instead, major events after the previous report for existing nuclear installations are described here according to the types of installations, which are BWR, PWR and power reactors in research and development stage.

6.1 Existing Nuclear Installations in the Scope of this Convention

There are a total of 55 nuclear installations in Japan in the scope of the Convention at the end of *August 2004*. The breakdown is shown in the followings:

Breakdown of Nuclear Installations in the scope of the Convention

Type		Status	Number of Units	Remarks
Commercial power reactor	Boiling water reactor (BWR)	in operation	*29*	
		under construction*	1	*Unit 5 of the Hamaoka Nuclear Power Station,*
	Pressurized water reactor (PWR)	in operation	23	
Power reactor in research and development stage		under construction*	1	Monju
		in preparation for decommissioning	*1*	*Fugen*

* Unit under construction that attained criticality

The existing nuclear installations are listed in Annex 1, and their locations are shown in Fig. 6-1.

6.2 Major Events in the Existing Nuclear Installations after the Previous Report

Major events in the existing nuclear installations after the previous report are shown in the followings:

(1) BWR Plants

1) Falsification of Self-Controlled Inspection Records by Tokyo Electric Power Co., Inc.

In August 2002, it was revealed that Tokyo Electric Power Co., Inc. had covered up the record for the existence of cracks on core shrouds of reactors and falsified the self-controlled inspection records. For the fact finding, NISA conducted On-the-Spot Inspection of all the nuclear power stations and the head office of Tokyo Electric Power Co., Inc. After the investigation, NISA announced that the fact of falsification was identified, and that although cracks or indications of crack, were found on the re-circulation system piping and shrouds, they did not pose any immediate risk to the reactor safety. A letter of severe warning was issued to Tokyo Electric Power Co., Inc. NISA conducted special Nuclear Safety Inspection and strict Periodic Inspection on those nuclear installations.

2) Instruction to Other 15 Licence holders to Make Comprehensive Checking

NISA also instructed other 15 licence holders, including PWR and fuel cycle facility licence holders, to make comprehensive checking on their plants to confirm whether there had been no falsification in the self-controlled inspection records. Some licence holders reported that cracks were found on shroud of their plants, and that they evaluated that the cracks pose no immediate risk to plant safety. NISA confirmed that there had been no falsification on the self-controlled inspection records, and that the licence holders' evaluation on cracks was appropriate.

3) Falsification on Inspection of Reactor Containment Leak Rate and the Administrative Measure Taken

It was revealed in October 2002 that, during the Periodic Inspections of the Unit 1 of the Fukushima Daiichi Nuclear Power Station in 1991 and 1992 attended by inspectors of regulatory body, the reactor containment leak rate tests were falsified by Tokyo Electric Power Co. Inc., to show intentionally low leak rate. In that month, NISA considered this falsification violated the law and took an administrative measure of one year suspension of operation of the Unit1, and conducted inspections of leak rate of all reactor containments of the company.

4) Prevention of Hydrogen Accumulation in Piping

On November 7, 2001, a part of residual heat removal system piping of the Unit 1 (BWR) of the Hamaoka Nuclear Power Station, Chubu Electric Power Co., Inc., ruptured by rapid combustion of the non-condensable gas (i.e., hydrogen) accumulated in the piping.

NISA instructed BWR licence holders to alter steam condensation system piping of the residual heat removal system by removing a part of piping or installing a shutoff valve in it to prevent accumulation of hydrogen, and to alter, for example, the inclination of other piping systems where hydrogen may accumulate.

(2) PWR Plants

1) Enhancement of Periodic Inspection Relating to Prevention of Recurrence of Primary Coolant Leak

It was reported in our previous report that NISA instructed licence holders to intensify Periodic Inspection to prevent recurrence of the primary coolant leak from the regenerative heat exchanger connecting piping which occurred at the Unit 2 (PWR) of the Tsuruga Power Station, the Japan Atomic Power Co. Since then, licence holders have added ultrasonic inspection, etc. to the inspection items for class 3 piping (located inside at the reactor containment). Furthermore, considering damage on the regenerative heat exchanger shell-side exit piping of the Unit 2 of the Tomari Power Station, Hokkaido Electric Power Co., Inc., NISA instructed licence holders, in December 2003, to expand their inspection scope over the systems and equipment belonging Class 1 and 2 defined by the Regulatory Guide for Reviewing Classification of Importance of Safety Functions for Light Water Nuclear Power Reactor. Licence holders are conducting the inspection in the Licensee's Periodic Inspection.

2) Improvement of Quality Assurance Activities for Inspection of Imported Fuels

It was reported in our previous report that the regulatory measures were taken against the falsification of inspection data of mixed oxide fuels (hereinafter called "MOX fuels") for the Unit 3 of the Takahama Power Station, the Kansai Electric Power Co., Inc. In October 2003, the Reactor Regulation Law was revised so that the licence holders' quality assurance activities were included in the scope of regulatory inspection. On the basis of new legislation, the Kansai Electric Power Co., Inc. reported to NISA of the improvement in the quality assurance program for procurement of MOX fuels from overseas. NISA confirmed that the program was appropriate, and reported it to the NSC in February 2004.

3) Inspection Concerning Ni-base Alloy Portions in Primary Coolant Boundary

In December 2003, NISA instructed licence holders to implement, bare metal inspections and ultrasonic inspections for Ni-base Alloy 600 portion in primary coolant boundary, during the nearest Licensee's Periodic Inspections, as measures against primary water stress corrosion cracking, that occurred weld joints of nozzle stubs at pressurizer bypass lines in the Unit 2 of the Tsuruga Power Station, the Japan Atomic Power Co., in September 2003, and at nozzle stubs at reactor vessel heads in the Davis-Besse Nuclear Power Station in March 2002. Moreover, NISA requested licence holders to provide inspection programs including volumetric examinations of nozzle stubs at reactor vessel heads and bottoms.

4) Secondary Pipe Rupture Accident at Unit 3, Mihama Power Station

On August 9, 2004 at the Mihama Power Station Unit 3 (PWR, 826MWe) of the Kansai Electric Power Co., Inc.(KEPCO), the main condensate water pipe ruptured and high temperature secondary water blew out into the turbine building when the reactor was in full power operation. In the turbine building, there were many workers preparing for the Periodic Inspection which was to commence on August 14. Workers who were close to the break were seriously exposed to the flashed water that killed four and injured seven by scald.

NISA immediately took its action as establishing the Accident Investigation Committee aiming at identifying the cause and preventing recurrence of the accident. The NSC also established a review subcommittee aiming at reflecting lessons learned from the accident to the future nuclear safety policy.

The location the rupture took place was in the just downstream of the flow measurement orifice.

According to KEPCO, they had their own guideline that obliges itself to conduct residual life evaluation and the planning of the inspection to the portions where the thinning is expected. KEPCO also reported that the inspection was not implemented to the portion since the beginning of its operation. The ruptured portion was planned to be inspected in the Periodic Inspection starting from August 14, 2004.

Since this event was considered to be generic not only to PWRs but to BWRs and thermal power plants, on August 11,2004, NISA issued instructions to operators of all nuclear power plants and thermal power plants with more than 1,000kW outputs;

- *to check whether obliged inspections were implemented to all the pipes in question, and*
- *to take adequate corrective actions if such un-inspected portions are identified.*

(Note)
The descriptions above are based on the information obtained as of August 13, 2004.

(3) Power Reactors in Research and Development Stage

The Kanazawa Branch of the Nagoya High Court delivered a judgment, on January 27, 2003, and nullified the license for the breeder reactor "Monju" on an administrative litigation lawsuit. The government lost the lawsuit, and appealed to the Supreme Court on January 31.

METI, considering the opinion of the NSC, approved in January 2004, the change of design and construction method in accordance with the Reactor Regulation Law and the change of construction plan in accordance with the Electricity Utilities Industry Law.

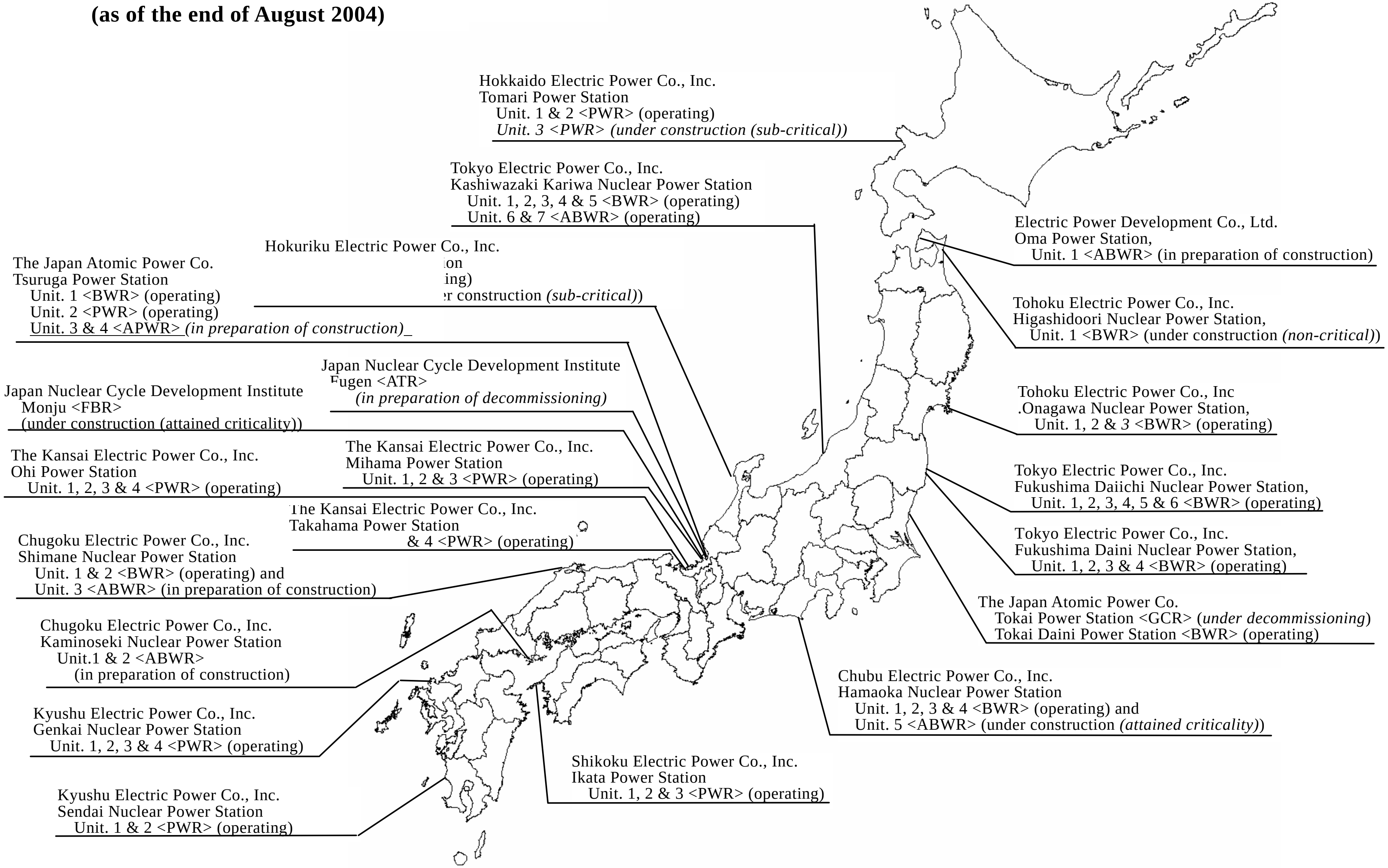
6.3 Evaluation and Verification of Safety, and Position as to Continued Operation

NISA had implemented the necessary safety assessment and verification for existing nuclear installations at planning, licensing, construction and operation stages. They are explained in the reports concerning Article 7 to Article 19.

Through those assessments and verification, principles of this convention have been applied to ensure the safety of existing nuclear installations for every stage from licensing to operation.

As shown in 6.2, the measures to ensure the safety has been appropriately applied to these events occurred during the period after the previous reporting. On the basis of the results of this report, The Japanese government concluded that continued operation of the nuclear installations in Japan is appropriate. The plants that are in construction stage and attained criticality are expected to be approved for commercial operation after pre-service inspection.

Fig. 6-1 Location of Nuclear Installations
(as of the end of August 2004)



B. Legislation and Regulation

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 licence;**
- **(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 licences, including suspension, modification or revocation.**

The Atomic Energy Basic Law has been established as the basic law governing the utilization of nuclear energy, and the Law on the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors (Reactor Regulation Law) and the Electricity Utilities Industry Law have been established as the laws to govern the safety of nuclear installations.

After the previous report, the Reactor Regulation Law has been revised to accommodate new regulatory framework, such as adoption of performance-oriented technical standards into regulatory system, clarification of reporting criteria for accidents/failures and clarification of modification or repair work that necessitate application of the construction permit, establishment of Licensee's Periodic Inspection and Periodic Safety Management Review System, provision of regulatory inspection etc. by JNES, and provision of the Periodic Assessment of Nuclear Facilities including Periodic Safety Review and Aging Management Program. The Allegation System was revised so that an alleger can allege violation of safety regulation to the NSC as well as to the regulatory body. Also, penalties to license holders have been intensified.

7.1 Basic Legislation Governing the Utilization of Nuclear Energy

Japan has enacted the Atomic Energy Basic Law as its basic law on the utilization of nuclear energy. The objectives of the Atomic Energy Basic Law are quoted as "to secure future energy resources, achieve progress in science and technology, and promote industry, by encouraging research, development, and the utilization of nuclear energy, and thereby contribute to improvement of the welfare of human society and the national 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 achieve these objectives and the basic policy, the law provides for the establishment of a set of laws to govern following areas:

- Establishment of the Atomic Energy Commission and the Nuclear Safety Commission, and their duties, organization, administration, and authorities.
- Regulations governing nuclear fuel materials.
- Regulations for the construction, etc. of nuclear reactors.
- Prevention of radiation hazards.

The law also provides that those who will utilize nuclear energy shall manage their facilities under the supervision of the regulatory body in accordance with these laws.

7.2 Legislations and Regulations Governing the Safety of Nuclear Installations

The major laws related to the safety regulation of nuclear installations have been established as shown in the following (1) through (5). The matters on the organization for the safety regulation of nuclear installations are provided in the Law for Establishment of the Atomic Energy Commission and the Nuclear Safety Commission, the Law for Establishment of the Ministry of Economy, Trade and Industry, etc.

The NSC reviews the quality of nuclear safety administration by observing and auditing not only regulatory activities but also regulatory system of NISA pursuant to Article 25 of Law for Establishment of the Atomic Energy Commission and the Nuclear Safety Commission.

The major laws governing safety regulation of nuclear installations are shown in Figure 7-1.

(1) The Reactor Regulation Law and the Electricity Utilities Industry Law

The Reactor Regulation Law and the Electricity Utilities Industry Law are applied to the safety regulations of commercial power reactors.

1) The Reactor Regulation Law

The Reactor Regulation Law, in order "to ensure that the utilization of nuclear source material, nuclear fuel material, and reactors are limited to peaceful purposes, and carried out in a planned manner, and to ensure safety of the public by preventing the hazards due to these utilization and providing physical protection of nuclear fuel material, in accordance with the spirit of the Atomic Energy Basic Law", provides for:

- Refining of nuclear source material and nuclear fuel material
- Fabrication and enrichment of nuclear fuel
- Establishment and operation etc. of reactors.
- Storage or reprocessing of spent nuclear fuel
- Management and disposal of radioactive wastes
- Use of nuclear source material and nuclear fuel material
- Use of internationally regulated substances, etc.

And the following are established for reactor facilities.

- Regulations for the basic design and policy nuclear facility for construction application
- *Regulations for the detailed design and construction for construction permit*
- Inspections at the time of facility construction including approval of welding method, welding inspection, pre-service inspection
- *Regulations for safe maintenance and operation (approval of Operational Safety Program, and Nuclear Safety Inspection)*
- Periodic Inspections of facility during operation
- Measures for securing safety and physical protection
- Regulations on facility transfer, and succession or merger of license holder
- Dismantling of facility.

The allegation system, established by the Reactor Regulation Law, was revised so that personnel can allege violation of safety regulation to the NSC as well as to NISA, without unfavorable treatment. The rule under the law provides that the personal data of alleger be protected. The rule also provides for adequate procedures for investigation and disclosure of alleged case.

The Minister of METI is required to report quarterly the status of regulatory activity to the NSC. When the NSC independently reviews the regulatory activities based on the quarterly report, the license holder and the contractor who engaged in the maintenance of nuclear installation, are required to cooperate with the NSC.

2) Electricity Utilities Industry Law

The Electricity Utilities Industry Law is established to protect the interests of users of electricity and to promote sound development of electric utilities industry by appropriate and reasonable administration of electric utilities industry, and to ensure the safety of public and to prevent pollution by regulating construction, maintenance and operation of power generating equipments (herein after referred to as “electric structures”), and it provides followings for the purpose:

- Electric utilities operation
- Electric structures
- Use of land etc.
- Registered safety management review agency, designated test agency, and registered survey agency

The provisions on Construction Plan, Welding Safety Management Review, Fuel Assembly Inspection, Pre-Service Inspection, Periodic Inspection, and *Periodic Safety Management Review* of the Electric Utilities Industry Law are applied to commercial power reactors, and the corresponding provisions of the Reactor Regulation Law are exempted from application.

Some of the technical standards under the Electricity Industry Law, which has been applied to detailed design, are specification code. In order to facilitate quick response to technological innovation and coordination with international standards and to encourage license holders' activities to promote safety, NISA is replacing specification code with performance code which are supplemented by academic society and association standards established through due and transparent process.

In the process of establishing performance code, harmonization of domestic standards with international standards are promoted. Namely, the confirmation of harmonization with IAEA nuclear safety standard NS-R-1is incorporated in the review process.

I*n addition to technical standards mentioned above, license holders adopt other academic society and association standards. The system of the technical standards based on the Electricity Utilities Industry Law is shown in Figure 7-2 and other related standards are shown in Table 7-2.*

The Minister of METI is required to report quarterly the status of regulatory activity to the NSC.

When the NSC independently reviews the regulatory activities based on the quarterly report of NISA, the license holder and the contractor who engaged in the maintenance of nuclear installation are required to cooperate with the NSC.

(2) The Basic Law for Emergency Preparedness and the Special Law for Nuclear Emergency

The nuclear emergency had been addressed within the legal framework of the Basic Law for Emergency Preparedness. Taking account of the special characteristics of a nuclear emergency, the Special Law for Nuclear Emergency was established in December 1999. The Law stipulates special measures for nuclear emergency, including license holders' obligation for preventing nuclear emergency, the Declaration of Nuclear Emergency, and establishment of the Nuclear Emergency Headquarters, as well as activation of emergency measures in nuclear emergency. It also stipulates that a Senior Specialists for Nuclear Emergency be stationed in the vicinities of nuclear installations, who guides and advises license holders in preparing preventive measures for nuclear emergency, and conducts other activities necessary to prevent the occurrence and progression of a nuclear emergency.

The chapter of nuclear emergency in the Basic Plan for Emergency Preparedness based on the Basic Law for Emergency Preparedness, clarifies the measures to be activated at each step from the occurrence of abnormal events, progression into nuclear emergency, to the recovery from emergency.

(3) Law for Radiation Protection

The radiation protection at nuclear installations is regulated by the Reactor Regulation Law, the Electricity Utilities Industry Law and the Industrial Safety and Health Law.

The Reactor Regulation Law stipulates zone control for radiation protection, dose control of personnel engaged in radiation work, measurement and monitoring of radiation levels, etc. in order to protect personnel and the public. The Electricity Utilities Industry Law prescribes the radiation instrument devices to be installed in nuclear power stations. The Industrial Safety and Health Law define the dose limits of personnel engaged in radiation work, which are equivalent to the Reactor Regulation Law. The Law for Technical Standards of Radiation Hazards Prevention maintains consistency among technical standards for radiation hazards prevention by establishing the Radiation Review Council.

In order to prevent hazards due to the use of radioisotopes in nuclear installations the Law for Prevention of Radiation Hazards due to Radioisotopes, etc. (hereinafter, called as Radioactive Hazard Prevention Law) stipulates zone control of radiation protection, dose control of personnel engaged in radiation work and radiation measurement in controlled area etc.

The ICRP Recommendation 1990 was incorporated into relevant legislation in April 2001.

(4) The Law for Environmental Impact Assessment

The Environmental Impact Assessment Law was enacted in June 1999, replacing the departmental decision, July 1977, of the MITI. The law stipulates for the environmental impact assessment of nuclear installation other than safety assessment.

The objective of the Environmental Impact Assessment Law is for license holders to perform proper assessment of a large business plan which may pose large impact on the environment, and to prepare proper plan to preserve the environment. The law provides for a set of procedures for it. Environmental assessment on commercial power plants, including nuclear power plants, is performed in accordance with the provisions of the Environment Impact Assessment Law and the corresponding provisions of the Electricity Utilities Industry Law. Environmental impact assessment is obligatory for nuclear installation regardless of its scale.

(5) The Law on Compensation for Nuclear Damage

The Law on Compensation for Nuclear Damage establishes the basic system on compensation for nuclear damage caused by a nuclear accident.

The Law adopts the “liability without fault” principle and imposes sole liability of compensation for nuclear damage on license holders, exempting claimants from proving license holder’s fault in accordance with the general principle of the Civil Law. Also, infinite liability of compensation is imposed on the license holder. To secure the fund of and to facilitate the compensation, the license holder is required to make the Financial Arrangement for Nuclear Damage Liability. The amount of the Arrangement is sixty billion yen for a nuclear installation.

The Arrangement consists of the Nuclear Damage Liability Insurance Contract with a civil insurer and the Indemnity Agreement for Compensation with the national government. The latter supplements the former in the case of large-scale accident such as caused by earthquake or volcanic eruption. And in case the total amount arranged by the license holder is not sufficient for full compensation, the national government, on the basis of decision by the Diet, would aid to cover the license holder. In the case of enormous natural disaster or social disturbance, the national government bears the compensation, exempting license holder from liability for compensation.

7.3 Legislative and Regulatory Framework at Each Stage

The overview of the safety regulations on the basis of the Reactor Regulation Law, the Electricity Utilities Industry Law, etc. from planning stage through operation stage is shown in Figure 7-3. A summary of the safety regulations for a commercial power reactor is stated in this section.

(1) Planning Stage

When selecting a site for a nuclear installation, the electric utility, on the basis of the Environmental Impact Assessment Law and the Electricity Utilities Industry Law, performs environmental impact assessment, and submits to METI the draft Environmental Impact Statement (draft EIS) explaining current status of the environment and measures to protect it. The draft EIS is sent to the related local governments to be disclosed for public comments. The utility prepares their views addressing residents' comments. Assessments on air, water, and soil pollution due to radioactive substances are performed under the Reactor Regulation Law and exempted from application of the Environmental Impact Assessment Law. METI conducts the evaluation, soliciting experts' opinion.

METI, also, holds public hearings (primary public hearings) to obtain understanding and cooperation of local residents. The results of public hearings are taken into consideration in the safety examination.

(2) Establishment Stage

The license applicant, having completed the procedure of planning stage, submit application format for the Establishment License to NISA in accordance with the Reactor Regulation Law. Applicants attach documents to the application format including description on safety design of the nuclear installation, radiation control, and accidents and failures.

NISA conducts an examination to determine the adequacy of the site, and the basic design of structure and equipment from the points of prevention of radiological hazards, focusing on the evaluation of the safety of the reactor core and the radiation exposure due to establishment of the nuclear installation. In addition, the regulatory body confirms that the nuclear installation should be used for peaceful purpose and in line with the planned development and utilization of nuclear energy, and the applicant has sufficient technical capability to ensure safety and sufficient financial basis to execute the plan.

In this examination, the regulatory guides in Table 7-1 and other documents established by the NSC are used. In the examination, site surveys, and analysis are conducted, when necessary.

The Minister of METI consults with the AEC and the NSC on the results of its examination.

During the process of review of METI's results, the NSC holds a public hearing (secondary public hearing) focusing on safety problems characteristic to the installation, and gives its views to the Minister of METI. The Minister of METI considers these views, asks for the consent of the Minister of MEXT, and then issues the license.

(3) Construction Stage

In accordance with the Electricity Utilities Industry Law, the license holder shall submit the Construction Plan for establishment of electric structures, and obtain the approval of the Minister of METI before starting construction work. NISA examines the Construction Plan to confirm that the detailed design of electric structures is consistent with the basic design and design policies approved at the stage of establishment license, and is in conformity with the technical standards based on the Electricity Utilities Industry Law. And the license holder shall designate Chief Electrical Engineers and Chief Engineers of Boiler and Turbine and notify NISA of it.

After obtaining approval of Construction Plan, the license holder shall undergo the Pre-Service

Inspection by NISA at each process of construction and at the completion of all construction work, which confirms that construction is conducted in accordance with the construction plan and is in conformity with the technical standards. The license holder shall obtain design approval by NISA for fuel assemblies to be loaded in the reactor and undergo the Fuel Assembly Inspection conducted by NISA. The license holder shall perform Licensee's Welding Inspection for welding of pressurized parts and containment vessels *and shall undergo review by JNES on the organization conducting the inspection, the inspection method, schedule control, and other items provided by the ordinance of METI (Welding Safety Management Review).*

(4) Operation Stage

At the start of operation, the license holder shall notify NISA of the operation plan, obtain approval of the fitness-for-safety program that prescribes the procedure of operational management, limitation of operating conditions and safety education of personnel, designate the Chief Engineers of Reactors, the Chief Electrical Engineers, and the Chief Engineers of Boiler and Turbine who supervise the safety of the operation, and the Persons Responsible for Operation, and notify NISA of them. The license holder is required to notify NISA of the operation plan annually.

The 17 items prescribed in the Operational Safety Program are shown in the report of Article 19 (Table 19-1), *which includes periodic assessment, quality assurance, and maintenance management etc.*

The license holder shall control the radiation exposure of personnel engaged in radiation work so that their doses do not exceed the dose limit, and shall report the exposure dose of personnel to NISA periodically.

License holder shall discharge into the environment gaseous and liquid radioactive waste generated during operation, in compliance with the concentration values provided in the Operational Safety Program which are lower than the concentration limits stipulated in the Reactor Regulation Law. A license holder shall make effort to reduce discharge amount as small as possible so that annual public exposure in the vicinity will be kept below 50 μ Sievert in accordance with the Regulatory Guide for the Annual Dose Target for the Public in the Vicinity of Light Water Nuclear Power Reactor Facilities (hereinafter referred to, as "Dose Target Guide for Public Dose").

After starting operation, the license holder, in accordance with the Electricity Utilities Industry Law, shall perform the Licensee's Periodic Inspection to confirm that that the installations conforms with the technical standards, and shall undergo the Periodic Inspection by NISA on the major part of structures important to safety. The Periodic Inspection and the Licensee's Periodic Inspection are conducted during shutdown of operation within the interval not exceeding 13 months from the date of start of operation or the date of completion of the previous inspection. Since October 2003, JNES conducts part of the Periodic Inspection and notifies NISA of the results on the basis of the revision of the relevant laws. Also, license holder shall undergo the Periodic Safety Management Review, in which JNES reviews the license holder's organization conducting the Licensee's Periodic Inspection, inspection method, schedule control, and other items provided in the ordinance of METI, and report to NISA for the evaluation.

License holder shall undergo the Nuclear Safety Inspection by the Nuclear Safety Inspectors on the observance of the Operational Safety Program, including the organization of license holder, quality assurance, maintenance management, operation, maintenance and repair of component, surveillance, radiation control, management of radioactive wastes, discharge control of gaseous and liquid radioactive wastes, monitoring, safety education. *NISA conducts the entry inspection of nuclear facilities to confirm compliance with safety regulation, if necessary.*

If any failures occur in nuclear installation, license holders shall report failures etc. immediately to NISA in accordance with the provisions of the Reactor Regulation Law and the Electricity Utilities Industry Law, and shall report to NISA, without delay, the situation of failures and the measures taken.

In order to improve transparency of information to the public, the reporting criteria for failures etc. were more clearly defined by amending the Reactor Regulation Law, in October 2003. License holders have established the system to collect information on events, including minor events that are outside of the reporting criteria, and disclose them to the public.

Criteria for necessity of approval or notification of the Construction Plan for any modification or repair work of electric structures after startup of operation was clarified by the amendment of the Rules for the Electricity Utilities Industry Law, in October 2003. NISA established "Regulatory Guide on the Construction Plan" to identify the details of the amendment and notified license holders of it.

MITI (present METI) issued, in 1992, a departmental decision to request license holders to voluntarily perform Periodic Safety Review at a regular operating interval (approximately every ten years), including incorporation of operating experiences from commissioning to date and the latest technological knowledge, and probabilistic safety assessment. On the basis of the amendment of the Reactor Regulation Law, in October 2003, the Periodic Safety Review was incorporated into the Operational Safety Program, the observance of which the Nuclear Safety Inspector inspects at the Nuclear Safety Inspection. *The implementation of probabilistic safety assessment, however, remains to be a voluntary activity of license holder as yet.*

On the basis of the amendment of the Reactor Regulation Law, in October 2003, license holder was obliged to perform technical evaluation on ageing of nuclear installation before the continuation of operation more than thirty years and shall prepare a ten-year maintenance program based on the technical evaluation. The subsequent evaluation should follow within ten years.

7.4 The Enforcement of Applicable Regulations and the Terms of License

In accordance with the Reactor Regulation Law, the Minister of METI may revoke the Establishment License or issue a Shutdown Order of nuclear installation for up to one year, under circumstances such as operating a nuclear installation without an Establishment License, violating an order legally issued by NISA, failing to implement measures necessary for safety prescribed by NISA, or failing to obtain approval for the Fitness-for-Safety Program.

The Reactor Regulation Law also prescribes imprisonment and/or fines under circumstances such as establishing a nuclear installation without an Establishment License, violating a Shut-Down Order, or failing to take relevant emergency measures. NISA may order changes in the Fitness-for-Safety Program whenever it is deemed necessary for preventing potential radiological hazards License holders failing to abide by such orders would be punished with a fine.

In accordance with the Electricity Utilities Industry Law, if it is judged for an electric structure not to conform to the technical standards, the Minister of METI may order repair, alteration, relocation, temporary suspension of usage, or limitation of usage.

The Electricity Utilities Industry Law prescribes fines if the license holder violates a Technical Standard Conformance Order, or establishes or alters an electric structure without obtaining necessary approval for a construction plan, or uses an electric structure without undergoing or passing the Pre-Service Inspection, the Fuel Assembly Inspection, or the Welding Safety Management Review. It also prescribes to revoke the business license, if an electric utility violates the law or orders based on the law causing serious damage to the public benefits.

On the basis of the amendment of the Reactor Regulation Law, October 2003, when an employee violates a law and is punished by a fine, the legal person who legally employs him or her is also punished by a fine as heavy as 100 times of the employee's fine, to prevent organizational illegal acts.

Table 7-1 Major Safety Regulatory Guides of the NSC for Light Water Nuclear Power Reactor Facilities

Prevention of Radiological Hazards	Siting	- Regulatory Guide for Reviewing Nuclear Reactor Siting 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 for 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 Reviewing Safety Assessment of Light Water Nuclear Power 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 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 Evaluating the Annual Dose Target for the Public in the Vicinity of Light Water Nuclear Power Reactor Facilities - Guide for Radiation Monitoring of Effluent Released from Light Water Nuclear Power Reactor Facilities
Technical Competence		-Regulatory Guide for Reviewing Technical Competence of Nuclear Operator

Table7-2-1 Academic Society and Association Standards etc.

(Guidelines and Rules of the Japan Electric Association)

Number	Title
JEAC 4111-2003 (*)	*Rules of Quality Assurance for Safety of Nuclear Power Plants*
JEAC 4201-2000	Method of Surveillance Tests for Structural Material of Nuclear Reactors
JEAC 4202-2004	*Drop-Test Method for Ferritic Steel*
JEAC 4203-2004	*Primary Reactor Containment Vessel Leakage Testing*
JEAC 4205-2000	In-service Inspection of Light Water Cooled Nuclear Power Plant Components
JEAC 4206-2000	Methods of Verification Tests of the Fracture Toughness for Nuclear Power Plant Components
JEAC 4206-2003	*Methods of Verification Tests of the Fracture Toughness for Nuclear Power Plant Components (supplement)*
JEAC 4209-2003 (*)	*Rules of Maintenance Management of Nuclear Power Plants*
JEAG 4602-1992	Definitions of Nuclear Reactor Coolant Pressure Boundary and Reactor Containment Boundary
JEAC 4605-1992	Definitions of Engineered Safety Features and Related Systems of Nuclear Power Plants
JEAG 4101-2000	Guide of Quality Assurance for Nuclear Power Plants
JEAG 4102-1996	*Guide of Emergency Measures for Nuclear Power Plants*
JEAG 4204-2003	*Guide for Quality Control of Nuclear Fuel for Nuclear Power Plants*
JEAG 4207-2004 (*)	*Ultrasonic Examination for In-service Inspection of Light Water Cooled Nuclear Power Plant Components*
JEAG 4208-1996	Eddy Current Test Guide for In-service Inspections of Steam Generator Heat Transfer Tubes for Light Water Type Nuclear Power Plants
JEAG 4601-1987	Technical Guidelines for A seismic Design of Nuclear Power Plants
JEAG 4601-S-1984	*Technical Guidelines for A seismic Design of Nuclear Power Plants: Classification and Allowable Stress*
JEAG 4601-1991	Technical Guidelines for A seismic Design of Nuclear Power Plants: Supplement
JEAG 4603-1992	Guide for Design of Emergency Electric Power Supply Systems for Nuclear Power Plants
JEAG 4604-1993	Guide for Design of Plant Protection Systems for Nuclear Power Plants
JEAG 4606-2003	*Guide for Radiation Monitoring for Nuclear Power Plants*
JEAG 4607-1999	Guide for Fire Protection of Nuclear Power Plants
JEAG 4608-1998	Lightning Protection Guidelines for Nuclear Power Plants
JEAG 4609-1999	Application Criteria for Programmable Digital Computer System in Safety–Related System of Nuclear Power Plants
JEAG 4610-2003	*Personal Dose Monitoring for Nuclear Power Plants*
JEAG 4611-1991	Guide for Design of Instrumentation & Control Equipment with Safety Functions
JEAG 4612-1998	Guide for Safety Grade Classification of Electrical and Mechanical Equipment with Safety Functions
JEAG 4613-1998	Technical Guide Lines for Protection Design against Postulated Piping Failures in Nuclear Power Plants
JEAG 4614-2000	Technical Guidelines on Seismic Base Isolation System for Structural Safety and Design of Nuclear Power Plants
JEAG 4615-2003	*Guide for Design of Radiation Shielding for Nuclear Power Plants*
JEAG 4616-2003	*Technical Guide for Design of Base Structures for Dry Cask Storage Buildings*
JEAG 4801-1995	Guide for Operating Manual of Nuclear Power Plants
JEAG 4802-2002	*Guide for Education and Training for Nuclear power Plant Operator*
JEAG 4803-1999	Guide for Operational Safety Preservation of Light Water Cooled Reactors

Table7-2-2 Academic Society and Association Standards etc.

(Guidelines and Rules of the Japan Society of Mechanical Engineers)

Number	Title
JSME S NA1-2002 (*)	*Standards for Nuclear Power Generation Equipment: Maintenance Standards (revised in 2002)*
JSME S NB1-2001	*Standards for Nuclear Power Generation Equipment: Welding Standards*
JSME S NC1-2001 (*)	*Standards for Nuclear Power Generation Equipment: Design an Construction Standards*
JSME S ND1-2002	*Standards for Nuclear Power Generation Equipment: Design Standards for Prevention of Piping Break*
JSME S NE1-2003	*Standards for Nuclear Power Generation Equipment: Concrete Reactor Containment Vessel*
JSME S FA1-2001	*Standards for Spent Fuel Storage Facility: Structural Standard for Metallic Cask*
JSME S016	*Guide for Prevention o f Fluid Induced Vibration of Tube and U-Tube of Steam Generator*
JSME S017	*Evaluation Guideline on High Cycle Thermal Fatigue of Piping*

Table7-2-3 Academic Society and Association Standards etc.

(Guidelines and Rules of the Atomic Energy Society of Japan)

Number	Title
AESJ-SC-P001:2002	*Procedure of Probabilistic Safety Evaluation on Shutdown Condition of Nuclear Power Station*
AESJ-SC-P002:2003	*Evaluation Criteria of Fuel Integrity after Transient Boiling Transition for BWR*
AESJ-SC-P003:2003	*Performance Criteria of Wind Tunnel Test to obtain the effective height of Discharge Source*
AESJ-SC-F001:2000	*Periodic Inspection Criteria of Cask for Spent Fuel, MOX fuel and High Level Radioactive Waste*
AESJ-SC-F003:2002	*Measurement method of Sorption Distribution Coefficient- Basic Procedure of Batch Method for Barrier Material of Near Face Disposal*

Table7-2-4 Academic Society and Association Standards etc.

(Guidelines and Rules of the Thermal and Nuclear Power Engineering Society)

Number	Title
TNS-S3121-2003	*Qualification Standards for Industry Product on Weld of Electri Structures*

*Note: * Academic Society and Association Standards etc. that NISA has reviewed for technical adequacy in order to utilize as references of specifications.*

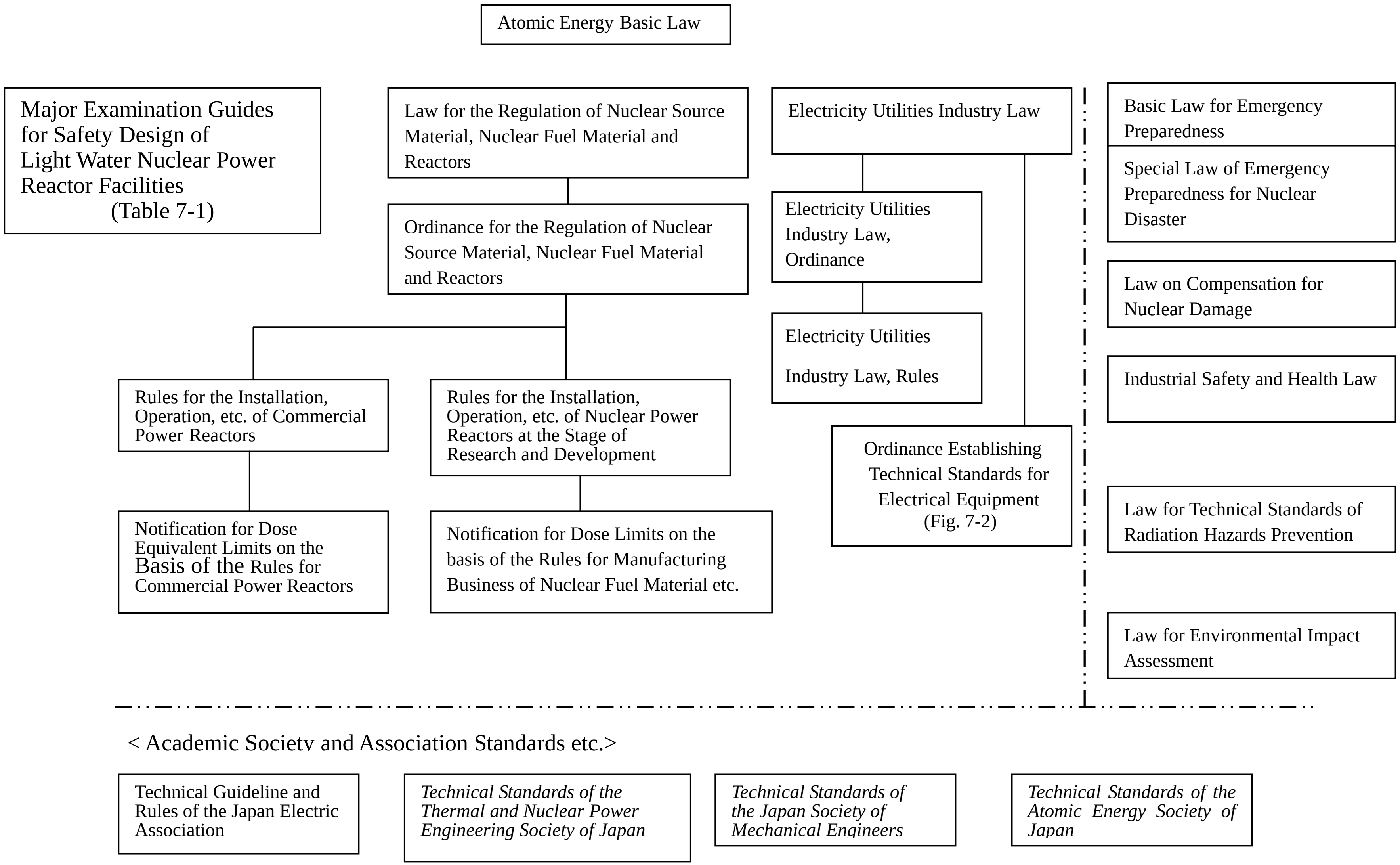


Fig. 7-1 Major Legislations Governing the Safety Regulation of Nuclear Installations

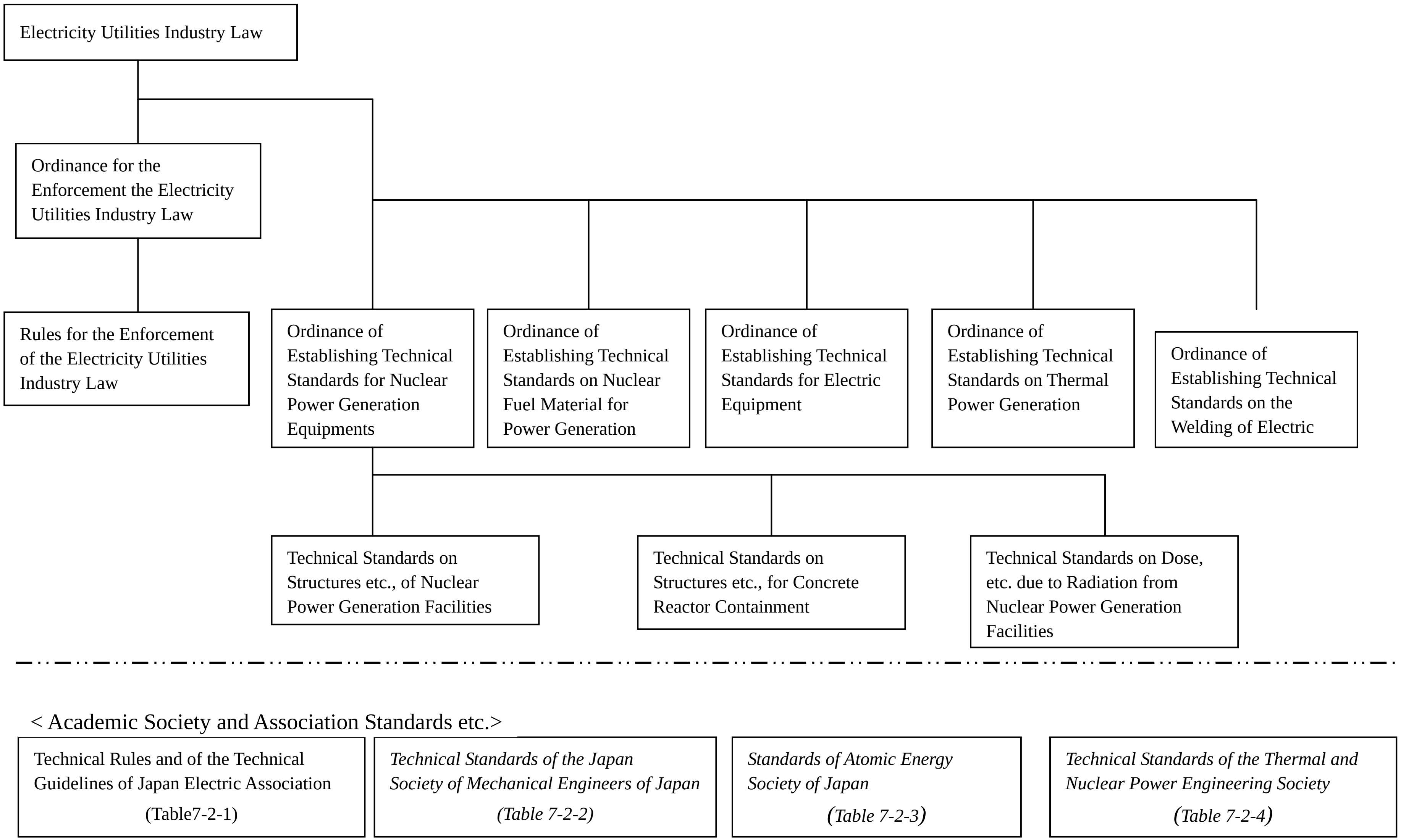


Fig. 7-2 Systems of Technical Standards

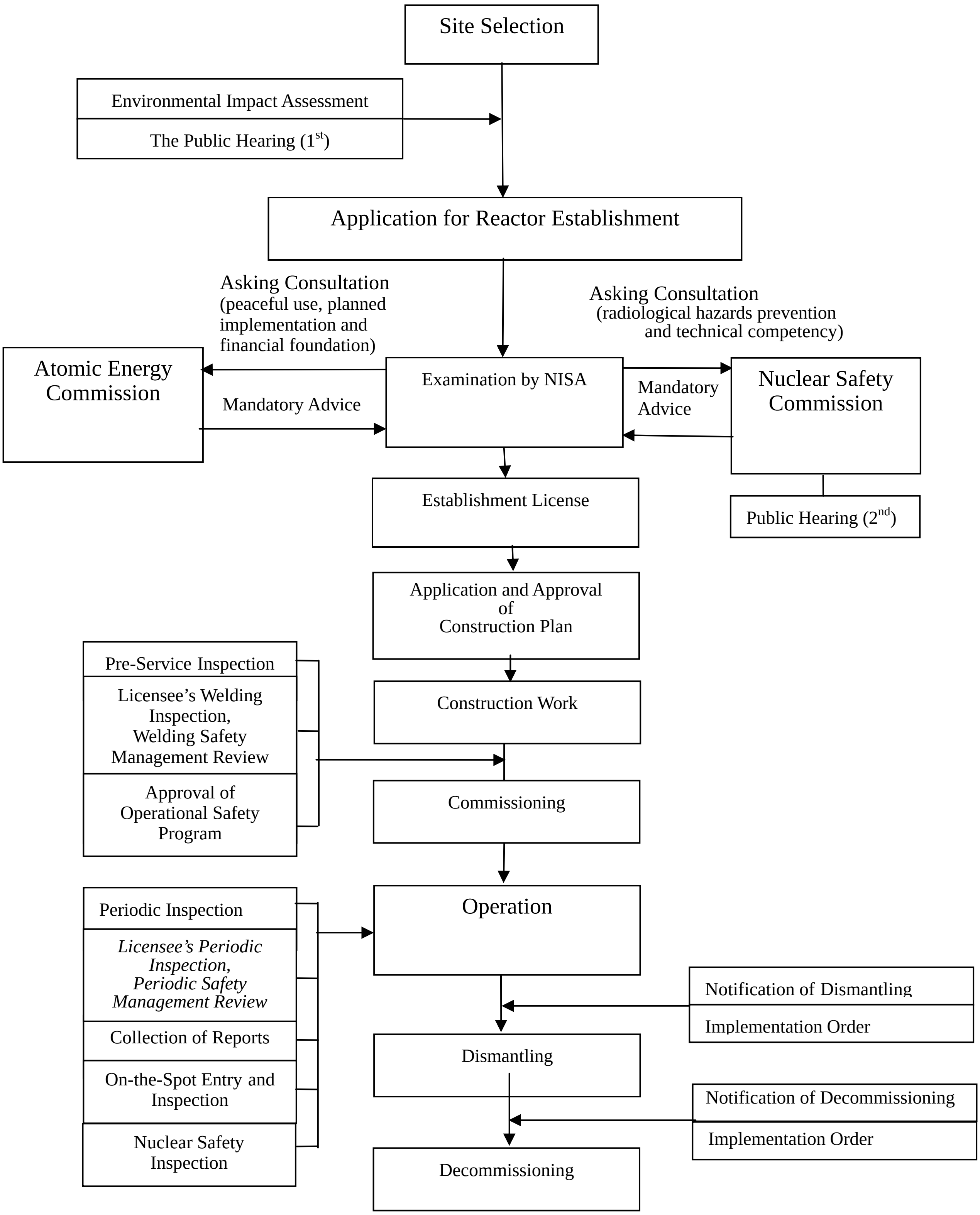


Fig. 7-3 Flow of Safety Regulations in accordance with Legislations, etc. for Nuclear Installations

Article 8 Regulatory Body

1. Each contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities.

2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.

As the regulatory body to ensure the safety of nuclear installations in Japan, Nuclear and Industrial Safety Agency (NISA) has been established as a "special organization into the METI. NISA has clear responsibilities for safety regulations pursuant to the Atomic Energy Basic Law and the Reactor Regulation Law and the functions of NISA are substantially separated, by the law, from those of other bodies or organizations concerned with the promotion or utilization of nuclear energy.

The Atomic Energy Commission (the AEC) and the Nuclear Safety Commission (the NSC) had been established. Each Commission is composed of commissioners appointed by the Prime Minister with the consent of the Diet. The AEC has duties of planning, deliberation, and making decisions concerning research and development for peaceful use of nuclear energy, and the NSC has duties of those for ensuring of nuclear safety. Both Commissions, through the Prime Minister, can recommend the heads of relevant administrative organs and can request them reports, documents, explanation, their opinions and, other necessary cooperation.

Since the second review meeting in order to implement measures for safety regulations more efficiently, the followings were newly established: the Senior Advisory Inspector System in NISA and the Incorporated Administrative Agency Japan Nuclear Energy Safety Organization (JNES) to support NISA

8.1 Mandate and Duties of Regulatory Body

The mandate of a regulatory body is to ensure safety of nuclear installations, and its duties are to enforce the legislative and regulatory framework described in the report of Article 7.

One of the important requirements for a regulatory body satisfying his responsibility is, as indicated in Article 8, Paragraph 2 of this Convention, to ensure effective separation between functions of the regulatory body and those of any other body or organization concerned with promotion or utilization of nuclear energy.

Another important function of a regulatory body is to keep communicating independently with the public of its regulatory decisions, its opinions and their basis.

On the basis of the Atomic Energy Basic Law, the regulatory body is responsible to conduct regulatory activities prescribed in the Reactor Regulation Law, the Electricity Utilities Industry Law, etc.

As for legislations and regulations etc. applied to the examination of the basic design or basic design policies of nuclear facilities and to the inspection of nuclear facilities in the construction and operational stages, the NISA and the NSC work toward improvement and enhancement of legislations and regulations based on operating experiences, trend of the latest knowledge of the technology advancement, etc., and the international consensus.

In case of a nuclear emergency, the Basic Law on Emergency Preparedness, the Special Law of Emergency Preparedness for Nuclear Disaster and other related laws are applied. Relevant administrative bodies in such a case are described in the report of article 16.

8.2 Organizations for Enforcement of Safety Regulation of Nuclear Installations

In Japan, the Minister of Economy, Trade and Industry serves as the minister in charge of safety regulation for all facilities and activities concerning utilization of nuclear energy.

Nuclear and Industrial Safety Agency (NISA) has been established in the Ministry of Economy, Trade and Industry (METI) as an independent "special organization" dedicated to the administration of safety regulations. NISA has been executing the policies independently from the Agency of Natural Resources and Energy dedicated to promote the nuclear energy.

The Incorporated Administrative Agency Japan Nuclear Energy Safety Organization (JNES) was established in October 2003.

JNES provides together with NISA infrastructure to assure safety in the use of the nuclear energy.

The NSC and the AEC had been established respectively in the Cabinet Office. The commissioners of both of these commissions are appointed by the Prime Minister with the consent of the Diet.

Each of these two commissions plans, deliberates, and decides policies concerning either the nuclear power application or ensuring the safety, from the standpoint to regulate all over the country respectively

As described in the report of Article 7, the NISA conducts a safety examination of nuclear installations, and the Minister of METI consults the NSC and the AEC on the results of the examination.

The NSC submits to the Minister of METI a specific report on the safety of the nuclear installation, after an independent examination and public hearings. The NSC establishes examination guides to be used for the examination. Fig. 8-1 presents an overview of administrative organizations that are responsible for the safety regulation of nuclear installations.

8.3 Nuclear and Industrial Safety Agency (NISA)

(1) The Role of NISA

NISA administers the safety regulations for nuclear installations. Specifically, NISA entrusted by the Minister of METI, conducts clerical works concerning the competence of the Minister of METI as follows:

- The Minister of METI, who is the competent minister stipulated in the Reactor Regulation Law, has the authority to issue a license for the establishment of a nuclear installation, after conducting examination of siting, structure, and equipment, so that radiological hazards due to the establishment of the nuclear installation are prevented. The Minister of METI has the authority to revoke the license under circumstances such as violation of the Reactor Regulation Law by the license holder.
- The Minister of METI has the authority to establish ministerial orders on the operation plans, measures on operational safety and on protection of specified nuclear fuel materials, Operational Safety Program, the Nuclear Installation Dismantling Notifications, the Chief Engineer of Reactors, emergency preparedness, etc. The Minister of METI has the authority 1) to approve Operational Safety Program, 2) to accept reports on operation plans, the Nuclear Installation Dismantling Notifications, and the appointment of Chief Engineer of Reactors, 3) to collect reports on incidents and failures from license holders, and 4) to order suspension of the operation of nuclear installations, dismissal of Chief Engineer of Reactors, measures relating to Dismantling Notifications and measures needed for emergency preparedness.
- The Minister of METI, and the Minister of MEXT, conducts examinations for Chief Engineer

of Reactors and issues the licenses. The Minister of METI has the authority also to order to return such licenses in a case of violation of the law by the Chief Engineers.

– The Minister of METI, who is the competent minister stipulated in the Electricity Utilities Industry Law, has the authority to establish ministerial ordinances relating to technical standards, Pre-Service Inspections, fuel assembly inspections, Welding Safety Management Reviews, Periodic Inspections, *and Periodic Safety Management Reviews.* The Minister of METI has the authority 1) to approve construction plans, 2) to conduct Pre-Service Inspections including confirmation of the safety performance of the power plant, Fuel Assembly Inspections, and Periodic Inspections, and 3) to issue an Order for Conformity with Technical Standards in the case of nonconformity to the technical standards. The Minister of METI has the authority also to hold examinations for Chief Electrical Engineers, to issue licenses for Chief Electrical Engineer and Chief Engineer of Boiler and Turbine, and to order the return of such licenses in case of violation of the law by the Chief Engineers.

NISA evaluates results of the Periodic Safety Management Review performed by JNES. JNES reviews the organization, inspection method, process control, and other items provided by Ministerial Order of the METI, concerning the Licensee's Periodic Inspection, and report the results to NISA.

NISA evaluates also the results of Welding Safety Management Review performed by JNES.

(2) Organization of NISA

NISA was established as a "Special Organization" in METI, *and has 11 divisions* dedicated to administration of the safety regulation of nuclear installations. Table 8-1 shows the assigned duties of the divisions.

Nuclear Safety Inspectors are assigned to the resident position at each nuclear installation. Fig.8-2 shows the locations of the Nuclear Safety Inspectors Offices.

NISA has a total of approximately 300 staff engaged in nuclear safety regulation, out of which 100 are Nuclear Safety Inspectors and the Senior Specialists for Nuclear Emergency stationed at nuclear installations.

(3) Improvement of Quality of NISA's Regulation

NISA provides a strong commitment to its mission, scientific and reasonable judgments, transparency, neutrality and fairness as the code of conduct for their activities. In this context, the Policy Planning and Coordination Division watches and assesses the performance of other NISA's divisions in discharging their duties, and take timely remedial actions after consulting with the senior managements.

NSC, independent from NISA, audits the quality of safety administration by observing and auditing NISA's activities aiming to stimulate ceaseless improvement and enhancement .

NISA makes continuous effort to maintain high quality of regulation through education and training of the personnel as stated in the report concerning Article 11, international activities and hearing to the advice from experts e.g. members of the Nuclear and Industrial Safety Subcommittee.

"The Law for Evaluation of the Policies Executed by Administrative Organizations" has been enforced since April 2002, and in accordance with this law, a framework, with which each administrative organization of the government evaluates and improves his own policies systematically, has been provided. METI has developed plans to evaluate the regulatory systems within its jurisdiction in fiscal year of 2004, and the NISA, according to these plans, evaluates the nuclear safety regulation system on the basis of the Reactor Regulation Law and the Electricity Utilities Industry Law.

(4) Further Approach to Information Disclosure

1) NISA's Activity for Communication with Public

NISA, at a web site (http://www.nisa.meti.go.jp/), has been disclosing information on incidents and accidents, radiation control, capacity factor and results of the periodic inspection of nuclear installations and activities of nuclear energy related to advisory committees, and is keeping communication with the public through questions and answers.

In order to recover the trust of the public which was lost due to the TEPCO falsification issue, NISA recognized that ensuring the transparency of the safety assurance of the nuclear plant, as well as explanation of the nuclear safety to the public and the residents in the vicinity of sites, was important.

NISA, held a numbers of explanatory meetings for the residents in the vicinity of sites to exchange opinions concerning the measures to prevent recurrence, the measures for safety assurance of the nuclear power station and the new safety regulation system enacted in October 2003. Thus, NISA has been making efforts to address the comprehensible explanation of nuclear safety, enhancement of the activities to hear from public and distribution of a periodic magazine to inform the activities of NISA, etc.

Also, the NISA opens Nuclear Energy Library in the JNES, where the public can access to license application documents of nuclear installations, reports of incidents and accidents of nuclear installations and, books and booklets on energy and nuclear power generation.

2) Public Information Law and Enhancement of NISA Public Information Organization

The Law concerning Access to Information Held by Administrative Organization enacted in April 2001, which prescribes disclosure of information on request, promotes the transparency of administration on safety regulation.

NISA developed in April 2004 a new budget to enhance activities to hear from and to speak to the public further, and has newly established the Nuclear Safety Public Relations and Training Division and assigned the Regional Public Relations Officer for Nuclear Safety.

The roles of the Nuclear Safety Public Relations and Training Division are a) to deepen communications with the public as a window to hear from and speak to public on NISA's activities, b) to conduct the activity to hear from and to speak to the public in various ways, corresponding to the various needs of the public, c) to provide the personnel of the NISA with education and training for development of risk communication skills so that the personnel may conduct activities for public hearing and public relations in a comprehensible manner, and d) to cooperate closely with Nuclear Safety Inspectors at the site area, in order to support of activities in the site area to hear from and to speak to the public, conducted by the Manager of the Nuclear Safety Inspectors Office as a leader.

The role of the Regional Public Relations Officer for Nuclear Safety is to promote communication activities with the public more actively upon request of local governments where many nuclear power facilities are located.

8.4 Organizations related to NISA

(1) Council

On the basis of the METI Establishment Law, the Advisory Committee for Natural Resources and Energy (ACNRE) was established, a subcommittee of which is the Nuclear and Industrial Safety Subcommittee (the NISS) that proposes policies on nuclear safety and safety of electric power as the terms of reference. The organization of the NISS is given in Table 8-2.

The Minister of METI appoints members of the ACNRE from persons of knowledge and experience, and these members select a chairperson of the ACNRE mutually. Subcommittees are established by the resolution of the ACNRE, and the chairperson designates members of the subcommittees including the NISS. The members of the subcommittees are assigned based on their expertise and experience from the fields of nuclear and thermal-hydraulic design, nuclear fuel design, system design, equipment design, seismic design, material strength, radiation control, meteorology, geology, soil etc.

Subjects to be discussed such as "How the safety assurance of nuclear power and operational safety of electric power system in the future should be under the changing social and economical circumstances" were submitted to the Nuclear and Industrial Safety Subcommittee. The NISS and other subcommittees have deliberated on what nuclear safety regulation system should be, and the results were reported to the NISA.

NISA solicits views of experts and members of the NISS.

(2) Incorporated Administrative Agency, Japan Nuclear Energy Safety Organization (JNES)

JNES, consisted of about 420 officers and staffs, was established in October 2003 as an organization that establishes the infrastructures in corporation with the NISA to ensure the safety in utilization of nuclear energy.

The mission of JNES is to implement their duties effectively and efficiently based on scientific judgments to contribute to the improvement of nuclear safety regulation and, to deliver and transmit actively the safety information to the public in order to gain the public confidence to the safety of nuclear energy.

JNES implements the following activities:

- *Inspection of nuclear fuel cycle facilities including nuclear power reactor facilities, and other inspections similar to those;*
- *Safety analysis and evaluation of designs of nuclear fuel cycle facilities including nuclear power reactor facilities;*
- *Activities to minimize probability of occurrence of nuclear emergencies, to prepare for a nuclear emergency, to prevent propagation of a nuclear emergency and, to recover from the nuclear emergency;*
- *Investigation, testing, research, and training concerning safety assurance for utilization of nuclear energy.; and*
- *Collection, analysis and transmission of information to assure nuclear safety.*

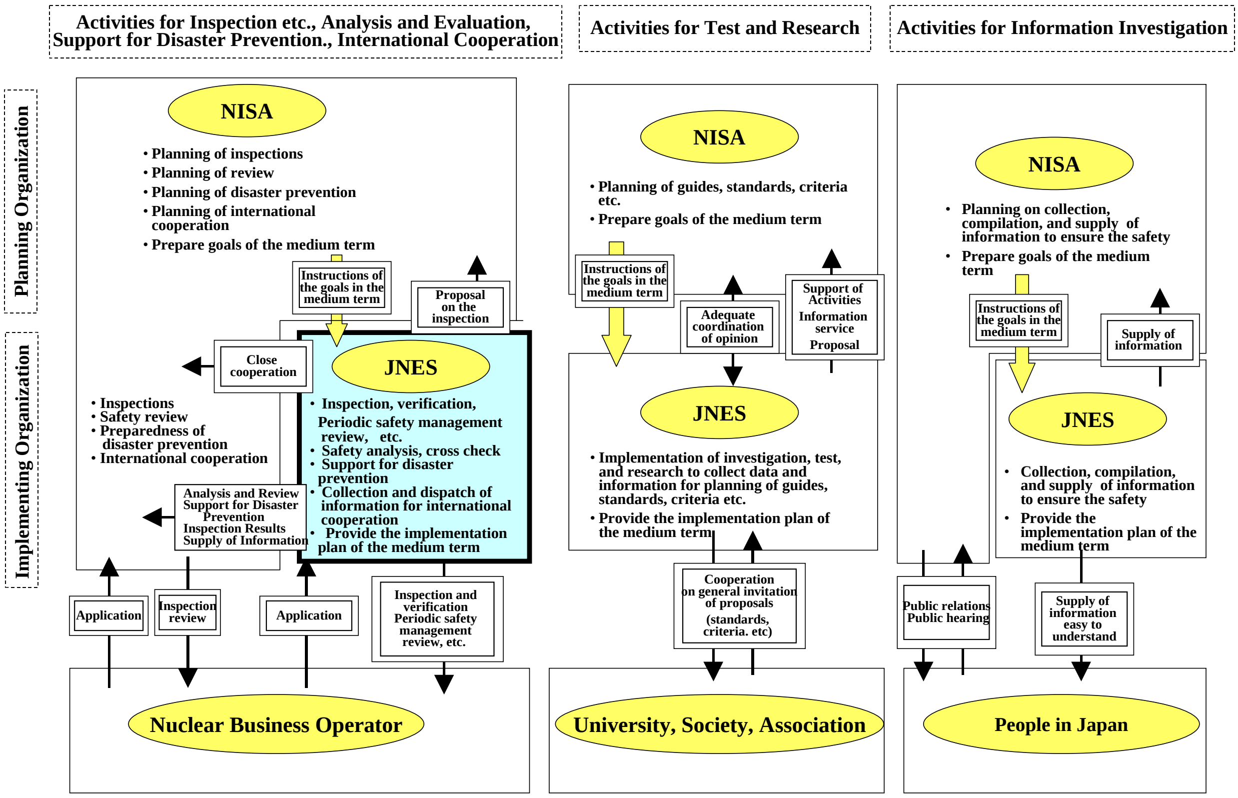
The procedure for JNES to implement activities and the relation of JNES with NISA of METI are as shown in the followings:

- *NISA develops a plan on each activity based on the regulatory needs, and defines the medium-term objective in accordance with the Law of the General Rules for Incorporated Administrative Agency, and the Minister of METI assign it to JNES.*
- *JNES prepares a scheme (medium-term scheme) to accomplish the medium-term objective, apply the scheme to the Minister of METI, and obtain the approval, then JNES prepares*

a-FY plan in accordance with the medium-term scheme, notify the plan to the said minister and implement it.

Allocation of Responsibilities Between NISA and JNES

NISA: Nuclear and Industrial Safety Agency
JNES: Japan Nuclear Energy Safety Organization



8.5 The Nuclear Safety Commission (the NSC)

The Atomic Energy Basic Law was partially revised on October 4, 1978 to establish the NSC under the Prime Minister's Office. The NSC administers the function of safety regulation, belonged to the AEC till then, in order to strengthen the system of ensuring the nuclear safety. (The NSC was transferred from the Prime Minister's Office to the Cabinet Office due to central government reform in 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 on the results of NISA's examination on a application, and supervises and audits the regulatory activities of the agency to check the appropriateness of his regulatory administration as the safety regulation in construction and operation stages after issuance of the license, as investigation activities to stimulate a ceaseless improvement and enhancement. Therefore, the framework that ensures the quality of safety administration is kept.

If the NSC deems it necessary as part of its assigned duties, the NSC may recommend and may request reports and cooperation concerning the submission of materials, statement of views, and explanation to the heads of relevant administrative organizations, by way of the Prime Minister.

Since April 2003 (partially, from October 2003), the above functions have legally been enacted. The

NSC receives from NISA the following reports on the quarterly bases after the approval of the license for establishment of nuclear installation: reports concerning conducts of the regulatory activities such as approval of construction plan, Pre-Service Inspection, Periodic Inspection, Periodic Safety Management Review, Welding Safety Management Review, approval of Operational Safety Program and Nuclear Safety Inspection, and reports concerning accidents and failures of nuclear installations. NSC has also the authority to inquire directly operators and contractors in order to supervise and to audit the safety regulation implemented by regulatory body.

In the case that there is violation of safety regulations in any of nuclear faciliies, one can directly allege the fact to the NSC, and the NSC has also the authority to investigate the allegation.

The Minister of METI, before issuing an establishment license for nuclear installations, shall receive views of the NSC on the following matters: (1) the applicant for the license of the nuclear installation has adequate technical capability to establish and reliably operate a nuclear reactor, and (2) the site, structures and equipment of the nuclear installation may not cause any hindrance to the prevention of radiological hazards.

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 Cabinet Office. The NSC Secretariat is composed of the Secretary-General, the General Affairs Division, the Regulatory Guides and Review Division, the Radiation Protection and Accident Management Division and the Subsequent Regulation Review Division and has about 100 personnel.

Under the NSC, two special safety examination committees, *eight special committees and five other*s are organized as shown in Table 8-3. 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 Fuels Safety are appointed from persons of knowledge and experiences by the Prime Minister in accordance with the Law for Establishment of the AEC and the NSC. The Emergency Technical Advisory Body is composed of the commissioners of the NSC and the Emergency Response Measures Investigators who are also appointed by the Prime Minister from persons of knowledge and experiences. The members of other Special Committees are selected from commissioners of the NSC and persons of knowledge and experiences.

The results of investigation and evaluation of each committee are reported to the NSC and are deliberated by the NSC. The results of the discussion in the Emergency Technical Advisory Body are reported to the NSC together with their advice and determined by the NSC as recommendation items.

Deliberations of all committees, including the special committees and working groups under the NSC are open to the public. The contents of the deliberations are provided for the public at a homepage (http://www.nsc.go.jp/) and the Nuclear Energy Library of the NSC.

8.6 The Atomic Energy Commission (the AEC)

The AEC was established, on January 1, 1956, under the Prime Minister's Office, on the basis of the Atomic Energy Basic Law and the Law for Establishment of the AEC and the NSC, to conduct national policy concerning research, development, and utilization of nuclear energy in a planned manner and to ensure the democratic administration of nuclear energy policy. (The AEC was transferred to the Cabinet Office in January 2001.)

The AEC has duties of planning, deliberation, and decisions concerning the research, development and utilization of nuclear energy (excluding matters relating to regulations on ensuring safety).

If the AEC deems it necessary as a part of its assigned duties, it may advise by way of the Prime Minister, and request reports and cooperation including the submission of materials, statement of views, and explanation from the heads of relevant administrative organizations.

The Minister of METI, before issuing an establishment license for nuclear installations, 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 is composed of the chairman and four other commissioners appointed by the Prime Minister with the consent of the Diet.

8.7 Other Administrative Bodies

Establishment of nuclear installations necessitates the compliance with the other laws such as the Fire Protection Law and the Port Regulation Law therefore the relevant safety regulations are conducted by the relevant government offices e.g. the Fire Protection Agency and the Ministry of National Land and Transportation.

Table 8-1 Assigned Duties of the Divisions Related to Safety Regulation of Nuclear Installations (including nuclear fuel cycle facilities), NISA, METI

Policy Planning and Coordination Division	- *Planning and coordination concerning the general policy of the NISA*
Nuclear Safety Public Relations and Training Division	- *Activities for public hearing and public relations concerning the nuclear safety* - *Administration of the Nuclear Safety Inspectors and Senior Specialists for Nuclear Emergency Preparedness* - *Training and education of personnel to gain and to improve their competency*
Nuclear Safety Regulatory Standard Division	- *Planning and coordination concerning technology and system to ensure the nuclear safety* - *Regulation of nuclear power reactors in the stage of research and development, etc.*
Nuclear Safety Special Investigation Division	- *Management of allegation and litigation concerning nuclear safety*
Nuclear Power Licensing Division	- Regulation of commercial power reactors in the design and construction stage
Nuclear Power Inspection Division	- Regulation of commercial power reactors in the operation stage
Nuclear Fuel Transport and Storage Regulation Division	- *Regulation of spent nuclear fuel storage business* - *Regulation concerning transportation of nuclear fuel materials from sites*
Nuclear Fuel Cycle Regulation Division	- Regulation concerning businesses of refining, processing, fabrication, spent-fuel storage, and reprocessing.
Radioactive Waste Regulation Division	- Regulation of radioactive waste business, and dismantling and decommissioning of nuclear installations including nuclear fuel cycle facilities
Nuclear Emergency Preparedness Division	- Planning of nuclear emergency preparedness - Prevention and investigation of incidents and accidents in nuclear businesses - Administration of activities in nuclear emergency - *Matters concerning physical protection*
Electric Power Safety Division	- Regulation of turbine etc. - Environmental impact assessment

Table 8-2 Organization of the Nuclear and Industrial Safety Subcommittee, ACNRE

Basic Safety Policy Subcommittee	- General matters securing safety
Nuclear Reactor Safety Subcommittee	- Technical matters on commercial power reactors and power reactors at the stage of research and development
Nuclear Fuel Cycle Safety Subcommittee	- Fabrication and reprocessing of nuclear fuel, storage of spent fuel, transportation of nuclear fuel material, and the technical standards
Decommissioning Safety Subcommittee	- Decommissioning of nuclear installations*
Radioactive Wastes Safety Subcommittee	- Securing safety of disposal and storage of radioactive wastes
Seismic and Structural Design Subcommittee	- Technical matters on seismic safety and structural integrity of nuclear installations*
Nuclear Emergency Preparedness Subcommittee	- *Measures for incidents and failure, and general crisis management for emergencies of nuclear installations*and physical protection of nuclear material*
INES Evaluation Subcommittee	- INES Evaluation on incidents and accidents of nuclear installations*
Subcommittee for the Convention on Nuclear Safety	- Matters related to the Convention on Nuclear Safety and international standards on nuclear safety
Electrical Power Safety Subcommittee	- Securing safety of electrical power
Study Group on the Way of Inspection	- *Matters concerning inspection system of nuclear power generation facilities and nuclear fuel cycle facilities*
Subcommittee for the Joint Convention on Radioactive Waste and Spent Fuel Safety	- *Matters related to the Convention on Joint Convention Radioactive Waste and Spent Fuel Safety*
Subcommittee for the Institution of Nuclear Safety Regulation	- *Study of the legal system for the prevention of falsification of the self-controlled inspection record based on the investigation of the background of the falsification*
Subcommittee for fitness-for-service assessment etc. of nuclear power system	*Study of the followings, in the case where a plant has cracks in a core shroud or reactor coolant re-circulation system piping:* *(1) Verification of validity in the check methods for core shroud etc.* *(2) Technical fitness-for-service assessment· judgment method* (3) *Fitness-for-service verification etc. of individual plant based on check result specifically*

*: Including nuclear fuel cycle facilities

Table 8-3 Committees, etc. under the NSC

Committee on Examination of Reactor Safety	- Matters concerning the safety of nuclear reactor facilities
Committee on Examination of Nuclear Fuel Safety	- Matters concerning the safety of nuclear fuel material
Emergency Technical Advisory Body	- Technical advice in emergency measures in case of occurrence of an accident or a failure that meet the given standard level in nuclear installation etc.
Emergency Technical Advisory Body for Disaster Prevention of Nuclear Carriers and Submarines	- *Technical advices etc. for the emergency measures required in a case of actual or potential nuclear ship emergency*
Special Committee for Nuclear Safety Standards and *Guides*	- Matters concerning safety standards and guides of reactors, nuclear fuel facilities, and other nuclear installations
Special Committee on Radioactive Wastes and Decommissioning	- *Matters concerning the safety assurance in radioactive waste disposal* - *Matters concerning the safety assurance in decommissioning of nuclear installations*
Special Committee on Safety Goal	- *Establishment of safety goals*
Special Committee on Radiation Protection	- *Matters concerning the radiation protection considering domestic and foreign trends.*
Special Committee on Safe Transport of Radioactive Materials	- *Matters concerning the safety assurance in transportation of radioactive materials considering domestic and foreign trends.*
Special Committee on *Analysis and Evaluation of* Nuclear Accidents and Failures	- Analysis and evaluation of domestic and foreign nuclear accidents and failures
Special Committee on Nuclear Safety Research	- Planning of nuclear safety research program - Investigation of implementation status of the nuclear safety research program - Evaluation of the nuclear safety research program
Special Committee on Nuclear Disaster	- *The emergency preparedness in the vicinity of nuclear installations, etc.*
Task Force for introduction of Safety Regulations Using Risk Information	- *Review and analysis of the issue in introduction of safety regulations using risk information*
Project Team on Safety Survey of Reprocessing Facilities	- *The survey and analysis on the matters considered in the safety regulation activities during the stage of test operation of the Rokkasho reprocessing facility*
Safety Investigation on Disposal of Specified Radioactive Wastes	- *Technical matters concerning the safety assurance in the final disposal of high-level radioactive wastes*

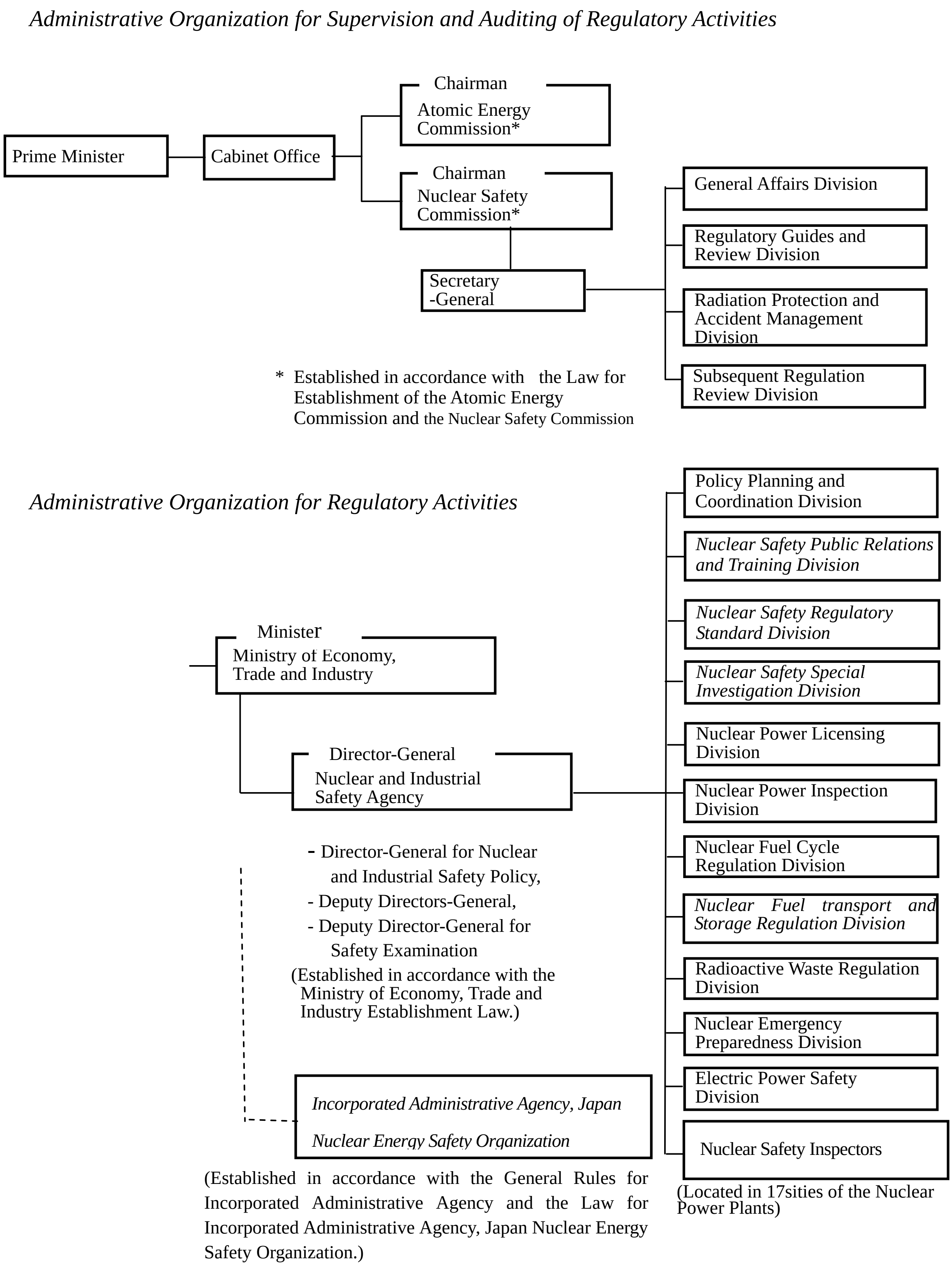


Fig. 8-1 The Outline of the Safety Administrative Organization for Nuclear Installations (including Nuclear Fuel Cycle)

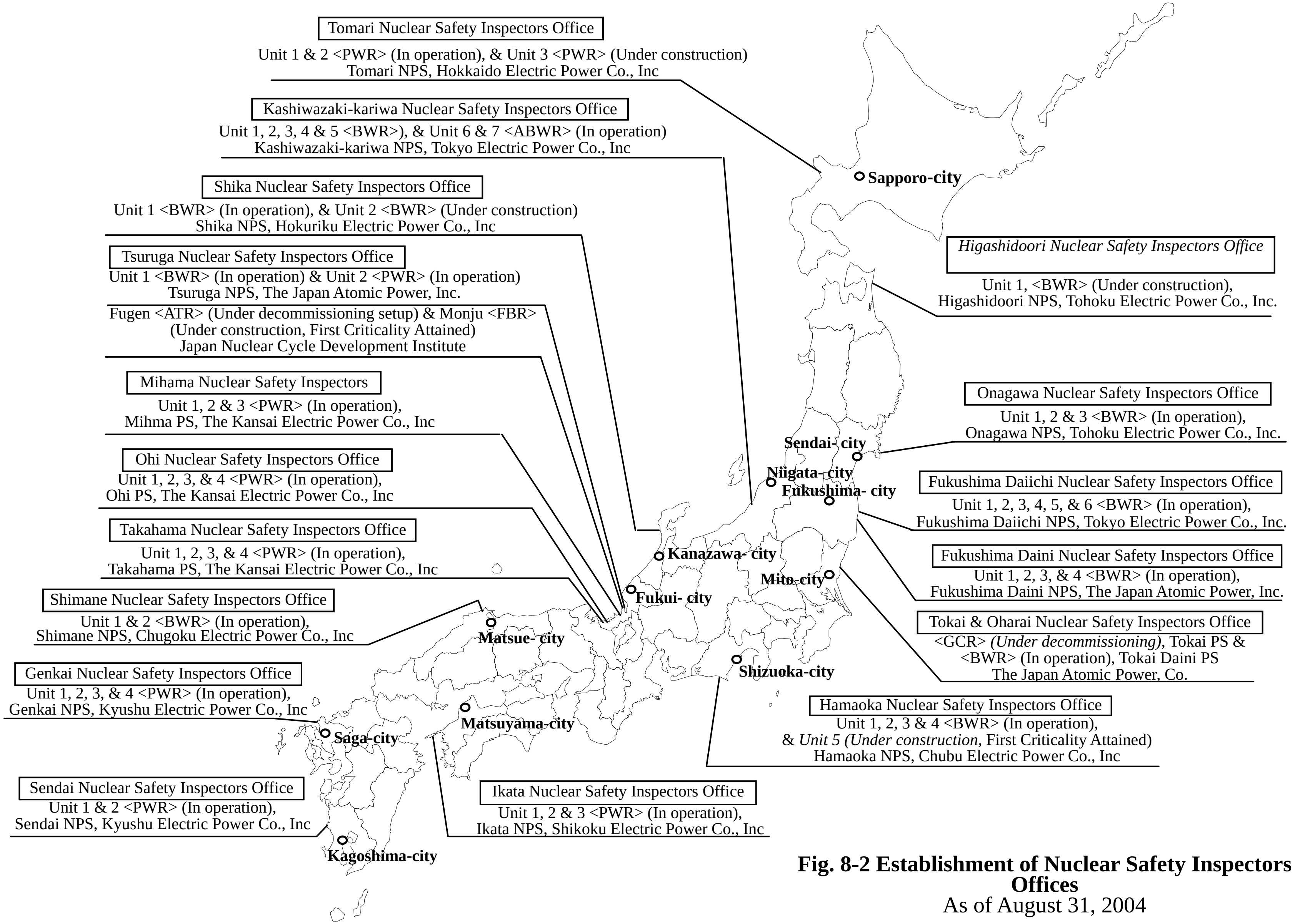


Fig. 8-2 Establishment of Nuclear Safety Inspectors Offices
As of August 31, 2004

Article 9 Responsibility of the Licensee

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

The prime responsibility for the safety of a nuclear installation rests with the licence holder, and the regulatory body establishes relevant regulation to ensure the public safety, and supervises that the licence holder complies with the regulation.

After the previous report, the amendment of the Rules for the Reactor Regulation Law clarified the licence holder's responsibility on quality assurance and maintenance management, and established the Licensee's Periodic Inspection and the Periodic Safety Management Review.

9.1 Regulatory measures for the licence holder to take the prime responsibility for the safety of nuclear installations.

The prime responsibility for the safety of a nuclear installation rests with the licence holder, and the licence holder shall comply with the regulatory requirements in each stage from planning through operation, which are stipulated in the Reactor Regulation Law, the Electricity Utilities Industry Law, etc. Those regulatory requirements are described in the report of Article 7.

The Licence holders activities concerning Education and Training of Operational Personnel etc. (Article 11), *Performance of quality assurance activities (Article 13), Periodic Safety Review (Article 14), Aging Management Review (Article 14),* Emergency Preparedness (Article 16), Design and Construction (Article 18), and Operation (Article 19) are described in the report of the respective article. The licence holder is continuously making efforts for improving the safety and reliability of its nuclear installations, as well as meeting with regulatory requirements, through training the personnel, preparing operation manuals, collecting, studying and sharing information on operating experiences and applying it to design, operation and maintenance, adopting the latest progress in technologies, performing the safety research, promoting quality assurance activities, and preparing accident management.

9.2 Supervision of Licence Holders by Regulatory Body

The basic mechanism to ensure the safety of nuclear installations is that NISA issues license, orders the licensee to bear the prime responsibility for safety, and supervises it within the legislative and administrative framework.

The following is an overview of the above mentioned mechanism.

(1) Licensing

The Minister of METI issues a license for the establishment of a nuclear installation after examining that the nuclear installation will not be used except for the peaceful purposes, that there is no potential obstacle for accomplishing the planned development of atomic energy, that technical capability and financial foundations of licence holders are sufficient, and that the site, the structure and the equipment of the nuclear installation may not cause any hindrance to the prevention of nuclear disaster. The regulation under the Reactor Regulation Law and the Electricity Utilities Industry Law in each stage from planning through operation is described in section 7.3.

(2) Licensee's Periodic Inspection and Periodic Safety Management Review

The Electricity Utilities Industry Law, as amended, stipulates that the licence holder shall perform the Licensee's Periodic Inspection replacing former self-controlled inspection, confirm the results to comply with the technical standards, and record the results. JNES conducts the Periodic Safety Management Review including review on the organization for implementing the Licensee's Periodic Inspection, etc., and reports the review results to NISA. NISA evaluates the review results and inform the licence holder of its conclusion.

(3) Nuclear Safety Inspection and Nuclear Safety Inspector

In accordance with the Reactor Regulation Law, NISA stations the Nuclear Safety Inspectors at each nuclear installation, who conducts the Nuclear Safety Inspection four times a year to confirm the licence holder's compliance with the Operational Safety Program, and addresses incidents if they occur.

(4) Quality Assurance Activities and Maintenance Management Activities

In accordance with the ordinance based on the Reactor Regulation Law, the licence holder shall establish quality assurance system and maintenance management system, and include them in the Operational Safety Program. NISA confirms the compliance with the Operational Safety Program through the Nuclear Safety Inspection.

(5) The Senior Specialist for Nuclear Emergency

In accordance with the Special Law for Nuclear Emergency, NISA stations Senior Specialist for Nuclear Emergency at each site of nuclear installations, who guides and advises the licence holder in preparing the Licensee's Plan for Emergency Preparedness, and conducts duties necessary to prevent nuclear emergency and mitigate the consequence should it occur.

(6) Periodic Safety Review

By the amendment of the ordinance based on the Reactor Regulation Law, the Periodic Safety Review is integrated into the Operational Safety Program.

(7) Aging Management Review

By the amendment of the ordinance based on the Reactor Regulation Law, the licence holder shall take measures for aging management, not later than thirty years after the commencement, to perform technical review on aging for the safety-related equipment and structures, and to establish the Ten-Year Maintenance Program. Measures for aging management are integrated into the Operational Safety Program, the compliance with which should be inspected by inspectors of NISA. Ten years Program must be revised every ten years.

(8) Accident Management

The licence holder prepares accident management program according to "Accident Management as a Measure for Severe Accident at Light Water Nuclear Power Reactor Facilities", a decision by the NSC, 1992, (partly revised by the NSC, 1997) and submits it to NISA for review. NISA reviews and evaluates the technical adequacy of it.

(9) Report

In accordance with the Reactor Regulation Law and the Electricity Utilities Industry Law, the licence holder shall report to NISA on their business.

(10) On-the-Spot Inspection

NISA conducts on-the-spot inspection, if necessary, at the plants, offices, etc. of licence holder or its contractor, in accordance with the Reactor Regulation Law or the Electricity Utilities Industry Law

(11) Revocation of License, etc.

Judging that the licence holder violated regulation, the Minister of METI may take measures of enforcement such as revocation of the license, suspension of operation, fine, etc., in accordance with the Reactor Regulation Law or the Electricity Utilities Industry Law

C. General Safety Considerations

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.

The development and utilization of the nuclear energy have been promoted giving due priority to safety in accordance with the Atomic Energy Basic Law.
The JCO criticality accident in 1999, etc. showed importance of moral and safety culture in the organization, and resulted in the introduction of the Nuclear Safety Inspection and the Allegation System.

However, the TEPCO falsification issue showed, again, that negligence of priority to safety among personnel gave rise to organizational falsification, and led to the renovation of the safety regulation by the NSC and NISA. In the renovated regulation, they clarify requirements for the license holder's quality assurance activities including organization, management, etc., urging the license holder to establish robust safety culture. The license holder is intensifying efforts to respond to it.

10.1 Basic Policy for Priority to Safety

Priority to safety is a basic policy in all nuclear energy development and utilization in Japan. The Article 2 of the Atomic Energy Basic Law states that priority should be given to ensure safety in all related activities (Annex 3.1). Also, The Article 1 of the Nuclear Regulation Law states that "this law, in accordance with the Atomic Energy Basic Law, is enacted for the purposes of providing necessary regulations on the establishment and operation of reactors, and uses of atomic energy are limited to peaceful purposes and carried out in a planned manner, and at the same time, to ensure the public safety by preventing the hazards due to these materials and reactors."

10.2 Efforts for Improvement in Safety Culture

Safety culture in organization is so vital to ensure safety of the nuclear installation, that the lack of safety culture there may result in serious consequence. Each of the regulatory body and the license holder takes various efforts to enhance safety culture.

(1) Efforts by the Regulatory Bodies

The regulatory body requests the license holder to comply strictly with the regulatory requirements for the quality assurance, urging, at the same time, license holder's top management to implement quality management and to take appropriate steps for robust safety culture to prevail among its personnel. For this purpose, NISA established the regulatory requirements on the quality assurance. Details of them are given in the report of Article 13.

Some of regulatory activities to enhance safety culture are shown below.

1) The NSC and NISA have attended, and contributed to, various international meetings or committees on safety culture of the IAEA, the OECD/NEA, etc., and collected and studied foreign examples of good practice on safety culture.

2) The NSC has promoted interdisciplinary and comprehensive study on safety culture, by collecting operating personnel's opinion on it, publishing booklets on it, analyzing mechanism to enhance it, colleting good practices on it in other industry, and analyzing characteristics of Japanese safety culture. Since July 2001, the NSC held 21 dialogue meetings on good practices and existing tasks on safety culture with operating personnel of nuclear power plants and other nuclear facilities, the report of which was published in January 2004.

3) NISA held advisory meetings on safety culture attended by experts including experts from other industries, and clarified tasks of the nuclear business operator, tasks of the regulatory body and tasks to be discussed with the public.

4) As an attempt for the regulatory body to monitor and quantify level of safety culture of license holder, JNES prepared review items on safety culture referring to ASCOT Guidelines of the IAEA, ISO9001, etc. on April 2004, and has been examining adequacy of them by applying them to foreign and domestic incidents.

(2) Efforts by Nuclear Industry

1) Efforts by Nuclear Industry

The Japan Atomic Industrial Forum Inc., consisting of about 800 business operators (electricity utilities, reactor manufacturers, etc.) who are engaged in the nuclear business, published a statement entitled "Toward Reform of Japan's Private Nuclear Industry" on October 8, 1999, being triggered by the JCO Criticality Accident. That says;

- Top management should establish policies that give due priority to safety, and make safety culture prevail over whole company.
- Top management of each division in a company should clarify scope of duty and responsibility of each staff, ensure compliance with rules and standards, and perform comprehensive review including preparedness for abnormal situation.
- Top management of each division should strengthen audit function by inviting managers of other divisions or experts out of the company.

---The rest is omitted---

In December 1999, 36 nuclear business operators such as utilities, fuel fabricators, plant manufacturers, and research organizations united and founded the "Nuclear Safety Network (NS network)" for sharing and improving the nuclear safety culture. *Activities of the Network were intensified by the revelation of the TEPCO falsification issue, and are shown in the followings.*

a. Activities to Disseminate Safety Culture

- *Holding several levels of seminars on nuclear safety for top management and senior management.*
- *Holding lecture meetings for member companies on corporate ethics by outside experts.*
- *Continuation of public relations campaigns on nuclear safety and safety culture with cooperation of other related organizations.*

b. Peer Review Activities

- *Peer review guide was revised to integrate lessons learned from the TEPCO falsification issue.*
- *Improvement of peer review process by inviting experts from outside.*

c. Collecting, Sharing and Dispatching Information

- *Information on nuclear safety and safety culture is extensively collected from member companies using questionnaire, and shared among them. Items on corporate ethics are recently added to the questionnaire reflecting the TEPCO falsification issue,*
- *Information is supplied to the public through Internet.*
- *Information is dispatched overseas positively.*

The Federation of Electric Power Companies, to restore public confidence lost by the TEPCO falsification issue, established the Confidence Recovery Committee consisting of presidents of all utility companies in October 2002, and revised the "Action Guideline of Federation of Electric Power Companies" in December 2002, stressing compliance with regulation and corporate ethics.

Recognizing importance of transparency in disclosing accidents and failures including minor events, license holders established public information library "NUCIA" on the Internet to collect and disseminate information on nuclear power station including information on accidents and failures, and started the operation in October 2003. Fig. 10-1 shows the practical use of operation and maintenance information by license holders.

2) Efforts by Each License Holder

Tokyo Electric Power Co., taking a series of falsification issue seriously, is now implementing various preventive measures against recurrence in three areas, that is, quality assurance, corporate ethics and safety culture. Measures in the area of safety culture include followings;

- *Requests personnel to comply with the corporate charter and the president's message calling for priority to safety.*
- *Establishes an organization that promotes safety culture.*
- *Establishes a forum where management of nuclear power plant discloses information on plant operation to the local residents, ensuring transparency.*

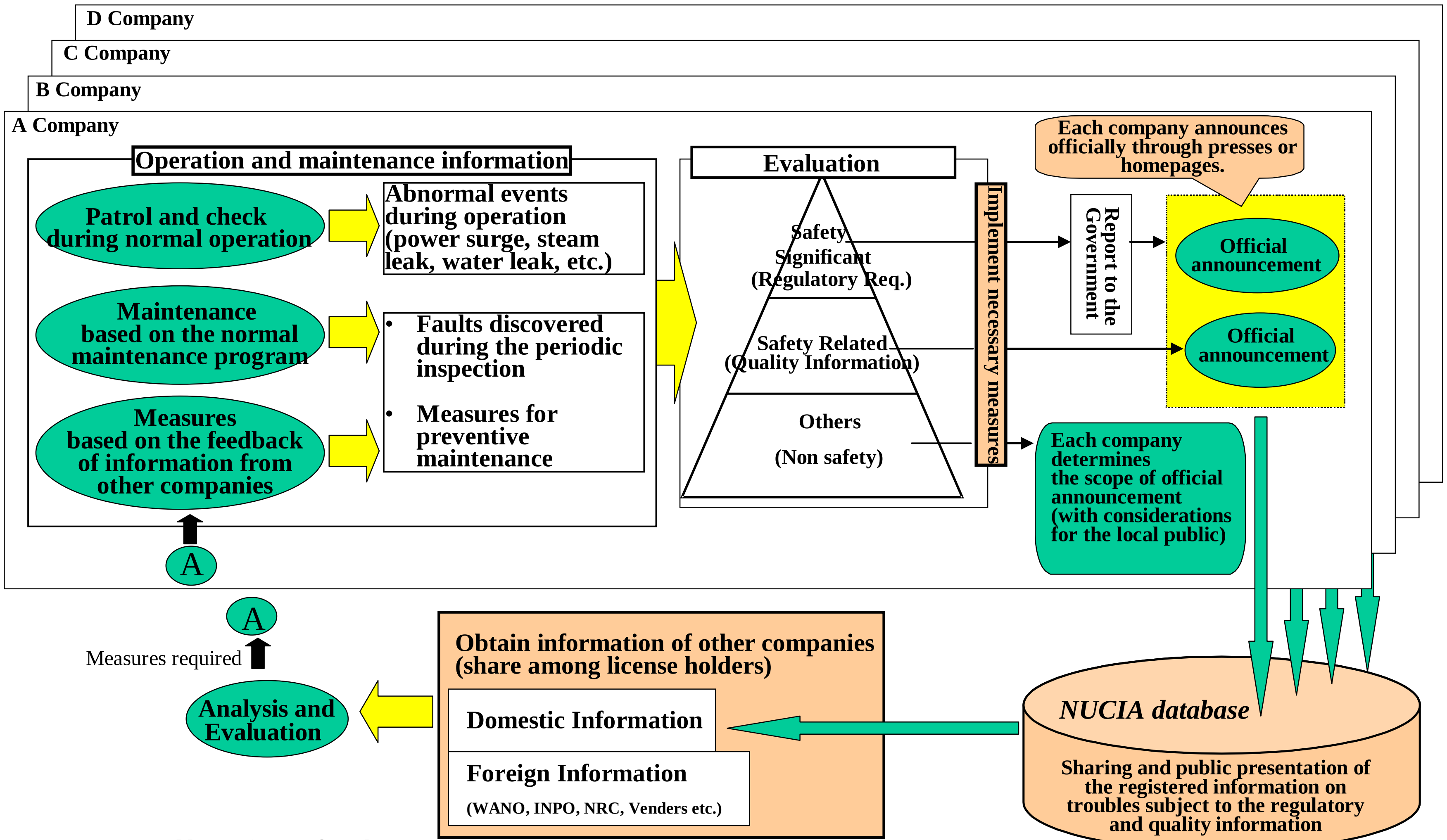
Other license holders, also, have publicly declared, in its annual management plan, a policy to give priority to safety in operation of nuclear power stations, and are implementing the similar measure to that of TEPCO.

Every license holder has established a nuclear safety planning committee at its head office reporting directly to the director of the nuclear power generation department, and a nuclear safety steering committee at each site chaired by the head of the power station. *The former reviews license application documents and alteration of the Operational Safety Program, etc., and the latter reviews the operation management procedure, educational plan on safety, etc.* In these committees, information on incidents of domestic and foreign plants are shared and transferred, and implementation plan on the periodic inspection, preventive maintenance, education and training programs for employees, and QA activities are discussed and promoted.

The Federation of Electric Power Companies provides a forum for exchange and study of information on domestic and foreign operational experiences and of measures for improvement, in addition to direct information exchange among persons in charge. Also, the electric power companies are engaged in international information exchange on operating experience through the Institute of Nuclear Power Operations (INPO), the World Association of Nuclear Operators (WANO), etc.

Nuclear manufacturers propose to utilities application of new technologies, and items for improvement on safety and work procedures, while utilities propose items for improvement based on operating experiences to manufacturers.
Some utilities have established institutes for research on safety culture and human factors. For example, the Kansai Electric Power Co., has established Institute of Nuclear Safety System, Inc. in 1992, and the research activities on the safety culture, etc. in nuclear power stations are carried on.
Central Research Institute of Electric Power Industry is carrying on research on human factors and safety culture.

Fig. 10-1 Use of Operation and Maintenance Information by License Holders



WANO: World Association of Nuclear Operators
INPO: Institute of Nuclear Power Operations
NRC: Nuclear Regulatory Commission, USA

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.

The financial basis of nuclear industry rests on the understanding and recognition that nuclear energy is the environmentally clean energy and reliable source for base load power, against the backdrop of deregulation of electricity utilities industry including that of power rates.

Although license holders have worked hard to comply with regulatory requirements on the appointment of Chief Engineers of Reactors, Persons Responsible for Operation, Chief Electrical Engineers, etc., they now face tasks of succession of technology, recruitment and training of personnel in various fields, etc.

11.1 Financial Resources of the License Holder

(1) Confirmation at Issuing License

Before issuing license of a nuclear facility, the Minister of METI, in accordance with Article 24 (Criteria for the license) of the Reactor Regulation Law, confirms that the applicant for the license possesses necessary financial basis by requiring the applicant to submit “Amount of Funds Required for Construction and Finance Procurement Plan”, and also consults with the AEC. (Refer to the section 7.3(2) and Fig. 7-3)

(2) Applicant for the License of Nuclear Facilities

Applicants for license of commercial power reactors are the General Electric Utilities, that is, 9 electric power companies and 2 wholesale electric power companies. The Minister of METI issues license for electricity utility business only to those meeting certain criteria of financial basis, technical competence, etc. *The licensing system of electricity utilities business and the recognition that nuclear energy is a clean and reliable source ensures license holders sound financial basis.*

METI enacted the Ministerial Order of Reserve Fund for Dismantling Nuclear Power Facilities, in accordance with the provisions of Article 35 of the Electricity Utilities Industry Law. Electric utilities deposit reserves for decommissioning on the basis of this order. They also deposit reserves covering final disposal of vitrified wastes and other wastes resulting from reprocessing of spent fuels. The deposit is reserved in financial accounts of the Nuclear Waste Management Organization of Japan, an implementing organization for disposal, founded by the Law for Final Disposal of Specified Radioactive Waste enacted in June 2000.

The JNC, who owns R&D reactors of Monju and Fugen, is established by a law, and financial basis necessary for its business operation is provided by the national budget.

11.2 Human Resources of the License Holder

(1) Confirmation of Technical Competence

Before issuing license of a nuclear facility, the Minister of METI confirms that the applicant possesses technical competence necessary to establish a nuclear facility and operate it adequately, and consults with the NSC. The NSC had established the “Regulatory Guide for Reviewing Technical Competence of a Nuclear Operator” on May, 2004 in order to improve objectiveness and rationality of reviewing. In this regulatory guide, the follows are provided as fundamental requirements for licensing related to human resources that should be satisfied by an applicant;

-Securing engineers,
-Education and training for engineers,
-Designation and arrangement of qualified personnel.

The license holders are responsible for safety of the decommissioning and for preparing personnel for it. They implement technical development programs on decommissioning in cooperation with national research institutes, manufacturers and construction companies, and have trained and secured human resources through studying decommissioning activities abroad and participating in the project of *decommissioning the Tokai Power Station of the Japan Atomic Power Company.*

(2) Qualification, Training and Retraining of Personnel Engaged in Safety Activities

1) Staff Qualification

The license holder shall appoint a Chief Engineer of Reactors to supervise safety operation of nuclear facility, a Chief Electrical Engineer and a Chief Engineer of Boiler and Turbine to supervise safety during construction, operation and maintenance of electric structures. *The license holder assign the Persons Responsible for Operation from those who have knowledge, skills, and experience required for nuclear reactor operation, and who satisfy the standards provided by the Minister of METI. The Persons Responsible for Operation supervise operators in the control room of a power plant.*

Table 11-1 shows numbers of qualified personnel in nuclear facilities in Japan.

NISA is considering to establish a qualifying system of specialist for ultrasonic flaw detection, which is necessary for the application of the Rules on Fitness-for-Service for Nuclear Power Plant Components.

2) Staff Training and Retraining, and Resources for Training

License holders shall integrate safety education programs of personnel in charge of operation and management of a nuclear facility into the Operational Safety Program, and prepare and carry out long-term and short-term staff training programs to maintain and improve their capabilities. License holders, in addition to in-house operator training course using simulators (Table 11-2), periodically send their operators to external operation training centers for retraining. There are two centers: the BWR Operation Training Center (BTC) for BWRs and the Nuclear Power Training Center (NTC) for PWRs. A curriculum suitable for the ability/skill of each operator is prepared in these training centers.

Each license holders has established maintenance training centers (Table 11-3) 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.

11.3 Efforts for Ensuring Infrastructure of Human Resources in Japan

Nuclear regulatory bodies and nuclear power industry are making efforts for ensuring nuclear experts now and in the future. Status after the previous reporting is as follows:

(1) Training of Experts in NISA

Staff members, who are in charge of nuclear regulation in NISA, are the Senior Specialist for Nuclear Emergency, the Nuclear Safety Inspector, the Nuclear Facility Inspector, the Electric Structure Inspector, and the Safety Examiner. These are called "Nuclear Regulatory Staff" as shown below.

A Senior Specialist for Nuclear Emergency is stationed at each nuclear installation, guides and advises the license holder in preparing its Plan for Emergency Preparedness, and conducts duties necessary to prevent progression of nuclear emergency should it occur.

A Nuclear Safety Inspector is stationed at each nuclear installation, conducts the Nuclear Safety Inspection to confirm license holder's compliance with the Operational Safety Program, address incidents if they occur, and supervises operation management of a nuclear installation.

A Nuclear Facility Inspector and /or an Electric Structure Inspector is dispatched from NISA head office, and conducts inspection activities, such as the Pre-Service Inspection and the Periodic Inspection of a nuclear installation, and the Fuel Assembly Inspection, on the basis of the Reactor Regulation Law or the Electricity Utilities Industry Law, respectively.

Safety Examiners conduct the Safety Examination of a nuclear installation.

A Nuclear Regulatory Staff is required to have expertise in nuclear technology. The system of long term and multistage education and training programs necessary for improvement of his/her expertise is developed, taking account of his/her experience and of the nature of the facility to which he/she is assigned. *Moreover, NISA started a Special Training Course on Quality Assurance of Nuclear Installation in 2002. Summary of training for nuclear safety regulation is shown in Fig. 11-1.*

NISA has appointed six Special Inspection Instructors in December 2003. They advise inspectors for the Nuclear Safety Inspection, the Periodic Inspection, etc. in each power station, instruct them to equalize the levels of inspections, and collect opinions and proposals from inspectors and license holders at the same time.

Furthermore, NISA maintains and develops its regulatory competence, as well as contributes to international safety regulation, through exchange of technical experts and information on safety regulation and safety technology, under bilateral arrangements with foreign regulatory bodies and in the framework of multilateral cooperation (the IAEA and the OECD/NEA).

(2) Training of Experts in JNES

JNES, as well as NISA, develops training courses for its personnel, putting emphasis on inspection activities.

JNES's inspection activities include the Electric Structure Inspection, the Nuclear Facility Inspection, the Welding Inspection, the Periodic Safety Management Review, the Welding Safety Management Review, the Safety Verification of Disposal Facility, the Safety Verification of Radioactive Waste Package, the Verification of Transportation Packaging, and the Verification of Transportation Method. The Electricity Utilities Industry Law or the Reactor Regulation Law stipulates that each of these activities be conducted by qualified personnel. JNES prepares various training courses for staff members to get appropriate qualification in their respective activities. President of JNES assigns inspectors from those qualified persons.

Moreover, JNES encourages inspectors and examiners to participate in the school of external bodies, scientific seminars, etc. to enhance their expertise.

(3) Efforts by Nuclear Industry

Confronting shrinking and aging population of Japan, the nuclear industry has grave concerns in the succession of technology, expertise and experiences, and the generational gap. The first generation experts are in the age of retirement. Each organization in the industry has made various efforts including revitalization of research and development activity, practical use of IT technology, etc. The

Japan Atomic Industrial Forum, Inc. established the "Subcommittee for Human Resources" consisting of senior managers in the industry and experts from outside, and studied on human resources in the future.

The subcommittee has made the following proposals in June 2003:

- *Training and career development of experts,*
  - *Establishment of an industry's qualification system of nuclear maintenance and repair technicians*
  - *Simplification of organizations of maintenance work*
  - *Establishment of an engineering center to share resources of maintenance and repair technicians, and to share common training facilities*
- *Recruitment of expert in the future,*
  - *Establishment of a nuclear educational system, sharing common educational infrastructure*

(4) Efforts by University and Research Institutes

Tokyo University is due to establish a graduate school, in 2005, consisting of three courses of the "Nuclear Engineering Specialist Course", the "International Engineering Course", and the "Innovation of Nuclear Energy Course".

Since 1958, JAERI has been operating training courses for engineers and technicians in radioisotope, radiation and nuclear technologies. Recently, JAERI started a course for nuclear emergency preparedness in close cooperation with national and local governments.

(5) Establishment of Professional Engineers System for Nuclear and Radiation Technologies

The Ministry of Education, Culture, Sports, Science and Technology decided to expand the existing Professional Engineers System, and established the nuclear and radiation technology department. Qualification test for the department will start in 2004 fiscal year.

The Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Energy and Resources published, in July, 2001, a report titled "To Ensure Infrastructure of Nuclear Safety", which suggests directions to strengthen the institutional infrastructure, the knowledge-based infrastructure and the infrastructure of human resources.

Table 11-1 Numbers of Qualified Persons in License Holders

(As of the end of June 2004)

Type of Qualification	Numbers of Qualified Persons
Chief Engineer of Reactors	*581*
Class I Electrical Chief Engineer	*181*
Class I Boiler and Turbine Chief Engineer	*334*
Class I Supervisor of Radiation Protection	*1375*
Person Responsible for Operation *(Note)*	*372*

(Note) System of the Person Responsible for Operation was changed into the assignment by the license holders based on the standards of a Ministry of METI from the qualification by the conventional designated agency in August, 2001.

Table 11-2 Operator Training Facilities of Nuclear Facilities

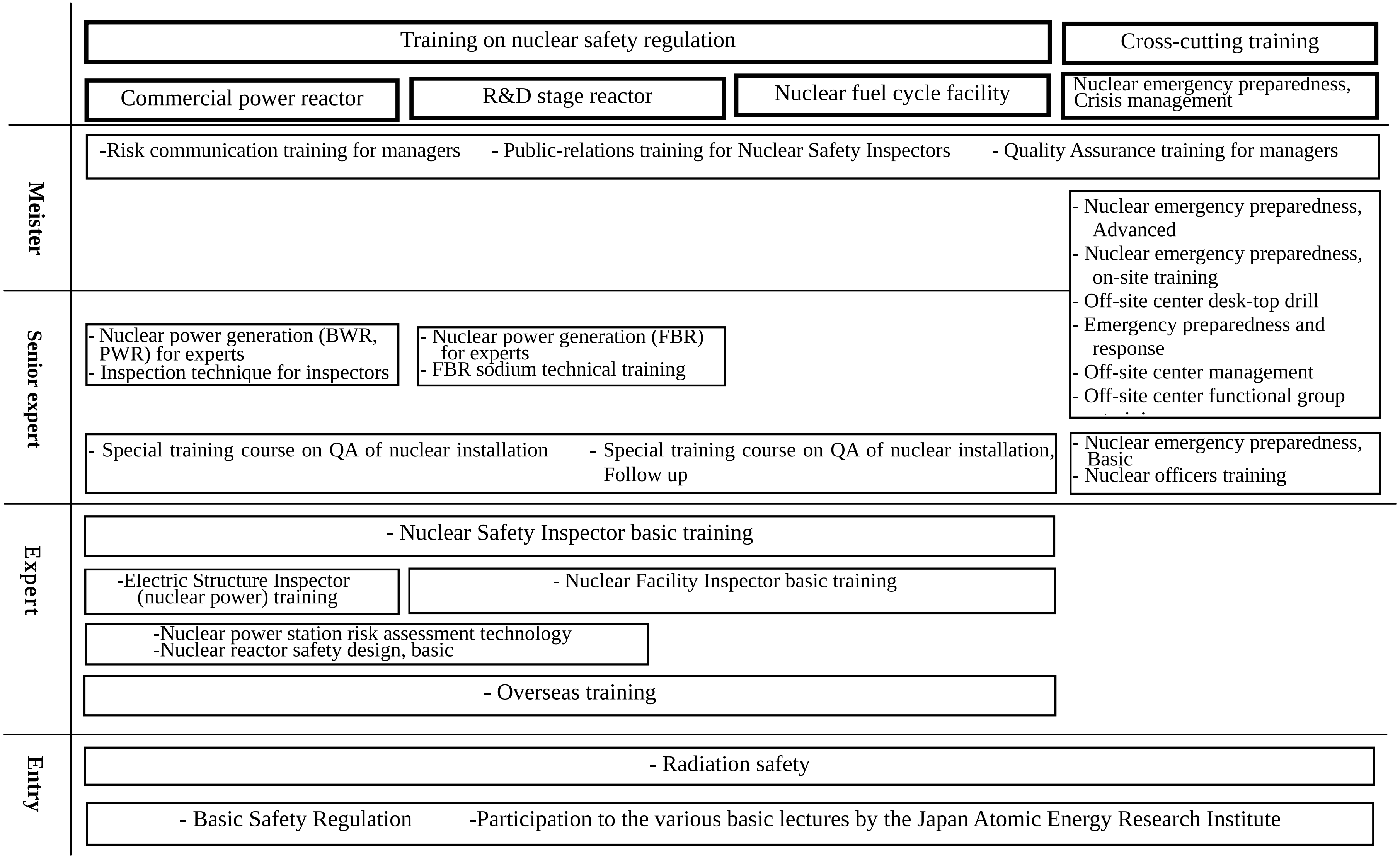
Organization	Location	Simulator
BWR Operator Training Center Corp.	Okuma-machi, Futaba-gun, Fukushima Prefecture Kariwa Village, Kariwa-gun, Niigata Prefecture	Full scale; *3units* Full scale; *2units*
Nuclear Power Training Center Ltd	Tsuruga, Fukui Prefecture	Full scale; *3units*
The Japan Atomic Power Co., Inc.	The Japan Atomic Power Company Training Center (Tokai Village) *On site of Tsuruga Power Station*	Compact; *1unit* *Compact 2units*
The Hokkaido Electric Power Co., Inc.	On site of Tomari Power Station	Full scale; *1unit*
Tohoku Electric Power Co., Inc.	Nuclear Power Engineering Training Center (on site of Onagawa Nuclear Power Station) *Nuclear Power Engineering Training Center (on site of Higashidori Nuclear Power Station)*	Full scale; *1unit* *Full scale; 1unit*
Tokyo Electric Power Co., Inc.	On site of Fukushima Daiichi Nuclear Power Station On site of Fukushima Daini Nuclear Power Station On site of Kashiwazaki Kariwa Nuclear Power Station	Full scale; *1unit* Full scale; *1unit* Full scale; *1unit*
Chubu Electric Power Co., Inc.	Nuclear Power Training Center (on site of Hamaoka Nuclear Power Station)	Full scale; *2units*
Hokuriku Electric Power Co., Inc.	Nuclear Power Engineering Training Center (on site of Shika Nuclear Power Station)	Full scale; *1unit*
The Kansai Electric Power Co., Inc.	On site of Mihama Power Station On site of Takahama Power Station On site of Ohi Power Station	Compact; *1unit* Compact; *1unit* Compact; *1unit*
The Chugoku Electric Power Co., Inc.	Ohno Training Center (Ohno-machi)	Full scale; *1unit*
Shikoku Electric Power Co., Inc.	Nuclear Engineering Training Center (Matsuyama) On site of Ikata Power Station	Full scale; *1unit*
Kyushu Electric Power Co., Inc.	Nuclear Power Training Center (*on site of Genkai Nuclear Power Station*) Nuclear Power Training Center (*on site of Sendai Nuclear Power Station*)	Full scale; *1unit* Full scale; *1unit*
Japan Nuclear Cycle Development Institute	On site of Fugen Power station On site of Monju Construction Office	Compact; *1unit* Full scale; *1unit*

(As of the end of June, 2004)

Table 11-3 Maintenance and Repair Training Centers of License Holders

Reactor Establisher	Name	Location
The Japan Atomic Power Co.	The Japan Atomic Power Company Training Center	Tokai Village, Naka-gun, Ibaraki Prefecture
Hokkaido Electric Power Co., Inc.	Nuclear Power Training Center	On site of Tomari Power Station
Tohoku Electric Power Co., Inc.	Nuclear Power Engineering Training Center	On site of Onagawa Nuclear Power Station
Tokyo Electric Power Co., Inc.	Fukushima Nuclear Power Plant Training Center	On site of Fukushima Daiichi Nuclear Power Station
	Kashiwazaki kariwa Nuclear Power plant Training Center	On site of Kashiwazaki Kariwa Nuclear Power Station
Chubu Electric Power Co., Inc.	Nuclear Power Training Center	On site of Hamaoka Nuclear Power Station
Hokuriku Electric Power Co., Inc.	Nuclear Power Engineering Training Center	On site of Shika Nuclear Power Station
The Kansai Electric Power Co., Inc.	Nuclear Power Maintenance Training Center	Takahama-cho, Ohi-gun, Fukui Prefecture
The Chugoku Electric Power Co., Inc.	Shimane Nuclear Power Station Engineering Training Center	On site of Shimane Nuclear Power Station
Shikoku Electric Power Co., Inc.	Nuclear Engineering Training Center	Matsuyama City, Ehime Prefecture
Kyushu Electric Power Co., Inc.	*Genkai Nuclear Power Station* Nuclear Power Training Center	On site of Genkai Nuclear Power Station
	Sendai Nuclear Power Station Nuclear Power Training Center	On site of Sendai Nuclear Power Station
Nuclear fuel cycle Development Organization	General Training Facility for FBR Cycle	*On site of International Engineering center*

Fig. 11-1 Training on Nuclear-Safety Regulation



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.

The license holder takes human factors into consideration at the design stage of nuclear installation, and, at the operation stage, prepares operational procedures, education and training course for its personnel and the management system for operation and maintenance. The regulatory body also takes various steps for prevention and remediation of human errors at design and operation stage.

12.1 Efforts by Regulatory Body

(1) Design Stage

1) The Regulatory Guide for Reviewing Safety Design requires that "reactor facilities be designed to reflect appropriate preventive considerations against operators' miss-operation", 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 inspection." 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 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."

JNES prepared a manual for evaluation of human factors in the main control room, to confirm that these requirements are reflected in the design.

2) At the Approval of Construction Plan, the Technical Standards under the Electric Utilities Industry Law 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.

(2) Operation Stage

1) The Reactor Regulation Law provides that the license holder prepare the Operational Safety Program, obtain approval of NISA on it and comply with it. The program includes preparation of operation management system, education program on safety, operational procedures etc. NISA confirms and approves the Operational Safety Program, and the resident Nuclear Safety Inspectors confirm the compliance with it by the license holder in the Nuclear Safety Inspection.

2) The license holder reports failures of the installation to NISA in accordance with the laws. Especially, in the case that the failures are identified to be caused by human errors, the license holder reports to NISA measures addressing failures including improvement of equipment. NISA consults on the failure with experts when necessary and urges license holders to apply lessons learned to other installations. *JNES analyses human error-related cases in detail, and selects items to be reflected in the safety regulations. JNES prepares a summary report on lessons learned, and accumulates them in the database.*

12.2 Efforts by License Holders

(1) Considerations in Design

License holders take following considerations on human factors in designing central control room.

1) Considerations for operator actions

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 accidents.

For example, *the control panel adopted in the advanced BWR, ABWR, has fully digitalized instrument and control system and safety protection system* (see Fig. 12-1). The advanced control panel makes it easy for operator to recognize operating conditions at a glance and to share information among operators by adopting a large-size display panel. The scope of automation is expanded, reducing routine operation by operator following a reactor scram. These measures have improved the reliability of monitoring and operator actions. *The fully digitalized main control panel is also adopted for PWR (see Fig.12-2)*

Remodeling control panel in the central control room of an existing nuclear installation, extensive use of CRT improves monitoring capability and operability of control panel.

2) Considerations on the control room

Following measures are taken to prevent operator's human errors.

- Control panels allow monitoring of the whole of main systems of the installation, and the layout provides easy access for operation.
- Operating devices are easily discernible by colors, shapes, name plate, etc., and are laid out in proximity of related indicators, avoiding human errors in operation, maintenance and checks.
- The alarm labels clearly indicate content of alarm, and important alarms are discernible from others by color, layout, etc.
- Instruments are laid out so that related plant parameters may be monitored easily.
- Monitoring capacity can be improved by CRT display and clearly discernible alarm indicators.
- *Information sharing among operators is improved by adopting large display panels.*

Fig. 12-1 Main Control Panel of ABWR

Fig. 12-2 Main Control Panel of the Latest PWR -proto type-

A design guide for digitalized main control panels is in preparation as one of the academic society and association standards named “Guide for Human Machine Interface of Computerized Central Control Rooms for Nuclear Power Plants” by the Japan Electric Association.

(2) Considerations in Operation Management

License holders perform appropriate operation management during normal operation and in accidents.

1) Operational management

a. Organizations for operation

The manager of power generation division, 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 in an accident, and *are selected from those who conform to the criterion specified by the Minister of METI.*

b. Shift of operators

Operators work in shifts. There are shifts devoted to education and training, in addition to operating shifts, to maintain and improve operator’s capability. The education and training of operators is one of the important elements of human factors. Details are described in Section 11.2.
When turning over shift duties, the shift supervisor makes sure to pass on the logbook, 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.

2) Preparation and amendment of operation procedures

Operation procedures are prepared for normal operation, failures and accidents and are constantly amended by lessons learned from incidents and accidents or by alteration of facilities.

Symptom-based procedures for multiple failures are prepared in addition to scenario-based procedures for design basis events. The symptom-based procedures enable prevention of accident progression without identifying the cause of an accident. Also prepared are the procedures addressing severe accidents exceeding design basis events, and accident management guidelines for the staff group supporting shift operators. The effectiveness of these procedures is verified by comparison with the results of the analysis of plant transient by the analysis code used in the application for establishment license, and probabilistic safety assessment. Training course using simulator, based on a symptom-based procedure, is conducted at the operator training facility. Preparation of the procedures for emergency situation is expected to be effective for mitigation of operators’ stress in an emergency.

3) Maintenance Management System

The maintenance department of a license holder controls the work of periodic inspection, 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, which means that the maintenance management by the license holder is very important.

The plant manager of a nuclear installation manages modification works, clarifying scope of work, scope of responsibility and authority. Maintenance of important equipment is carried out with a prior mock-up test.

Chief engineers (Chief Engineer of Reactors, Chief Electrical Engineer, 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.

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.

The regulatory body (NISA), license holders, plant manufacturers and equipment suppliers (hereinafter referred to as "manufacturers"), conduct quality assurance (hereinafter referred to as "QA") activities for nuclear installations in a coordinated way at each stage from design through operation and maintenance.

The basic concept of regulatory inspection has been continually renovated, seeking for more effective and efficient inspection activities, and in line with international trend in regulatory inspection. It has moved from a concept of system and component inspection to a concept where NISA encourages license holders to improve their QA activities and confirms the adequacy of them. A series of wrongdoings by license holders and manufacturers, such as the TEPCO falsification issue, falsification of fuel assembly inspection results, improper construction work at a spent fuel reprocessing facility, revealed the importance of transparency of license holder's QA activities and of regulatory supervision on them. In view of the circumstances, NISA accelerated its regulatory renovation and the NSC reviewed the regulation concerning QA activities for safe operation and presented its views and opinions to NISA.

After the previous reporting, NISA clarified regulatory requirement for QA. NISA encouraged establishment of academic society and association standards in conformity to international standards and reviewed their technical adequacy and license holders apply newly established academic society and association standards to their QA activities.

13.1 Regulatory Requirements for QA of Nuclear Installation

NISA conducts regulatory activities from design stage to operation stage, such as issuance of license, approval of construction plan, inspection of equipment, etc., on the basis of the Reactor Regulation Law and the Electricity Utility Industry Law.

The Reactor Regulation Law stipulates that quality assurance system should be established and be included in the Operational Safety Program, the compliance with which should be confirmed in the Nuclear Safety Inspection.

The aim of the mechanism mentioned above is for license holders to establish comprehensive and systematic QA programs, to implement them and to carry out their accountability to the public to restore confidence of the public.

The key points of QA activities are; a) to involve top management, b) to be based on international standards on QA (ISO9001:2000), c) to improve them by Plan-Do-Check-Act cycle, and d) to establish an independent audit organization.

The Reactor Regulation Law stipulates that license holder's QA program should include a) organization governing the performance of QA, b) plan of activities for safe operation, c) implementation of activities for safe operation, d) evaluation of activities for safe operation, and e) improvement of activities for safe operation.

Note) The term, activities for safe operation, means activities necessary to maintain safety, in maintenance work of facilities, operation of reactors, and transportation, storage and management of nuclear fuel materials or materials contaminated by nuclear fuel materials.

License holders prepare their QA program of the nuclear facilities and implement them, according to JEAC 4111-2003, "Rules of Quality Assurance for Safety of Nuclear Power Plants" established by JEA in autumn of 2003 based on the ISO9001:2000. NISA evaluated the rules and accepted them as *the standards to meet the regulatory requirements.*

The contents of JEAC4111-2003 are shown in Table 13-1.

13.2 Confirmation of QA by Regulatory Body

NISA requires applicant for license, or license holder, of a nuclear installation to submit appropriate QA program, and confirms implementation of QA program as follows:

(1) Examination of Basic Policy for QA activities at Reactor Establishment

NISA requires the applicant to submit the “Policy for Quality Assurance” attached to the application document at safety examination for establishment license of a nuclear installation,

(2) Examination of QA Program in Construction Stage

At examining the construction plan, NISA requires the license holder to submit the “Description on QA Program” which the license holder would carry out through design, manufacturing, installation and functional tests. NISA confirms that the license holder has prepared appropriate procedure to audit subcontractor’s quality control, material control, etc. as well as those of the primary contractor.

(3) Confirmation of QA of Fuel Assembly

NISA requests license holders of fuel assembly fabrication to submit application document for fuel assembly design approval, which describes performance, strength, and flow sheet of fabrication process, etc. of fuel assemblies, and to submit an explanatory document on QA attached to it. *When conducting the Fuel Assembly Inspection, the inspector of NISA confirms not only the license holder’s test results but also license holder’s test procedure.*

For imported fuel assembly, NISA requests the license holder of reactor to submit the description of QA program.

(4) Confirmation of QA Activities throughout Operating Life

NISA confirms QA activities of license holders throughout the operating life of nuclear installations as follows:

- *Description of QA activities in the Operational Safety Program*
- *Confirmation of compliance of the Operational Safety Program in the Nuclear Safety Inspection*

During outage of nuclear facilities, NISA and JNES, in the Periodic Safety Management Review, confirms that the Licensee’s Periodic Inspection is performed appropriately.

13.3 Implementation and Assessment of QA Program by License Holders

Outline of QA activities by license holders is as follows;

(1) Establishment of QA Program

License holder prepares QA program in accordance with *JEAC4111-2003*, and implement QA activities based on it. These programs cover document control, design control, procurement control, management of inspection and testing, nonconformity management, and audit, etc. The license holder submits the “Policy for QA” and “Description on QA Program” to NISA as described in section 13.2 (1) through (4).

(2) QA Activities in Design, Construction, Commissioning, Operation and Maintenance

QA activities are carried out by many organizations. The license holder clarifies the scope and responsibility of the manufacturer in QA activities, and entrust it with QA activities in its scope. In the same way, the manufacturer entrust its subcontractors with QA activities in their scope.

(3) QA Audit

JEAC 4111-2003 defines that QA system of manufacturers undergoes prior review and *inspection* by license holder.

The license holder audits manufacturer's QA activities. The license holder performs an independent in-house QA audit by departments other than nuclear department reporting directly to top management. The independent internal QA audit started, learning lessons from the steam generator tube rupture accident at Mihama Power Station, Unit 2 in 1991.

The manufacturer audits subcontractors' QA activities in addition to its own internal audit of QA activities.

Table 13-1 Contents of JEAC4111-2003, "Rules of Quality Assurance for Safety of Nuclear Power Plants"

0. Introduction
1. Objective
2. Scope of Application
3. Definition
4. Quality Management System
5. Responsibility of Management
6. Management of Resources
7. Planning and Implementation of Job
8. Evaluation and Improvement

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.

Regulatory body (NISA) and licence holders perform and record the assessment and verification of the safety of nuclear installations in accordance with the legislative framework, at each stage of planning, establishment, construction, and operation of nuclear facilities. Necessary regulatory guides are enacted and utilized for assessment and verification of each stage. The audit type inspection is introduced to review the implementing system for the inspection conducted by licence holders at the operation stage.

In recent years, the probabilistic safety assessment methodology has been developed as a supplement to the conventional deterministic safety evaluation, and the resulted risk information are used in regulatory activities such as the development of accident management, and the Periodic Safety Review (PSR) in Japan. Also introduction of the safety goals that define the acceptable risk levels are under development.

The legislative framework required for assessment and verification of the safety is described in the Article 7th .

14.1 Assessment and Verification of Safety prior to Construction

The applicant for a license to establish a commercial power reactor submits a license application document to NISA pursuant to the Reactor Regulation Law.

NISA examines whether the application conform to the licensing criteria prescribed in the Reactor Regulation Law.

The outlines of the safety assessment submitted for Establishment Licence and regulatory criteria are described below.

(1) Documents for Establishment License

An application for establishing a commercial power reactor consists of a main text and attached documents detailing safety design, safety analysis, siting assessment, etc. in accordance with the provisions of the Reactor Regulation Law and the related legislation. The application document describes basic design with sufficient information for examining the safety.

(2) Safety Assessment and Acceptance Criteria

1) Siting Assessment

The siting assessment of a commercial power reactor is conducted pursuant to the Regulatory Guide for Reviewing Nuclear Reactor Siting Evaluation and Application Criteria. The Guideline requires that a) there have as yet been no event (natural disaster) in the past liable to induce large accident and no such event is expected to occur in the future, b) in relation to its engineered safety features, nuclear reactors shall be located at a sufficient distance from the public, and c) 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.

2) Safety Assessment

In the safety examination conducted by NISA, it is verified that basic design or design concept of the commercial power reactor applied conforms to Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities (hereinafter called, the Regulatory Guide for Safety Design), and the safety is discussed and evaluated as a whole in accordance with the provisions of Regulatory Guide for Reviewing Safety Assessment of Light Water Nuclear Power Reactor Facilities (hereinafter called, the Regulatory Guide for Safety Assessment.).

The Regulatory Guide for Safety Design requires that the basic policy of the safety design for commercial power reactors should be established, and structures, systems and components of nuclear reactor facilities should perform the required functions not only in the normal operation condition but also in the assumed abnormal situation to ensure the safety. Specifically, two postulated event categories of "anticipated transients during operation" and "accidents" are defined and the safety during these events is evaluated based on the Regulatory Guide for Safety Assessment. The definition of event categories is almost the same as that of the nuclear safety standards (NUSS) of the IAEA.

Applicants to install nuclear reactors perform safety analysis on these postulated events and proves the adequacy of the safety design of the plant referring the results to the acceptance criteria.

And, NISA examines the results of analysis performed by applicants to install nuclear reactors and if necessary confirms the adequacy receiving the report concerning independent analysis results performed by JNES. Selections of postulated events and their evaluations are as follows.

Single failures and erroneous operation for each system and component are identified as events to be postulated in the safety evaluation, and the representatives of events leading to similar consequences in transients but with the severest results are selected. These postulated events are classified into anticipated transients during operation or accidents through their probability and consequence as described in the Regulatory Guide for Safety Assessment, and the safety is evaluated in accordance with the defined acceptance criteria according to the classification.

a) Anticipated Transients During Operation.

Anticipated transients during operation are those events that may be caused by a single failure or malfunction of component or a single erroneous operation by the operator during the life of commercial power reactors, or events that result in abnormal conditions caused by external disturbances expected to generate in the same degree of frequency of those. Fourteen events for Pressurized Water Reactors (PWRs) and twelve events for Boiling Water Reactors (BWRs) are specified as events to be evaluated. In the analysis of these events, the adequacy of the safety design of such important safety systems as reactor protection system, reactor shutdown system, etc. are confirmed through verifying the integrity of reactor core and reactor coolant pressure boundaries based on the acceptance criteria provided in the Regulatory Guide for Safety Assessment.

b) Accidents

Accidents are events more serious and less frequent than anticipated transients during operation, which have to be postulated for the potential of releasing radioactive substances from a commercial power reactor that should be evaluated. Ten events for PWR and nine events for BWR are selected as events to be evaluated. In the analysis of these events, the adequacy of the safety design of engineering safety features is confirmed by verifying that there would be no significant damage to the core, that reactor containment boundaries would remain sound, and that there would be no significant risk of radiation exposure to the public in the vicinity based on the acceptance criteria provided in the Regulatory Guide for Safety Assessment.

Among the accidents, loss of coolant accident is analyzed and evaluated according to the Regulatory Guide for Safety Assessment and the Regulatory Guide for Evaluating Emergency Core Cooling System Performance of Light Water Power Reactors, and reactivity insertion accident is analyzed and evaluated according to the Regulatory Guide for Safety Assessment and the Regulatory Guide for Evaluationg Reactivity Insertion Events of Light Water Nuclear Power Reactor Facilities.

The Minister of Economy Trade and Industry consults the Nuclear Safety Commission in order to hear the opinion about the results of examination, and the Nuclear Safety Commission deliberates whether there is some problems for preventing radiological hazards or not, etc., and implements the public hearing to evaluate the public opinion.

14.2 Assessment and Verification of Safety Prior to the Commissioning

The licence holder of reactor establishment shall develop a construction plan for establishment of electric structures, and shall obtain the approval of NISA before starting construction in accordance with the Electricity Utilities Industry Law. After obtaining the approval of construction plan, he shall undergo the pre-service inspection by NISA at the every process and at the completion of construction. For fuel assemblies to be loaded into the nuclear reactor, he shall obtain the design approval and undergo the fuel assembly inspection by NISA. For the welding of pressurized parts, containments, etc., the licence holder of reactor establishment shall conduct the Licensee's Welding Inspection, and shall undergo review of the implementation system concerning Licensee's Welding Inspection (Welding Safety Management Review) *performed by JNES.*

Verification of the safety for the approval of construction plan, of fuel assembly design and Welding Safety Management Review are described in the followings.

(1) Verification of Safety at Approval of Construction Plan, and Pre-service Inspection

The licence holder shall develop a construction plan for establishment of electric structures, and shall obtain the approval of NISA after obtaining the establishment license and before starting construction in accordance with the Electricity Utilities Industry Law. NISA will review to confirm that the detailed design of electric structures is not contradictory in the basic design or fundamental design policies of the establishment licensing stage, and is not nonconforming with the technical standards in accordance with the Electricity Utilities Industry Law for the approval of construction plan concerned.

Licence holders, after receiving the Approval of Construction Plan, undergoes Pre-Service Inspection by NISA at each construction stage and at the completion of all construction works, to verify that the construction is completed in accordance with the Approval of Construction Plan and is not nonconforming with the technical standards. The Pre-Service Inspections includes those inspections on structure, strength or leak-tightness of each component and these inspections on function and performance of overall system of commercial power reactor. Details are shown in Table 14-1. The inspection at the time of the criticality and the completion of construction works in the table are so-called commissioning tests. *From October 2003, JNES conduct a part of the above mentioned Pre-Service Inspection.*

(2) Verification of safety through the Approval of Fuel Assembly Design and the Fuel Assembly Inspection

A person who intends to use fuel assembly undergoes the Fuel Assembly Inspection, pursuant to the Electricity Utilities Industry Law, after receiving the Approval of Fuel Assembly Design. NISA, in issuing the approval, verifies that the proposed fuel design takes into consideration of thermal conditions, radiation conditions, corrosion resistance, corresponding to operating conditions, and that it maintains sufficient strength through the years in service. NISA confirms in inspection that fabrication of fuel assemblies is performed in accordance to the approved design and technical standards. The Fuel Assembly Inspection is also required for the replacement fuel, regardless of whether or not there have been design changes. *From October 2003, JNES conduct a part of the above mentioned Fuel Assembly Inspection.*

Imported fuel assemblies are also required to undergo and pass the Fuel Assembly Inspection by NISA.

(3) Verification of Safety through Welding Safety Management Review

The licence holder performs Licensee's Welding Inspection on welded pressurized parts and welded containment, and the management system of Licensee's Welding Inspection undergoes the review by JNES.

14.3 Assessment and Verification of Safety during Operating Life Time

The licence holder obtains the approval of Operational Safety Program before commissioning, and perform the periodical safety assessment, and investigation of an accident or a failure and measures to prevent the recurrence, and undergoes the spot entry inspection conducted by NISA/JNES at any time in addition to the Nuclear Safety Inspection, the Periodic Inspection, and the Periodic Safety Management Review during the operating lifetime, so that the comprehensive confirmation of the safety of commercial power reactors is performed.

Confirmation of the safety by inspection and periodical evaluation of the safety are described in the followings:

(1) Verification of the Safety by Inspection

NISA has set-up resident Nuclear Safety Inspectors at nuclear reactor facilities and performs four inspections per year (Nuclear Safety Inspection) on the observance of Operational Safety Program in accordance with the Reactor Regulation Law to recognize the status of compliance to various regulations for the safety and the status of the activities for safe operation performed by the licence holder. In accordance with the Electricity Utilities Industry Law, NISA and JNES perform the Periodic Inspection of structures and components important to the safety in the time interval that does not exceed 13 months after the day of commissioning or the day of last Periodic Inspection ended,

The inspections which was conducted by the licence holder as self-controlled inspection previously was redefined by the amendment in the Electricity Utilities Industry Law as a Licensee's Periodic Inspection, and JNES performs the audit type inspection (Periodic Safety Management Review) to review the implementing system, planning and management of Licensee's Periodic Inspection.

(2) Periodic Safety Assessment

In accordance with the Reactor Regulation Law, NISA decided in October 2003 to request the *licence holder for the implementation of "Periodic Safety Review (PSR)" in every 10 years interval after the first review at the time not exceeding ten years after commissioning, and for the implementation of "Aging Management Review" by the day passing 30 years after commissioning.*

1) Periodic Safety Review (PSR)

PSR is the effort by the licence holder to evaluate his activities for-safe operation that has been carried out since the commissioning of the plant. PSR is performed in every about ten years and for the purpose to acquire the prospect for the plant concerned be able to continue the safe operation in the next decade with maintaining the high level of performance equivalent to the newest nuclear power plant.

PSR had been carried out since 1992 by the licence holder in accordance with the request of the Ministry of International Trade and Industry (old Ministry of Economy, Trade and Industry), but NISA decided that it is necessary to clarify the position of the Periodic Safety Review as a part of renovation of nuclear safety regulations.

For this purpose, the provisions of "Periodic Assessment of Nuclear Reactor Facilities" was added in October 2003 to the Ordinance of the MITI, No. 77, 1978, the Rules for the Installation, Operation, etc. of Commercial Power Reactors (hereinafter called, the Rules for Commercial Power Reactors), and the implementation of PSR was defined as one of the requirement in the Operation Safety Program

Since compliance to Operational Safety Program is confirmed by Nuclear Safety Inspection, it is possible for NISA to confirm that the licence holder is properly implementing the activities for safe operation in every about ten years through PSR in "the Periodic Assessment of Nuclear Reactor Facilities", and to make request of improvement, if needed.

As items to be implemented at the PSR, a) evaluation of the situation of the activities for safe operation of nuclear reactor facilities (comprehensive evaluation of operating experiences), b) evaluation of the situation of reflection of the state of the art technical knowledge to activities for safe operation (reflection of the newest technical knowledge) are defined. The probabilistic safety assessment is not requested as obligation based on regulation, but required to the licence holder as a self imposed activities to be implemented as used to be.

PSR was implemented for 40 times as to 34 units out of 52 units in operation as of June, 2004 PSR was implemented for second times to six units. (Refer to Table 14-2)

2) Aging Management Review

The Ministry of International Trade and Industry (old Ministry of Economy, Trade and Industry) evaluated the Measures for Aging Management implemented by the licence holder in February 1999 for the nuclear reactors with 30 years after commissioning, and documented in the report, "Evaluation of the Measures for Aging Management for Nuclear Power Stations, and Future Activities on the Aging Management"

In October 2003, NISA added the Aging Management Review in the provisions of "Periodic Evaluation of Nuclear Reactor Facilities" to "the Rules for the Commercial Power Reactors" and provided as one of the requirement in the Operational Safety Program to implement Measures for Aging Management.

Aging Management Review to be implemented at the time within 30 years after commissioning, are:

a) analyze the impacts of technically conceivable aging phenomena on structures and components of nuclear power stations with safety functions, and technically evaluate the *possibility for prevention of the loss of function of the components and structures due to aging phenomena under the present maintenance activities provided to them,*

b) extract new maintenance measures from the technical evaluation results to make a plan of ten-year maintenance program.

c) re-evaluate this ten-year maintenance program with ten-year interval

NISA requested licence holders to report the newly extracted maintenance measures in the ten-year maintenance program of "Measures for Aging Management" to reflect the results on inspections, such as the Periodic Inspection, as necessary. Licence holders should materialize methods of maintenance management, frequency and time, etc. of the maintenance measures into ten-year maintenance program. Licence holders should implement those in accordance with Operational Safety Program.

Since the "Measures for Aging Management" was defined as a requirement of the regulation, more rational and standardized Measures for Aging Management will be investigated and will be provided as academic and association standards etc. in the future based on recipe to aging in abroad and on the latest knowledge.

NISA evaluates the technical evaluation and ten-year maintenance program conducted by licence holders with the incorporation of the of specialists' opinion, as well as the lessens learned from operating experiences in and outside Japan and the latest knowledge, and experimental results.

Technical evaluation and planning of the ten-year maintenance program in relation with the aging were implemented for nine out of fifty-two units as of June 2004. (See to Table 14-3)

14.4 Probabilistic Approach in Regulation

(1) Prior to Construction

1) Acceptance Criteria in Safety Examination

- *Consideration of Fall of an Airplane*

  In the safety examination of reactor establishment licensing, the necessity to consider the fall of an airplane to the reactor facility design as "a human induced external event" should be determined. The probability of an airplane fall to the reactor facility is evaluated as the determining criteria. NISA enacted "on the Assessment Standard on the Airplane Fall Probability to a Nuclear Power Reactor Facility" as a regulatory guide in July 2002.
- *Impact Assessment of the Turbine Missile*

  In the safety examination of reactor establishment licensing, the necessity to consider the turbine missile to the reactor facility design as "a missile generated inside the reactor facility to be assumed" should be determined. The probability of damage to the reactor facility (the coolant pressure boundary in the containment and the spent fuel pool) is evaluated as the determining criteria.

(2) Prior to Commissioning

1) Assessment of the Effectiveness of Accident Management Measures

The licence holders implemented PSA for nuclear power reactors under operation or construction to evaluate the integrity of the core and the containment in a case of the severe accident, and utilized it for assessment of the effectiveness of their accident management measures. Internal events during operation were subject to their analysis, and the results were utilized to extract accident management measures and to evaluate their effectiveness.

(3) During the Operating Lifetime

1) Safety Assessment through the Periodic Safety Review(PSR)

As one of the activities of PSR the licence holders implemented PSA for internal events during power operation using the newest data, and the results were utilized for the assessment of safety features of the nuclear reactor facilities and verification of the effectiveness of the accident management measures. *PSA for internal events during the shutdown conditions was additionally implemented through the PSR in 2001 and afterwards.*

2) Assessment of Allowed Out of Service Times (AOT) defined in Operational Safety Program

The operational restriction of the engineered safety system and the permissible time of recovery at the time of the standby exceptions (Allowed Out of Service Times (AOT)) are to be set up in the Operational Safety Program. On this matter, the Nuclear Power Engineering Corporation (predecessor of JNES) had developed and proposed standard techniques as evaluation methods on the adequacy of AOT, referring mainly to the U.S Standard Technical Specifications (STS) and taking account of the components failure rates in Japan also.

3) The Impact Assessment and Evaluation of the Measures Taken to Pipe Rupture Accident in the Unit-1 of Hamaoka NPS

In the study on the measures to prevent recurrence of the pipe rupture accident occurred in November 2001 on the steam condensing line (SCL) of the residual heat removal system (RHRS) of the Unit 1 of Hamaoka NPS, the PSA with considerations of the pipe break accident specifically to SCL of RHRS, was implemented on core integrity and it was evaluated that the pipe rupture of the accident concerned does not significantly increase the risk. It was also evaluated that several proposed measures were effective in reducing the risk.

14.5 Introduction of Safety Goals

The NSC has issued regulatory guides and standards required for the examination in administrative steps to ensure the prevention of radiation hazards and the public safety. These standards and regulatory guides provided the basis of design, construction, and operation of the facility necessary to restrict the risk on the public, to a sufficiently low level. However, except the Regulatory Guide for the Annual Dose Target for the Public in the Vicinity of Light Water Nuclear Power Reactor Facilities, there were no guidelines that define quantitative objectives for acceptable to the public.

As development on PSA methodology to quantify the risk levels of nuclear power plants has progressed, the NSC started discussions on safety goals and issued a report on Interim Safety Goals in December 2003. The report discusses the objectives, scope and draft of the interim safety goals and issues to be investigated further.

The outline of the draft safety goals are as follows.

(1) Concerned Activities for Utilization of Nuclear Energy

The safety goal should be established for all activities in the utilization of nuclear energy that may have the adverse influence of radiation exposure on the public. Application of the established safety goal should be with considerations of the maturity of risk assessment models and the characteristics of each risk in each activity area. And the established safety goal should not be uniformly applied to all *activities.*

(2) Structure of Safety Goal

The safety goal consists of two fold. One is the qualitative goal, which is a acceptable level of danger (risk) of an accident that nuclear operators (licence holders) must observe under the nuclear safety regulations. The other is the quantitative goal that specifies the numerical value corresponding to the acceptable level of the risk. In this context, the risk during normal operation of nuclear power reactor facilities, for which the numerical guideline of dose limits is specified, is excluded.

Since indicators of the qualitative goal is important to show the safety level, it is desirable to be objective and common to all risks accompanied to various activities, in which the possibility of health damage is not fully excluded.

Therefore, the individual mortality of the pubic should be used as the indicator to meet these requirements. And the events to be concerned that may have effects on the quantitative goal are both internal events such as failure of components and human error, and external events such as earthquakes, tsunamis, and fall of an airplane. But, intentional and artificial events such as destructive activity against an industry are excluded.

The mean values that could be obtained by evaluating the magnitude of the uncertainty will be used as a general rule for the comparison of quantitative goal or the performance goal of nuclear installations to be developed in the future to the results of risk-assessment.

(3) Contents of the Draft of the Safety Goal

The draft of the safety goal is as follows:

1) the Qualitative Goal

The possibility of health damage to the public by emission of radiation or release of radioactive materials accompanied with activities for utilization of nuclear energy should not meaningfully increase the risk of damage to the health of the public in daily life.

2) the Quantitative Goal

The mean value of acute fatality risk by radiation exposure resulting from an accident of a nuclear installation to individuals of the public, who habit in the vicinity of the site boundary of a nuclear installation, should not exceed the probability of about $1x10^{-6}$per year. And, the mean value of fatality risk by cancer caused by the radiation exposure resulting from an accident of a nuclear installation of individuals of the public, who habit in the area in some distance from the nuclear installation, should not exceed the probability of approximately $1x10^{-6}$per year.

3) the Performance Goal for Each Area of Activities for Utilization of nuclear energy

It is reasonable to review and indicate the level that will be understood as the performance goal to conform with the safety goal, according to the characteristics of each accident that could occur at nuclear installations. As an example for nuclear reactor facilities, it is appropriate to review the probability of occurrence of the severe core damage and the probability of occurrence of a release event of significant amount of radioactive materials in a specific time period during normal operation of nuclear reactor facilities.

14.6 Activities for Introduction of the Safety Regulation with Utilization of Risk Information

In order to establish more effective and efficient regulatory system, utilization of risk information for safety regulations has been progressing in each country, though the extent is different.

Also in Japan, the Nuclear Safety Commission decided in November 2003, "the Basic Policy on Introduction of Nuclear Safety Regulation with Utilization of Risk Information". This policy describes that nuclear safety regulations with utilization of risk information will be as follows:

- *It is useful for enhancement of the rationality, consistency and transparency of the safety regulation and for proper allocation of resources for activities of the safety regulation.*
- *It will evolve and advance the regulation, which has been based on the conventional engineering judgment and deterministic evaluation, by utilizing risk information obtained from quantitative and probabilistic assessment, while basically maintaining the concept of defense-in-depth.*
- *At this stage, it is appropriate to focus on a study on its introduction at the operation stage, and in the future, it will be aimed at to systematically study its introduction into the whole safety assurance system that includes design and construction stage, taking into considerations of the safety goals currently under study.*
- *For its introduction, it is important to ensure the reliability and transparency of the risk assessment and to win its broad understanding of the general public.*

And the NSC expects regulatory bodies and licence holders to perform the positive study on its introduction into their concrete safety assurance and regulatory activities, and academic and industrial societies and research organizations, etc. to prepare the voluntary consensus standards for risk assessment and conduct the safety research on the risk assessment.

In response to the above-mentioned decision of the NSC, NISA announced in December 2003, "the Study of the Nuclear Safety Regulation with Utilization of Risk Information", and clarified the approach, as the administrative authority of the regulation, to show how risk information will be utilized for the safety regulation from now on. The contents are as follows:

(1) Fundamental Concept

The fundamental concept for the study of NISA on the concrete method for utilization of risk information for the safety regulation is as follows. The study will be conducted with due deference to the basic policy of the NSC and close exchange of opinions with the NSC.

- *The utilization of risk information will be studied, in principle for all stages such as siting, design, construction, operation, inspection and decommissioning, etc. of all nuclear facilities under the regulatory responsibility of NISA.*
- *By utilizing risk information, the subjects to be improved from now on will be found out from all the systems and activities responsible for the safety regulation of NISA, and more effective and efficient safety regulation will be realized.*
- *However, since the significance and urgency of utilization of the risk information and the maturity of the methodology for risk assessment vary in each area and stage of utilization of nuclear energy, the study will be initiated first from the area where the enhancement of the effectiveness of safety regulation and the efficiency improvement with the regulatory resources can be expected by utilization of risk information, as well as the area where the risk assessment methodology has matured.*
- *With these considerations, the immediate major subjects of the study will be nuclear power plants among nuclear facilities, which have the utilization experience of the risk information. The buildup of research results on PSA methodology, and operating experiences, and the area where the risk information (such as frequency of core damage, its contributing factors and the uncertainty) obtained as a result of Level 1 PSA can be used.*

- *Taking into account the fact that the importance of inspection system has been pointed out from the falsification issues of licence holders, utilization of risk information in the inspection system such as Periodic Inspection and Licensee's Periodic Inspection shall be the first and foremost immediate subject.*
- *Utilization of risk information shall be promoted conducting the adequate study and building up sufficient experiences through a trial run (for example, pilot projects) etc. to find issues and resolve them, prior to its full-scale application.*
- *It is required to normalize the standard PSA methodologies by academic and industrial societies and perform PSA with those methodologies in advance of utilization of risk information. While NISA cooperates with academic and industrial societies for review of PSA methodologies, NISA will recommend licence holders to perform PSA with such standardized methodologies.*

(2) PSA Methodology and Preparation of Database

In order to use the methodology of probabilistic safety assessment (PSA) for the safety regulation, it is required to ensure the reliability and transparency of the methodology.

The maturity of the PSA methodologies varies depending on the subjects to be assessed. In the case of nuclear power stations, the assessment of core damage frequency (level 1PSA) and the assessment of reactor containment failure frequency and source term (level 2PSA), caused by components failure due to internal events, have been almost established technically, and the standard methodology has been already developed by the Nuclear Safety Research Association (foundational juridical person). And currently the Atomic Energy Society of Japan (corporate juridical person) has been conducting its review and standardization. The assessment methodologies for risk to the public health (level 3PSA) and external events such as earthquake have been developed, but not yet standardized by academic and industrial societies. For facilities other than nuclear power stations, the methodologies of PSA have been under developmental stage in many cases. For this reason, much more efforts to develop and improve those methodologies are desirable.

From the standpoint of ensuring the reliability and the transparency of assessment methodologies, it is important that review of assessment methodologies are conducted by organizations such as academic and industrial societies, and they are standardized under fair procedures. Currently, the Atomic Energy Society of Japan has been performing the standardization of assessment methodologies under fair and neutral procedures including public review. While NISA participates in those activities of academic and industrial societies, it will further confirm the technical adequacy of the standardized methodologies as the regulatory body and then apply them for the safety regulation. While doing that, it is also necessary to clarify the applicable scope and limits of assessment methodologies, and uncertainties of analytical results, etc. and make the conditions clear to use those methodologies properly.

Also for data of components failure rates to be used for PSA, it is necessary to ensure their adequacy and reliability. Licence holders have been preparing database in the Central Research Institute of Electric Power Industry, but the adequacy and reinforcement of domestic actual data concerning common cause failures and human factors, etc. are required, while the reliability of data is to be reviewed in fair and neutral channels such as academic and industrial societies.

In the study on utilization of risk information for the safety regulation, it is necessary to take into consideration the preparation status of PSA methodologies and data.

(3) How to Proceed with the Study

From now on, NISA is going to steadily perform the study on the concrete methods for utilization of risk information for the safety regulation, and the study on the concrete methods for utilization of risk information for inspections at nuclear power stations, which is the immediate top-priority subject, is to *be conducted by "Study Group on the Way of Inspection" set up under the Nuclear and Industrial Safety Subcommittee.*

It is necessary in conducting the study on utilization of risk information for safety regulation to make efforts to get understanding of the general public at all levels, asking for public comments at the appropriate study stage and reflecting their opinions on the study, along with ensuring the transparency of study process.

Table 14 - 1 Outline of Pre-Service Inspections

Time of Inspection	Contents of Inspection
(1) At the time of installation of each structures and components	Test of structure, strength and/or leak tightness of reactor, reactor cooling system, instrumentation and control system, fuel handling system, radiation management system, waste processing system or reactor containment structure is performed, when each item has been installed and be ready to such testing. Specifically, material inspection, structure inspection, pressurized leak test, inspection on foundation and inspection on support structure are performed
(2) At the time of installation of steam turbine and auxiliary boilers	Test of structures of steam turbine is performed when installation of bottom half part of turbine casing is completed. Test of structure, strength and/or leakage on auxiliary boiler is performed when its main part completed to assembly.
(3) At the time of fuel loading	When the reactor is ready for fuels to be loaded, inspections of systems around reactor, items required ensuring safety before fuel loading, and items for which inspection would be difficult after fuel loading are performed. In the case of BWR, inspection of main steam bypass valves, inspection of function and performance of those systems as control rod drive system, core spray system, residual heat removal system, etc. and functional inspections of safety protection system, etc. are performed.
(4) At the time of criticality	When the reactor reaches criticality, inspections are performed on nuclear characteristics of reactor core, and function and performance of overall commercial power reactor which can be performed only after fuel loading In the case of BWR, an inspection to confirm shutdown margin at full fuel loading, inspections of control rod full stroke test, effective multiplication factor at first criticality and moderator temperature coefficient tests are performed.
(5) At the time of completion of construction	When all construction work under the Construction Plan has been completed, inspections are performed on performance of systems around reactor, functions and performances of overall commercial power reactor that can be confirmed after fuel loading, and functions and performance of systems other than those around reactor. In the case of BWR, inspections are performed on one control rod scram test, loss of external power-supply test, generator load interception inspection, plant trip inspections, load inspections.

Table 14-2 Periodic Safety Reviews Performed During the Reporting Period

The 8th Review (announced in August 2002)

Unit 3 of the Fukushima Daini NPS (Tokyo Electric Power Co., Inc.: BWR)
Unit 4 of the Fukushima Daini NPS (Tokyo Electric Power Co., Inc.: BWR)
Unit 1 of the Kashiwazaki-kariwa NPS (Tokyo Electric Power Co., Inc.: BWR)
Unit 3 of the Hamaoka NPS (The Chubu Electric Power Co., Inc.: BWR)
Unit 2 of the Shimane NPS (The Chugoku Electric Power Co., Inc.: BWR)
Unit 1 of the Sendai NPS (Kyushu Electric Power Co., Inc.: PWR)
Unit 2 of the Sendai NPS (Kyushu Electric Power Co., Inc.: PWR)

The 9th Review (announced in December 2003)

Unit 1 of the Takahama PS (The Kansai Electric Power Co., Inc.: PWR) (the second time)
Unit 2 of the Takahama PS (The Kansai Electric Power Co., Inc.: PWR) (the second time)
Unit 1 of the Shimane NPS (The Chugoku Electric Power Co., Inc.: BWR) (the second time)
Unit 1 of the Genkai NPS (Kyushu Electric Power Co., Inc.: PWR) (the second time)

Table 14-3 Implementation Status of Measures for Aging Management

The 1st Time (announced in February 1999)

Unit 1 of the Tsuruga PS (The Japan Atomic Power Co., Inc.: BWR)
Unit 1 of the Fukushima Daiichi NPS (Tokyo Electric Power Co., Inc.: BWR)
Unit 1 of the Mihama PS (The Kansai Electric Power Co., Inc.: PWR)

The 2nd Time (announced in June 2001)

Unit 2 of the Fukushima Daiichi NPS (Tokyo Electric Power Co., Inc.: BWR)
Unit 2 of the Mihama PS (The Kansai Electric Power Co., Inc.: PWR)

The 3rd Time (announced in March 2004)

Unit 1 of the Takahama PS (The Kansai Electric Power Co., Inc.: PWR)
Unit 2 of the Takahama PS (The Kansai Electric Power Co., Inc.: PWR)
Unit 1 of the Shimne NPS (The Chugoku Electric Power Co., Inc.: BWR)
Unit 1 of the Genkai NPS (Kyushu Electric Power Co., Inc.: PWR)

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.

The standards of radiation protection for the general public and personnel engaged in radiation work in Japan are prescribed in the laws and legislations, such as the Reactor Regulation Law, the Electricity Utilities Industry Law and the Industrial Safety and Health Law, etc. The recommendations of the ICRP 1990 are incorporated into their provisions of radiation protection with due considerations. Consequently, licence holders have kept the radiation exposure doses of personnel engaged in radiation work below the dose limit, as a matter of course, and have attempted to reduce the exposure based on the ALARA policy.

15.1 Summary of Laws and Requirements on Radiation Protection

The national standards of radiation protection for a nuclear installation are provided in the Reactor Regulation Law, the Electricity Utilities Industry Law and the Industrial Safety and Health Law, etc. and related government ordinances, ministerial orders and notifications based on these laws, and guidelines. The recommendations of the ICRP 1990 are given due consideration and are incorporated into legislation and regulation. Japan will consider the incorporation of future recommendations if necessary.

A ministerial ordinance, the Rules for Commercial Power Reactors, established close on radiation protection, on the basis of the Reactor Regulation Law, prescribes area control for radiation protection, radiation control of personnel engaged in the radiation controlled areas, measurement and surveillance of radiation levels, monitoring of discharged radioactive materials, and maintenance of radiation control equipment. The Dose Limit Notification are enacted, which prescribes dose limits and concentration limits of radioactive materials both inside controlled area and outside peripheral monitoring area, and dose limits and concentration limits of radioactive materials for personnel engaged in radiation work, and dose limits for personnel engaged in emergency activities.

In order to ensure those rules are complied with, each licence holder, it is required to prescribe in the fitness-for-safety program, 1) radiation control area, access controlled areas, and peripheral 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.

Ministerial order “Ordinance of Establishing Technical Standards for Nuclear Power Generation Equipment” based on the Electricity Utilities Industry Law, provides the technical standards for radiation control equipment (biological shielding walls, ventilation facilities, instrumentation devices, alarm devices, and waste processing equipment, etc.) at nuclear installations. NISA confirms that such radiation control equipment conforms to the ministerial order at issuing approval of the construction plan and conducting inspection of the equipment.

The Industrial Safety and Health Law provides that licensees (employers of laborers) take measures to prevent damage to health of personnel engaged in radiation works, including radiation exposure, throughout the period of employment, and requires them to take actions for safety and health education, work environment monitoring and medical examination of workers. On the basis of the law, the Ministry of Health, Welfare and Labor has enacted a ministerial order, the Rules for Prevention of Damage from Ionizing Radiation, which prescribes controlled areas, dose limits and measurement, protection from external radiation, and prevention of radioactive contamination.

Radioisotopes etc. used in commercial power reactors are also regulated in accordance with the Law for Prevention of Radiation Hazards due to Radioisotopes, etc. in the same manner as regulated by the Reactor Regulation Law.

In examining the license to establish a nuclear installation, it is confirmed that the application conforms to the Regulatory Guides established by the NSC as well as the legislation and technical standards. Regulatory Guide for the Annual Dose Target for the Public in the Vicinity of Light Water Nuclear Power Reactor Facilities, one of these Regulatory Guides, gives dose target guide to reduce the discharge of radioactive materials from a nuclear installation into environment and the dose rate of the public as low as reasonably achievable (ALARA).

Each licence holder has defined the release control target of liquid wastes and gaseous wastes in the fitness-for-safety program based on this Regulatory Guide for the Annual Dose Target for the Public in the Vicinity of LWR.

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

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

15.2 Laws and Requirements and Response of Licence Holders

(1) Allowable Dose Limits

1) Allowable Dose Limits for Controlled Areas

The Rules for Commercial Power Reactors and the Dose Limits Notification requires licence holders to establish radiation controlled area including reactor room, and spent fuel storage facilities and radioactive waste disposal facilities, where the dose of external radiation may exceed 1.3mSv 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.

2) Allowable Dose Limits for Occupational Exposure

The allowable dose limits for personnel engaged in radiation works are specified in the Dose Limits Notification as listed in Table 15-1

Table 15-1 Dose limits for personnel engaged in radiation work

Items	Limit
1. Effective dose limits	
a) Personnel engaged in radiation works	100 mSv / 5 year, but do not exceed 50 mSv for any year
b) Female personnel	100 mSv / 5 year, but do not exceed 5 mSv for any 3 months
c) Pregnant Female personnel	100 mSv / 5 year, but do not exceed 1 mSv from internal exposure during pregnancy
2. Equivalent dose limits	
a) Eye lens	150 mSv/ year
b) Skin	500 mSv/ year
c) Female abdominal region	2 mSv from notification of pregnancy to delivery
3. Dose limits for the personnel engaged in emergency radiation works	
a) Effective dose	100 mSv/ incident
b) Equivalent dose for eye lens	300mSv/ incident
c) Equivalent dose for skin	1Sv/ incident

Licence holders have paid much effort not only to comply with the allowable dose limits but also to reduce doses in line with ALARA concept by taking following activities:

– reducing radiation source in systems and components of a nuclear installation,
– keeping distances from or setting shields against radiation sources,
– reducing working time in radiation environment.

Consequently, the exposure doses of personnel engaged in radiation work, etc. have been successfully reduced to the level as shown in Annex 2.

Exposure doses of personnel engaged in radiation work in commercial NPPs during the reporting period are summarized as below;

a. Dose per Persons at Commercial NPPs

Average of dose per persons at commercial NPPs for the reporting period were1.2 to 1.4 mSv/year, and it shows slight increase for recent several years. However, the doses are well within the dose limit prescribed in the notification.

In fiscal 2003, average personnel dose was 1.4mSv/year, maximum personnel dose experienced at a NPP was 19.8mSv, this number was within the dose limit of the notification, still they were slightly higher than these numbers of 1.3mSv/year and 19.7mSv for the previous year. One worker who had worked in plural NPPs exceeded 20mSv, but it was well below the dose limits. The number of workers who had been exposed of 15 to 20 mSv/year was 577, and this number showed slight increase of 559 for the previous year.

Table Collective Dose ,Average Dose per Persons and Numbers of Workers at Commercial NPPs

	2000 Fy	*2001 Fy*	*2002 Fy*	*2003 Fy*
Collective Dose (man-Sv)	*78.83*	*78.05*	*84.03*	*96.41*
Average dose per person (mSv/year)	*1.2*	*1.2*	*1.3*	*1.4*
Total number of Workers	*65,900*	*67,800*	*63,800*	*66,600*

b. *Performance of Collective Dose at Commercial NPPs*

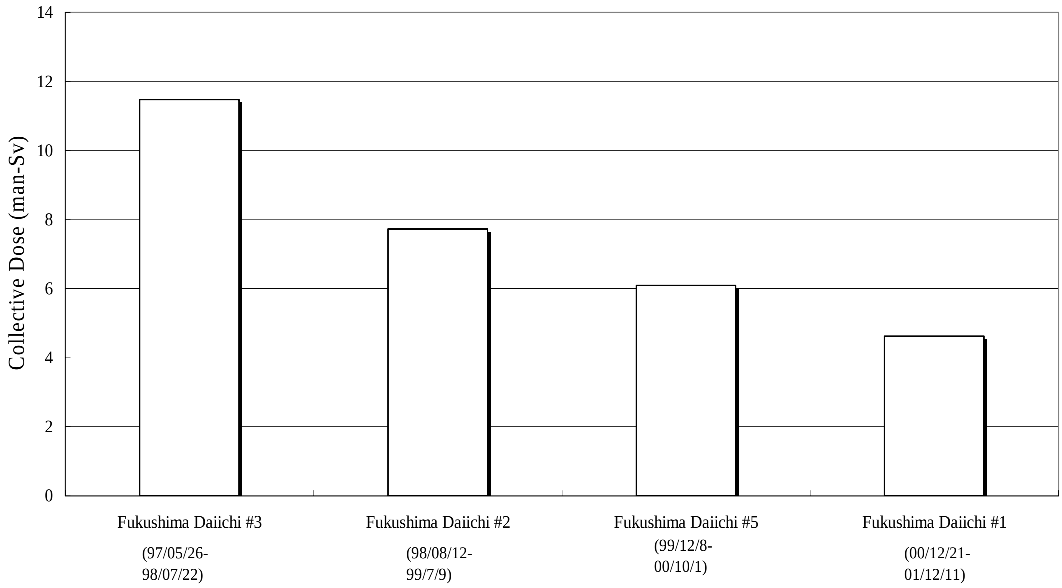
In Japan at the end of March, 2004, total of 53 units, namely 30 BWRs and 23 PWRs were operating.

The average collective dose per reactor year was slightly increasing for recent several years. The data for operating BWRs were 2.10 man-Sv for 2002 Fy and 2.20 man-Sv for 2003 Fy respectively. The reasons for these increase were due to many modernization works in primary loop recirculation pipings and CRDMs and many inspections/repairs works in core shroud and primary loop recirculation pipings under the high radiation environments.

Table Collective Dose per Unit/Reactor-Year

	2000 Fy	*2001 Fy*	*2002 Fy*	*2003 Fy*
BWR Plants(man-Sv/Ry)	*1.96*	*1.68*	*2.10*	*2.40*
PWR Plants(man-Sv/Ry)	*1.03*	*1.27*	*1.00*	*1.07*

Licence holders has been making efforts to reduce collective dose associated with large scale modernization like replacement of core shroud and primary loop recirculation pipings, and the collective doses are reducing year by year as shown in the case of reactor units of Fukushima Daiichi NPPs as shown below



Reduction of Man-Sv in the Core Shroud Replacement at Fukushima Daiichi NPPs

3) Dose Limits for the Public

The dose limits for the public are also given in the Dose Limit Notification as listed in Table 15-2.

Table 15-2 Dose limits for the public

Items	Limit
Dose limits outside the peripheral monitoring area	
Effective dose	1 mSv/ year
Equivalent dose for eye lens	15 mSv/year
Equivalent dose for skin	50 mSv/ year

(2) Conditions for Discharge of Radioactive Materials

1) Dose Target Guide to Reduce Dose of the Public in Vicinity and Discharge Control (ALARA)

In the Dose Target Guide for the Public in the Site Vicinity, the NSC has prescribed the numerical guide of 0.05 mSv, one twentieth of the dose limit to the public, in order to reduce 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 licence holder establishes an annual numerical discharge control guide, which corresponds to the dose target guide at the site vicinity, and makes efforts to keep the discharges of radioactive effluents below the numerical discharge control guide. NISA acknowledges the numerical discharge control guide and receives report on it from the licence holder.

2) The 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 (BWR and PWR) over the past seven years are shown in Tables 15-3 to 15-5. The tables clearly show that the discharge quantities are substantially below the numerical discharge control guide, gas discharge from the PWR being only one thousandth of the dose target. This is due to the fact that the licence holders have carried out the radiation management of the nuclear installation in line with the ALARA principle, including following measures.

Gaseous waste is discharged from ventilation port, while being measured and monitored, after particles are removed by high efficiency filter, and noble gas and iodine are decayed in a holdup tank or charcoal bed noble gas holdup equipment.

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

Substantive reduction of fuel leak by improvement of fuels, (consequently, only three cases with four fuel assemblies) of fuel leak arose during the period of reporting), filtering ventilation during periodic inspections through local high efficiency filter, and other efforts to minimize generation of liquid waste resulted in very low level of discharge of gaseous and liquid radioactive wastes.

(3) Environmental Radiation Monitoring

The licence holder is required to install environmental radiation monitoring equipment during normal operation of a nuclear installation. These equipments include monitoring devices of the dose inside the radiation control area and outside the peripheral monitoring area and automatic devices to alarm any abnormal increase of concentration of radioactive materials or dose rates.

The licence holder 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 radiation level independently at the site vicinity to protect public health and safety.

The NSC decided fundamentals of planning and implementation of monitoring and the evaluation of radiation dose in the Guide for Environmental Radiation Monitoring, in order to improve and to standardize monitoring technology. Local governments and licence holders implement monitoring in accordance with this guide.

15.3 Regulatory Control Activities

(1) Discharge Control of Radioactive Materials

By the Rules for Commercial Power Reactors, the licence holder is required to report immediately to the NISA when 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 peripheral 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.

(2) Control of Personal Exposure

The Rules for Prevention of Damage from Ionizing Radiation require licence holder to measure dose due to external and internal exposure of workers who are engaged in radiation work or in emergency work, or enter temporal access into radiation control area. The rules require that the licence holder monitor and check daily dose due to external exposure, if it is expected to exceed the specified value of 1mSv at 1cm dose equivalent, and calculate, without delay, the dose of the personnel engaged in radiation works using the method prescribed by the Minister of Health and Labor, and keeps those records for a period of thirty years.

The Radiation Workers' Registration Center of the Association of Radiation Impact was established in November 1977, to address the difficulty of controlling the personal dose of workers who work in more than one radiation environment. The Center unitarily collects and controls such personal radiation control data of the workers who work under the Reactor Regulation Law, as personal identification control, personal radiation control booklet, periodical dose registration and transfer and custody of personal radiation dose record.

(3) Control of Collective Dose

Collective dose per rector unit is increasing in recent years as described in 15.2 (1) b. As one of the approach to scientific and rational regulation, feasibility of optimizing the collective dose by effective and efficient inspection/repair work introducing Rules on Fitness-for-Service for Nuclear Power Plants.

It is necessary to analyze the factors in detail that leads to the increase in collective dose, fact finding survey is planned in 2004Fy, and it is planned to abstract the items to be studied for optimization. It is planned to derive practical measures for optimization in future, based on the survey.

Table 15-3 Annual discharge of radioactive noble gas in gaseous waste

(unit: Bq / year)

Year / Station	1997	1998	1999	2000	*2001*	*2002*	*2003*	Dose Target Guides
Station - A	N.D.*	N.D.	N.D.	N.D.	*N.D.*	*N.D.*	*N.D.*	6.7×10^{15}
Station - B	4.3×10^{11}	6.1×10^{11}	1.2×10^{11}	5.7×10^{10}	1.5×10^{10}	2.8×10^{10}	1.8×10^{10}	3.7×10^{15}

*: N.D. indicates a value below the detection limit concentration of 2 x 10^{-2} Bq/cm^3.

Table 15-4 Annual discharge of radioactive iodine (I-131) in gaseous waste

(unit: Bq / year)

Year / Station	1997	1998	1999	2000	*2001*	*2002*	*2003*	Dose Target Guides
Station - A	N.D.*	N.D.	N.D.	N.D.	*N.D.*	*N.D.*	*N.D.*	2.3×10^{11}
Station - B	8.6×10^{5}	1.2×10^{5}	1.6×10^{5}	1.1×10^{6}	2.7×10^{5}	*N.D.*	*N.D.*	1.0×10^{11}

*: N.D. indicates a value below the detection limit concentration of 7 x 10^{-9} Bq/cm^3.

Table 15-5 Annual discharge of radioactive materials (excluding ^{3}H) in liquid waste

(unit: Bq / year)

Year / Station	1997	1998	1999	2000	*2001*	*2002*	*2003*	Dose Target Guides
Station - A	N.D.*	N.D.	N.D.	N.D.	*N.D.*	*N.D.*	*N.D.*	2.5×10^{11}
Station - B	N.D.	N.D.	N.D	N.D.	*N.D.*	*N.D.*	*N.D.*	1.4×10^{11}

*: N.D. indicates a value below the detection limit concentration of 2 x 10^{-2} Bq/cm^3. (Represented by ^{60}Co.)

(Note) Station - A : Kashiwazaki-Kariwa NPS (BWR)

Station - B : Ohi NPS (PWR)

Article 16 Emergency Preparedness

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

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

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

On emergency preparedness, the Special Law of Emergency Preparedness for Nuclear Disaster (hereinafter called as "Special Law for Nuclear Emergency") was enacted in December 1999, taking the lessons learned from the JCO criticality accident.

Considering the special characteristics of nuclear emergency, measures for nuclear emergency preparedness have been defined to cope with the existing legal framework established by the Basic Law on Emergency Preparedness, which had defined preparedness for disasters such as earthquakes, typhoons, and conflagrations.

After the previous reporting, the NSC reviewed "Emergency Measures for Nuclear Installations Guideline" (hereinafter called as "Emergency Preparedness Guidelines"), which decides technical aspects of nuclear emergency measures, harmonizing with the Special Law for Nuclear Emergency and including the lessons learned from the JCO criticality accident, and revised the guidelines concerning the preventive intake of stable iodine tablets, measures for mental health at a nuclear emergency, the designation of regional medical treatment system for exposed patients in emergency, etc.

16.1. Development of Laws and Rules for Nuclear Emergency Preparedness

For Japan who was promoting the utilization of nuclear energy under the basic premise of securing safety, the JCO criticality accident occurred in September 1999 was for the first time, and such a very serious accident as local residents were instructed for sheltering or evacuation.

Lessons learned from the accident clarified the special characteristics of nuclear emergency, which would require quick initial responses, close coordinated cooperation between national government and local governments, strengthening of the national emergency preparedness and the clarification of licence holder's responsibilities. The Special Law for Nuclear Emergency was enacted in December 1999 and enforced in June 2000, addressing the special characteristics of nuclear emergency mentioned above. The Special Law for Nuclear Emergency was enacted so as to harmonize with existing legal framework established by the Basic Law on Emergency Preparedness, which had defined roles of the national government, local governments, etc. in emergencies such as earthquakes, typhoons, and conflagrations.

The "Nuclear Emergency Preparedness" in the Basic Plan for Emergency Preparedness based on the Basic Law on Emergency Preparedness, was extensively revised in accordance with the Special Law for Nuclear Emergency, clarifying roles and responsibilities of the national government, local governments, and licence holders etc.

The NSC, in May 2000, also taking into consideration of the Special Law for Nuclear Emergency and the lessons learned from the JCO criticality accident, revised the "Emergency Preparedness Guidelines" on technical and special matters of a nuclear emergency measures, to include:

- Research reactors and nuclear fuel cycle facilities in addition to commercial power reactors, and,
- Accidental release of nuclear fuel material etc. in addition to release of rare gas and iodine from NPS etc.

After that, the Emergency Preparedness Guidelines have been enhanced through the following several revisions by the NSC:

- In March 2001, the dose coefficient (Sv/Bq) for internal exposure was changed along with the term, in response to amendment of the relevant legislations such as the Reactor Regulation Law etc. based on adoption of the 1990 Recommendation of ICRP;
- In June 2001, provisions of the medical treatment for exposed patients in emergency was revised to be more effective and responsibilities of the national and local governments and nuclear licence holders were clarified based on the experience of the criticality accident;
- *In April 2002, protective measures concerning preventive taking of stable iodine tablets were established based on the scientific knowledge acquired from the long-term follow-up survey to atomic bomb sufferers and the investigation results of the Chernobyl Power Station accident, etc;*
- *In November 2002, measures for mental health care in a nuclear emergency were established based on the experience of JCO criticality accident, experiences of natural disasters such as seismic disasters, etc; and,*
- *In July 2003, the designation of regional medical treatment system for exposed patients in emergency was established.*

16.2. Nuclear Emergency Preparedness and the Measures

The Special Law for Nuclear Emergency has prescribed measures in nuclear emergency at power reactors, research reactors, nuclear fuel cycle facilities, etc. Emergency preparedness of a commercial power reactor is given below.

(1) Nuclear Emergency Preparedness concerning Nuclear Installations (Fig. 16-1)

Quick response and closely coordinated cooperation among relevant organizations are important in a nuclear emergency.

- The Special Law for Nuclear Emergency defines specific initial events in NPS (see Table 16-1), the occurrence of which the licence holder shall immediately notify the Minister of METI and the heads of related local governments.
- The Minister of METI, receiving the notification, triggers activities according to the procedure stipulated by the law. Staff with expertise in emergency measures will be sent to local governments on request. The Senior Specialist for Nuclear Emergency collects information and coordinates activities preventing expansion of the events.
- When the Minister of METI recognizes that the specific initial event exceeds the predetermined level and has developed into an emergency, the Minister immediately reports it to the Prime Minister.
- The Prime Minister have powerful authority to declare “Nuclear Emergency”, and to advise or direct relevant local governments on necessary measures such as sheltering or evacuation to be taken by them, as well as to request for dispatch of the Self-Defense Forces concerning implementation of emergency measures.
- The Prime Minister establishes the "Nuclear Emergency Response Headquarters" in Tokyo, which he will head, and the "Local Nuclear Emergency Response

Headquarters" at the site.

- *In a nuclear emergency, the NSC establishes "Technical Advisory Organization in an Emergency" that is composed of commissioners and the Advisors for Emergency Response. The Organization gives technical advises to the Prime Minister..*
- Local governments establish their own emergency response headquarters.
- In order to share information between the national government and related organizations such as local governments, nuclear licence holders, 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 mentioned later.

(2) Measures for On-site and Off-site Nuclear Emergency Preparedness of Nuclear Installations

In order to prepare the "Nuclear Emergency Preparedness" described in paragraph (1), organizations relevant to nuclear emergency preparedness keep themselves ready to collect and send information and start quick response against an emergency, and conduct emergency drills, disseminate knowledge and promote research on emergency preparedness. Outline of roles and responsibilities of related organization are as follows.

1) On-Site Emergency Preparedness of Nuclear Installations

When the licence holder detects abnormal release of radioactive material or abnormal level of radiation at a nuclear installation, it takes necessary measures to prevent progression of the event into an emergency.

The licence holder, to cope with emergency properly, prepares a licence holder's emergency action plan after consulting with related local governments, which provides for prevention of, emergency measures against, and post-emergency restoration of a nuclear emergency, including on-site and off-site cooperation with other organizations. Especially, quick and accurate notification of occurrence of specific initial events to related organizations is a very important obligation of the licence holder.

The licence holder is required to take part in comprehensive drills with related organizations, and keep close contact with them.

2) Emergency Preparedness in the Vicinity of Nuclear Installations

Roles and responsibilities of the national government and local governments in emergency preparedness in the vicinity of nuclear installations are defined in the Special Law for Nuclear Emergency and the Basic Plan for Emergency Preparedness. Each local government develops its own regional emergency prevention plan. They carry out emergency environmental radiation monitoring, and implement evacuation or sheltering of residents receiving advice or direction from the Prime Minister based on the report of the Minister of METI. Taking of stable iodine tablets, as well as sheltering or evacuation, is defined as one of the protective measures.

(3) Responsibilities of Related Organizations Concerning Nuclear Emergency Preparedness

1) Responsibility of the National Government

The national government establishes following preparation to prevent occurrence of nuclear emergency and to take measures in emergency.

- METI stations a Senior Specialist for Nuclear Emergency in the vicinity of each nuclear installation, who guides and advises a licence holder in preparing his emergency action plan and, in emergency, takes necessary measures preventing expansion of the emergency.

- *The NSC organizes "Technical Advisory Organization in an Emergency" that composed of the commissioners and Advisors for Emergency Response. The mandates of the organization is to give technical advices to the Prime Minister on a) dissolution of nuclear emergency, b) the designation or alteration of the regional area that necessitates emergency measures to be taken, and c) technical matters on implementation of emergency response measures.*
- The Minister of METI designates a facility in the vicinity of a nuclear installation as Off-Site Center to be used in an emergency. In the case of an emergency, the national government, the local governments and the licence holder establish at the Off-Site Center the "Joint Council for Nuclear Emergency Response", in order to share information and to coordinate their activities. Off-Site Centers are built on the point shown in Fig. 16-2, and have necessary facilities and equipments capable to communicate with the Prime Minister's Official Residence, the Cabinet Office, the Emergency Response Center of NISA, the Emergency and Disaster Countermeasures Center of MEXT and related local governments.
- Each Off-Site Center is equipped with means by which the relevant organizations monitor environmental radiation levels and the plant status. The environmental radiation levels, other than temporary data measured in an emergency, can be monitored every moment since the monitoring equipments are connected on line with the monitoring posts located in the vicinity of a NPS. The on-line status of NPP that are sent from a licence holder in an emergency can be displayed on the monitors. The results of estimation are also displayed by means of Emergency Response Support System (ERSS), which forecasts progress of an abnormal NPS condition using plant information.
- The national government establishes arrangements to secure quick and coordinated activities in an emergency.
- The national government conducts the comprehensive emergency drill based on the program established by the competent minister.

2) Responsibilities of local governments

Each local government shall develop and revise the regional disaster prevention plan in accordance with Article 40 of the Basic Law on Emergency Preparedness, and shall consult beforehand with the Prime Minister for its development or revision.

3) Responsibilities of licence holders

- Each licence holder shall develop his emergency action plan after consulting with relevant local governments, and submit it to the Minister of METI before commissioning of the reactor.
- Each licence holder shall establish an on-site organization for nuclear emergency preparedness, and designate a Manager for Nuclear Emergency Preparedness who administers the organization.
- The Manager for Nuclear Emergency Preparedness shall notify specific initial events to the competent authorities.

16.3. Implementation of Nuclear Emergency Drill

The emergency preparedness action plan in accordance with the Basic Law on Emergency Preparedness, and the Off-Site Center in the vicinity on the nuclear installation provided in the previous section has been established for nuclear installation, and nuclear emergency drill is implemented to confirm the effectiveness of these measures. The purpose of the nuclear emergency drill is 1) to enhance understanding of, and adequate actions for, the nuclear emergency preparedness by responsible personnel of the national government, local governments and the licence holder, and residents, and 2) to verify whether emergency measures function in predetermined way, and whether information sharing and cooperation among related organizations are adequate. The national government, local governments, designated public organizations and the licence holder cooperate and participate in the drill, which cover communication, monitoring, decision on emergency measures to be taken, sheltering or evacuation etc., ranging from large scale national drill to licence holder's on-site drill. Drills implemented in the past years are shown below.

(1) Drills Planned by the National Government (Table 16-2 (1))

Nuclear emergency drills used to be planned and conducted by local governments with support and coordination of the national government before the JCO criticality accident. The Special Law for Nuclear Emergency, stipulated the drills to be planned and conducted by the national government.

Drills including accident management activities assuming a scenario results to the core damage have been implemented in the national emergency drills.

The drill planned by the national government has been conducted once a year as the comprehensive nuclear emergency drill in collaboration with the national government, local governments, licence holders, etc.

Drills implemented in and after year 2001 are as follows:

- *On October 27, 2001, a drill for the Unit 1 of the Tomari Power Station, (located in Tomari Village, Furuu County, Hokkaido Prefecture) was conducted in collaboration with the national government, the local governments of Hokkaido Prefecture, and relevant towns and villages, Hokkaido Electric Power Co., Inc., and organizations related to the emergency preparedness. About 2,700 persons including local residents etc. participated in the drill. This was the first operation of "Hokkaido Nuclear Emergency Preparedness Center," which has been designated as the Off-Site Center as a base for implementing emergency measures.*
- *On November 7, 2002, a drill for the Unit 3 of the Ohi Power Station, (located in Ohi Town, Ohi County, Fukui Prefecture) was conducted in collaboration with the national government, the local governments of Fukui Prefecture and related cities and towns, the Kansai Electric Power Co., Inc., and organizations relevant to the emergency preparedness. About 4,000 persons including local residents etc. participated in the drill. Vulnerable groups in emergency such as children etc. participated for the first time as a national drill. Moreover, evacuation to the sea was implemented in consideration of the nature of the region.*
- *On November 26, 2003, a drill for the Unit 2 of the Genkai Nuclear Power Station, (located in Genkai Town, Higashi Matsuura County, Saga Prefecture) was conducted in collaboration with the national government, the local governments of Saga Prefecture, Nagasaki Prefecture and related cities and towns, Kyushu Electric Power Co., Inc., and organizations relevant to the emergency preparedness. About 9,400 persons including local residents etc. participated in the drill. This drill was implemented over two prefectures for the first time. Furthermore, the NSC performed training of advice activities by tele-conference from the Tokyo headquarter to the local response headquarter for the first time.*

Results of the drills held every year are assessed and reflected to the items and methods of drills to be implemented in and after the following fiscal year. Three kinds of method, participant's questionnaire, check by an independent assessment agency, and observation by external experts, are adopted for the assessment.

(2) Drills Planned by the NSC

The NSC is conducting communication drills those aim enhancing the emergency communication system and keeping up and/or improving its functions. The NSC also is conducting call and set up drills of Emergency Technical Advisory Body those aim to confirm and improve the capability to respond properly and effectively in emergency.

(3)Drills Planned by Local Government (Table 16-2 (2) –(5))

The regional emergency prevention plan prescribes the local drills to be planned and conducted by each local government, which METI and the NSC support by dispatching expert staffs..

(4) Drills Planned by Licence Holders

Each licence holder has implemented an on-site drill once a year including establishment of an emergency response headquarter, notification and communication, emergency environmental monitoring, etc. based on the licence holder's emergency action plan for each site.

When the said site is a subject of 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.

Each licence holder also has implemented a drill taking into consideration of accident management activities, if necessary, in order to comprehensively confirm effectiveness of the organization implementing the accident management.

(5) Participation in International Nuclear Emergency Exercise

Japan participated in the Joint International Nuclear Emergency Exercise (JINEX1) held in May 2001 sponsored mainly by the IAEA, learning lessons on cross border radiological emergency, and will participate future international exercises.

16.4 International Framework and Relationship with Neighboring Countries

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. The following system has been established for the notification of a nuclear accident to neighboring countries:

- For nuclear installations, the Ministry of Foreign Affairs has been designated as the authority for notification and as the competent authority for foreign accidents, and the Ministry of METI has been designated as the competent authority for domestic accidents.
- METI receives a report immediately on an accident in a nuclear installation on the basis of legal obligation of the licence holder.
- When occurrence of an accident is confirmed and it is predicted that release of radioactive materials may affect neighboring countries, the IAEA and the countries that may be affected by the accident are notified of the accident.

In accordance with an arrangement aiming at enhancement of the safety level of commercial power reactors concluded with the People's Republic of China, on the basis of the bilateral agreement for peaceful use of nuclear energy, the governments should mutually notify without delay of serious events of nuclear installations. Bilateral inter-governmental agreement with the Republic of Korea calls for cooperation in the establishment and operation of an early notification network for nuclear safety.

If an accident should occur at a foreign nuclear installation and a request for assistance is made, Japan will dispatch, on the basis of the Conventions on Assistance in the Case of a Nuclear Accident or Radiological Emergency, specialists in emergency monitoring and emergency medical treatment, and provides materials and equipment such as radiation monitoring equipment and radiation protection equipment.

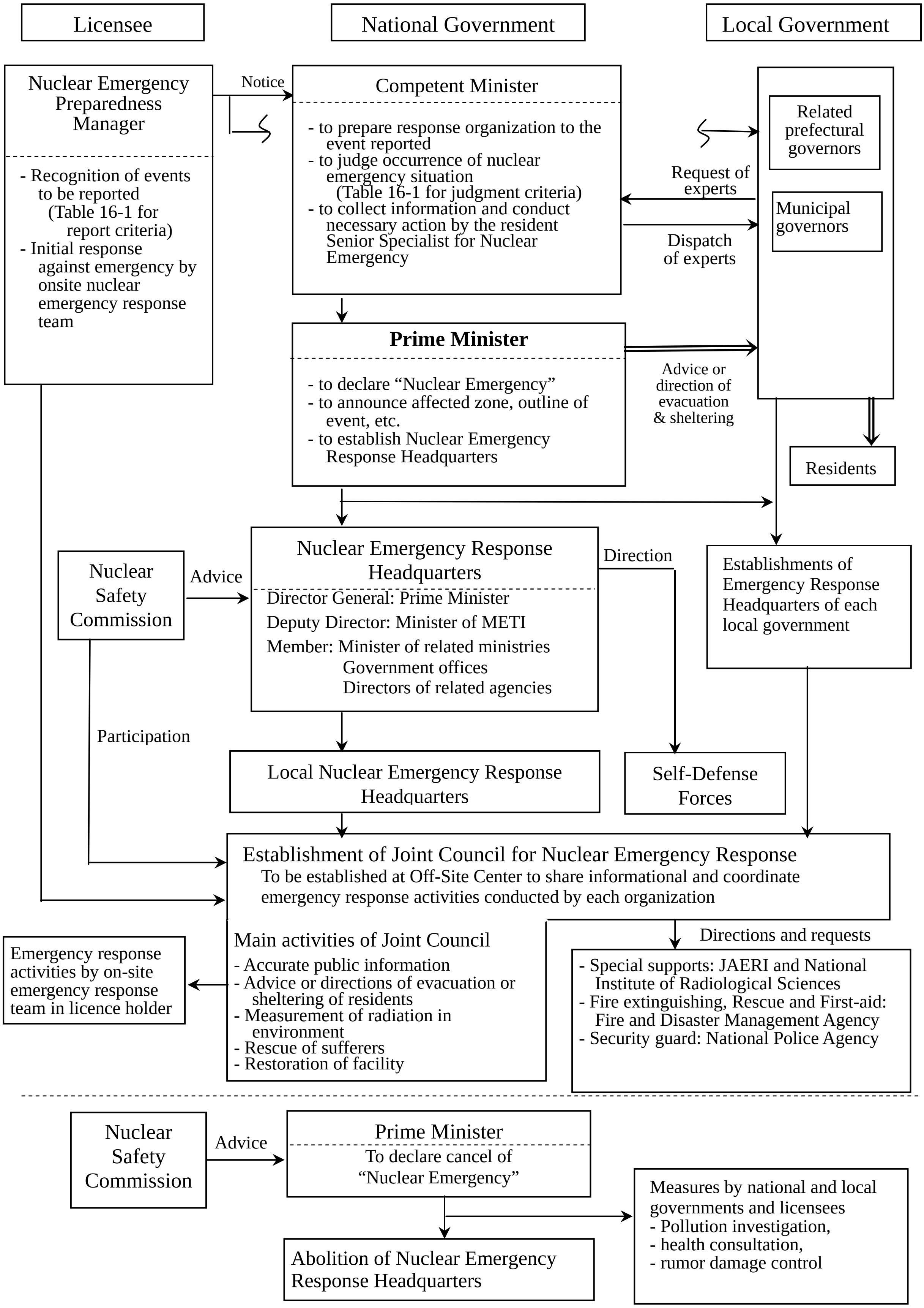


Fig.16-1 Nuclear Emergency Preparedness based on the Special Law for Nuclear Emergency

Table 16 – 1 Main Specific Events and the Nuclear Emergency specified in the Special Law for Nuclear Emergency

	Events	Criteria for reporting by licensees and "Nuclear Emergency" declaration by national government	conditions of declaration of "Nuclear Emergency"
Events that licensees should report.	a) Dose of radiation near the site boundary detected dose	5 micro Sv/h at one point for more than 10 min 5 micro Sv/h at more than 2 points at the same time	500 micro Sv/h at one point for more than 10 min, 500 micro Sv/h at more than 2points at the same time
	b) Detection of the radioactive materials in usual release points, such as exhaust pipes	Radioactive materials worth to more than 5 micro Sv/h	Radioactive materials worth to more than 500 micro Sv/h
	c) Radiation by fire, explosion, etc. or detection of radioactive materials (outside the management zone)	Radiation dose of more than 50 micro Sv/h Release of radioactive materials worth to more than 5 micro Sv/h	Radiation dose of more than 5 mSv/h Release of radioactive materials worth to more than 500 micro Sv/h
	d) Individual events of each nuclear installations (Example for reactor)		
	- Failure of scram	When the nuclear reactor shutdown cannot be performed by usual neutron absorbers	When all of reactor shutdown functions are lost
	- Loss of reactor coolant	Occurrence of leakage of nuclear reactor coolant which needs operation of the emergency core coolant system (ECCS)	When water cannot be poured to the nuclear reactor by all ECCSs
	- Loss of all AC power supplies	When all AC power supplies stops power supply for more than 5 minutes	When all measures for cooling reactor core are lost with loss of all AC power supplies.

↓ ↓

Response of the national government	- The Minister of METI sends staff with expertise on request of local governments. - The resident Specialist on Nuclear Emergency Preparedness carries out necessary works.	- The Minister of METI reports the nuclear emergency to the Prime Minister immediately after confirming the situation. - The Prime Minister declares "Nuclear Emergency" and takes following responses; - to advice or direct related local governments on necessary measures such as sheltering or evacuation. - to establish the Nuclear Emergency Response Headquarters in Tokyo and Local Nuclear Emergency Response Headquarters at Off-Site Center. - to establish the Joint Council for Nuclear Emergency Response for information exchange among the national government and local governments.
	Following responses are carried out based on the agreement of related ministries, not specified in the Special Law for Nuclear Emergency. - Related ministries and agencies organize joint task group for the incidents in Tokyo. - Related local organizations organize joint local task group in the Off- Site Center.	

Table 16-2. Nuclear Emergency Drills

Conductor	Date	Nuclear Power Station
(1) Drills conducted by National Government		
METI	03/23/2000 (Thurs.)	Tsuruga Power Station (The Japan Atomic Power, Inc.)
METI	10/28 /2000 (Sat.)	Shimane Nuclear Power Station (Chugoku Electric Power Co., Inc.)
METI	*10/27/2001 (Sat.)*	*Tomari Power Station (Hokkaido Electric Power Co., Inc.)*
METI	*11/07/2002 (Thurs.)*	*Ohi Power Station (The Kansai Electric Power Co., Inc.)*
METI	*11/26/2003 (Wed.)*	*Genkai Nuclear Power Station (Kyushu Electric Power Co., Inc.)*
(2) Drills conducted by Local Governments (April 2000 - March 2001)		
Tokai-mura (Ibaraki Pref.)	09/30/2000 (Sat.)	Tokai Daini Power Station (The Japan Atomic Power, Inc.)
Niigata Pref.	10/27/2000 (Fri.)	Kashiwazaki Kariwa Nuclear Power Station (Tokyo Electric Power Co., Inc.)
Ehime Pref.	10/31/2000 (Tue.)	Ikata Power Station (Shikoku Electric Power Co., Inc.)
Ishikawa Pref.	11/17/2000 (Fri.)	Shika Nuclear Power Station (Hokuriku Electric Power Co.)
Saga Pref.	11/27/2000 (Mon.)	Genkai Nuclear Power Station (Kyushu Electric Power Co., Inc.)
Fukushima Pref.	11/28/2000 (Tue.)	Fukushima Daiichi Nuclear Power Station (Tokyo Electric Power Co., Inc.)
Kagoshima Pref.	02/06/2001 (Tue.)	Sendai Nuclear Power Station (Kyushu Electric Power Co., Inc.)
Hokkaido	02/08/2001 (Thurs.)	Tomari Power Station (Hokkaido Electric Power Co., Inc.)
Fukui Pref.	03/22/2001 (Thurs.)	Takahama Power Station (The Kansai Electric Power Co., Inc.)
Shizuoka Pref.	03/23/2001 (Fri.)	Hamaoka Nuclear Power Station (Chubu Electric Power Co., Inc.)
(3) Drills conducted by Local Governments (April 2001 - March 2002)		
Miyagi Pref.	*07/11/2001 (Wed.)*	*Onagawa Nuclear Power Station (Tohoku Electric Power Co., Inc.)*
Ehime Pref.	*11/01/2001 (Thurs.)*	*Ikata Power Station (Shikoku Electric Power Co., Inc.)*
Shimane Pref.	*11/07/2001 (Wed.)*	*Shimane Nuclear Power Station (Chugoku Electric Power Co., Inc.)*
Saga Pref.	*11/26/2001 (Mon.)*	*Genkai Nuclear Power Station (Kyushu Electric Power Co., Inc.)*
Fukushima Pref.	*11/28/2001 (Wed.)*	*Fukushima Daini Nuclear Power Station (Tokyo Electric Power Co., Inc.)*
Ishikawa Pref.	*01/10/2002 (Thurs.)*	*Shika Nuclear Power Station (Hokuriku Electric Power Co.)*
Kagoshima Pref.	*01/31/2002 (Thurs.)*	*Sendai Nuclear Power Station (Kyushu Electric Power Co., Inc.)*
Shizuoka Pref.	*02/21/2002 (Thurs.)*	*Hamaoka Nuclear Power Station (Chubu Electric Power Co., Inc.)*
Fukui Pref.	*03/30/2002 (Sat.)*	*Mihama Power Station (The Kansai Electric Power Co., Inc.)*
(4) Drills conducted by Local Governments (April 2002 - March 2003)		
Miyagi Pref.	*09/03/2002 (Tue.)*	*Onagawa Nuclear Power Station (Tohoku Electric Power Co., Inc.)*
Hokkaido	*10/25/2002 (Fri.)*	*Tomari Power Station (Hokkaido Electric Power Co., Inc.)*
Ehime Pref.	*10/25/2002 (Fri.)*	*Ikata Power Station (Shikoku Electric Power Co., Inc.)*

Kagoshima Pref.	*10/29/2002 (Tue.)*	*Sendai Nuclear Power Station (Kyushu Electric Power Co., Inc.)*
Fukui Pref.	*11/07/2002 (Thurs.)*	*Ohi Power Station (The Kansai Electric Power Co., Inc.)*
Fukushima Pref.	*11/08/2002 (Fri.)*	*Fukushima Daiichi Nuclear Power Station (Tokyo Electric Power Co., Inc.)*
Shimane Pref.	*11/08/2002 (Fri.)*	*Shimane Nuclear Power Station (The Chugoku Electric Power Co., Inc.)*
Niigata Pref.	*11/09/2002 (Sat.)*	*Kashiwazaki Kariwa Nuclear Power Station (Tokyo Electric Power Co., Inc.)*
Ishikawa Pref.	*11/11/2002 (Mon.)*	*Shika Nuclear Power Station (Hokuriku Electric Power Co.)*
Saga Pref.	*11/25/2002 (Mon.)*	*Genkai Nuclear Power Station (Kyushu Electric Power Co., Inc.)*
Nagasaki Pref.	*01/30/2003 (Thus.)*	*Genkai Nuclear Power Station (Kyushu Electric Power Co., Inc.)*
Shizuoka Pref.	*02/04/2003 (Tue.)*	*Hamaoka Nuclear Power Station (Chubu Electric Power Co., Inc.)*
(5) Drills conducted by Local Governments (April 2003 - March 2004)		
Ibaraki Pref.	*09/30/2003 (Tue.)*	*Tokai Daini Power Station (The Japan Atomic Power, Inc.)*
Hokkaido	*10/24/2003 (Fri.)*	*Tomari Power Station (Hokkaido Electric Power Co., Inc.)*
Ehime Pref.	*10/27/2003 (Mon.)*	*Ikata Power Station (Shikoku Electric Power Co., Inc.)*
Niigata Pref.	*10/27/2000 (Fri.)*	*Kashiwazaki Kariwa Nuclear Power Station (Tokyo Electric Power Co., Inc.)*
Miyagi Pref.	*10/29/2003 (Wed.)*	*Onagawa Nuclear Power Station (Tohoku Electric Power Co., Inc.)*
Fukui Pref.	*11/15/2003 (Sat.)*	*Tsuruga Power Station (The Japan Atomic Power, Inc.)*
Fukushima Pref.	*11/28/2003 (Fri.)*	*Fukushima Daini Nuclear Power Station (Tokyo Electric Power Co., Inc.)*
Shimane Pref.	*01/23/2004 (Fri.)*	*Shimane Nuclear Power Station (Chugoku Electric Power Co., Inc.)*
Kagoshima Pref.	*01/28/2004 (Wed.)*	*Sendai Nuclear Power Station (Kyushu Electric Power Co., Inc.)*
Ishikawa Pref.	*03/23/2004 (Tue.)*	*Shika Nuclear Power Station (Hokuriku Electric Power Co.)*

D. Safety of Installations

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.**

In Japan, in order to judge the appropriateness of the site for a nuclear installation, it is deemed necessary to conduct the safety impact assessment on natural phenomena and human induced external events to the nuclear installation, the safety impact assessment on the postulated accident of the nuclear installation to the general public in the vicinity, and the impact assessments on the siting of the nuclear installation to the environment other than the safety, therefore, required legislations and regulations for implementing relevant assessments has been provided, and the assessments are being conducted.

The probabilistic assessment had been performed to judge whether considerations on the fall of an airplane would be necessary to be included in the design as a human induced external event, and the regulatory guide was provided and set forth as a standard assessment method, since the previous report.

17.1 Basic Concept on the Siting of Nuclear Facilities

The following assessments must be taken into consideration when deciding upon the siting of nuclear facilities, and are incorporated in the relevant legislation, etc.

- Safety impact assessment on a nuclear installation by natural phenomena and postulated human induced external events
- Safety impact assessment on the radioactive impact to the environment by a nuclear installation should reactor accidents occur
- Environmental impact assessment other than radioactive impact due to the siting of a nuclear installation

17.2 Principal Assessment System Concerning the Siting of Commercial Power Reactors

The Reactor Regulation Law requires that location of a commercial power reactor must be selected and its structures and components must be designed so that the radiological hazards can be prevented. The adequacy of siting is examined in accordance with the Regulatory Guide for Reviewing Nuclear Reactor Siting Evaluation and Application Criteria (hereinafter called, the Regulatory Guide for Reactor Siting) etc. as part of safety examination of establishment license.

The Regulatory Guide for Reactor Siting requires that no such event that might induce serious accidents has occurred in the past or could be expected to occur in the future at the proposed site and furthermore, there should not be events that may aggravate accidents, and that reactors are isolated at a sufficient distance from the public in consideration of engineered safety features.

When deciding a site, an adequate attention in design shall be paid to the postulated external initiating event specific to the site, in addition to the site conditions stipulated by the Regulatory Guide for Reactor Siting.

In this respect, the Regulatory Guide for Safety Design prescribes that structures, systems and components with safety functions shall be designed to sufficiently withstand appropriate design basis seismic forces. As well, they shall be so designed that the safety of the commercial power reactor will not be impaired by other possible natural phenomena than earthquake and also by postulated external human initiated events.

The Regulatory Guide for Reactor Siting also prescribes that the dose to the public shall meet with the application criteria in consideration of the engineered safety features by establishing an exclusion area and low population zone and ensuring sufficient distance from high population zones, when assessing radiation impact to the public in the vicinity imposed by the postulated accidents in commercial power reactor. Meanwhile, the Regulatory Guide for Safety Assessment provides events to be evaluated in siting, acceptance criteria and specific conditions, etc. to be used in the analysis.

Environmental impact assessment of all of the power stations including nuclear power stations is performed in accordance with the Environmental Impact Assessment Law enforced in June 1999, before when the departmental council decision of MITI (present METI) dated in July 1977 was applied. This subject is described in Section 17.5.

17.3 Evaluation to Events Caused by External Factor

The Regulatory Guide for Safety Design prescribes that the earthquakes, natural phenomena other than earthquake and external human initiated events shall be addressed in the design, being in accordance with the prescription in the Regulatory Guide for Reactor Siting, stating “no such event that might cause serious accidents has occurred in the past nor could be expected to occur in the future at the proposed site and furthermore, there should not be events that may aggravate accidents”.

On the seismic design, it is required that the structures, systems and components (SSCs)with safety functions shall be designed in accordance with seismic classification, and shall be designed to withstand fully against the appropriate force of design basis earthquake.

It has been verified that the earthquake ground motions 'S1' that was derived with considerations of the "design basis maximum earthquake" assumed from the recorded earthquakes and active faults and the earthquake ground motions 'S2' that was derived with considerations of the "design basis extreme earthquake" that exceeds the "design basis maximum earthquake" are appropriate as the force of design basis earthquake in accordance with the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities.

As classification on seismic design, SSCs are classified into three classes of A, B, and C from a view point of radioactive impact to the environment which could be induced by an earthquake based on this guidelines. And the basic policy with which the seismic design is performed is confirmed, so that the class A SSCs can withstand the earthquake ground motions S1 and the class As SSCs that are specifically important facilities among the class A SSCs can retain the safety function against the earthquake ground motions S2.

It is also required to confirm that the design is appropriate based on the technical standards provided in the Electric Utility Law.

The NSC established the Task Group on Seismic Design Guideline under the Special Committee on Safety Standards in July 2001, and started studies to develop more appropriate guidelines reflecting the latest knowledge etc. to the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities etc.

First, the Task Group on Seismic Design Guideline arranged and classified items that should be studied concretely based on the latest knowledge and technology related to the seismic design, and established a working group which consists of specialists of many fields in order to make efforts in collecting, arranging, etc. of new knowledge.

Hereafter, deliberation and investigation at the Task Group will be effectively performed based on the outcome of the working group.

For the assumed natural phenomena other than earthquake (floods, tsunami, breeze, freezing, snowfall, landslides, etc.), the SSCs with safety functions are required to be designed so that the safety of the nuclear reactor facility will not be failed by any of these natural phenomena. Those SSCs with safety functions of particularly high importance shall be designed to withstand against the most severe conditions of natural phenomena or to withstand against combination of such natural forces and loads induced by an accident.

Moreover, the SSCs with safety functions are required to be so designed that the commercial power reactor should not be impaired by postulated human induced external event (airplane crashes, dam collapse, explosions etc.).

On the consideration on then airplane fall, the standard evaluation method is shown with a guide to judge whether design consideration as "an assumed human induced external event" is required or not, in "Evaluation Standards of the Probability of Airplane Falling to a Commercial Power Reactor Facility (Regulatory Guide)", which NISA enacted as a Regulatory Guide in July 2002. Besides, for airplanes, flight over nuclear facilities is limited in principle.

Commercial power reactors are required to be provided with appropriate measures to prevent illegal access to the reactor by third persons in Japan.

17.4 Evaluation for the Impacts to the Public of Accidents

In order to ensure safety of the public even from a worst accident, the Regulatory Guide for Reactor Siting prescribes, as a fundamental siting condition, that a commercial power reactor be located with a sufficient distance from the public taking into account the engineered safety features. The conditions for fulfilling this requirement are as follows:

A) The area within a specified distance from a commercial power reactor shall be the exclusion area, and no radiation hazard is imposed on the public in the vicinity outside the exclusion area, even postulating the occurrence of a major accident.

   A major accident is defined in the above Guideline to be an accident, occurrence of which is conceivable as a worst scenario from a technical point of view with considering such factors as the conditions at the site vicinity, the characteristics of the reactor and the engineered safety features.

B) The area within a specified distance beyond the exclusion area shall be the low population zone, and no substantial radiation damage is imposed on the public in the vicinity of the low population zone, even postulating the occurrence of a hypothetical accident.

A hypothetical accident is defined in the above Guideline to be an accident, which exceeds a major accident, and the occurrence of that is not conceivable from a technical point of view. The Guideline for example, hypothesizes that some of engineered safety features in the reactor, which are assumed to be effective in postulating a major accident do not function and corresponding release of radioactive materials occurs.

C) A site of a nuclear reactor shall be located at a specified distance from high population zones.

The specified distance means a distance where cumulative value of whole-body dose in case of a hypothetical accident shall be small enough to be deemed acceptable based on the collective dose of view.

The application criteria on dose rate are specified in the attachments of the Regulatory Guide for Reactor Siting. The meteorological observation methods, the statistical processing methods of the observed data and the methods for the analysis of the atmospheric diffusion of the released radioactive materials, to be used in the dose assessments, are prescribed in the Regulatory Guide for Meteorological Observation for Safety Analysis of Nuclear Power Reactor Facilities.

17.5 Environmental Impact Assessment

The Environmental Impact Assessment Law was established to ensure business operators, that are undertaking large-scale projects that could have a serious impact on the environment, to conduct an environmental impact assessment properly and reflect the results of the assessment in implementing the project in term of protecting the environment, and also set forth the procedures in conducting the environmental impact assessment. The assessment for commercial power stations including nuclear power station must be performed in accordance with the provisions of the Environmental Impact Assessment Law and the Electricity Utility Industry Law. All of nuclear power reactors are subject to assessment regardless of their scale. The procedure is summarized in Figure 17-1.

Business operator, prior to application for reactor establishment, must prepare a Scoping Document presenting information concerning the contents of the project, items to be considered in an environmental impact assessment, method of survey, prediction, and assessment method to be utilized, and must submit it to NISA, as well as to the local governments having jurisdiction over the area deemed likely to be environmentally impacted by the project. NISA examines the Scoping Document taking into consideration the comments submitted by the related prefectural governor(s), as well as the comments of the residents and the views of the business operators regarding such comments, and gives recommendations on the contents of Scoping Document to the business operator, if needed.

Then business operator shall prepare a draft environmental impact statement (draft EIS) after conducting survey, prediction and assessment in consideration with the recommendation received from NISA and establishing the measures for protecting the environment. The draft EIS must be submitted to NISA, as well as to the related local governments. NISA, after examining the draft EIS, taking into account the opinion of the Minister of Environment and the related Governors as well as the comments of the residents and the views of the business operators regarding such comments, and receiving the view of advisers on the environment protection, gives recommendations on the environmental assessment to the business operator if needed. Meanwhile, concerning the items with large environmental impact, business operators shall check and provide the necessary measures for protecting the environment so that the environmental impact by the project would be reduced as low as practical, considering the project plan and the state of the area environmentally impacted by the project.

Finally, business operator shall prepare the environmental impact statement (EIS), taking into account the recommendation on the draft EIS, and submit it to NISA. NISA, after examining the EIS, orders alteration of the EIS if needed, otherwise notices acceptance of the EIS to business operator. The accepted EIS is distributed to the Ministry of Environment and related local governments.

At the stage of examining construction plan, NISA does not approve it in case that the plan does not conform to the accepted EIS.

17.6 Re-evaluation of Site Related Factors

All the factors related to site selection must be re-evaluated at the time of alteration of an establishment license, such as new plant construction at the existing site, so as to review and assure the continuous safe operation of commercial power reactors. Adequacy of the safety design is re-evaluated referring to new findings and new experiences having impact on the design.

17.7 Arrangements with Neighboring Countries on Safety Impact of Nuclear Facilities

Commercial power reactor in Japan is so located at the place where there are no events liable to induce serious accidents and so designed to secure the safety against postulated initiating events including natural phenomena. It also implements the measures for the accident management. Furthermore, because of the fact that Japan is an archipelago country and separated from neighboring countries by a considerable distance, adverse impact of Japanese commercial power reactor over neighboring countries is deemed to be extremely small. Accordingly, no consultation has been made so far with neighboring countries on the siting of commercial power reactors.

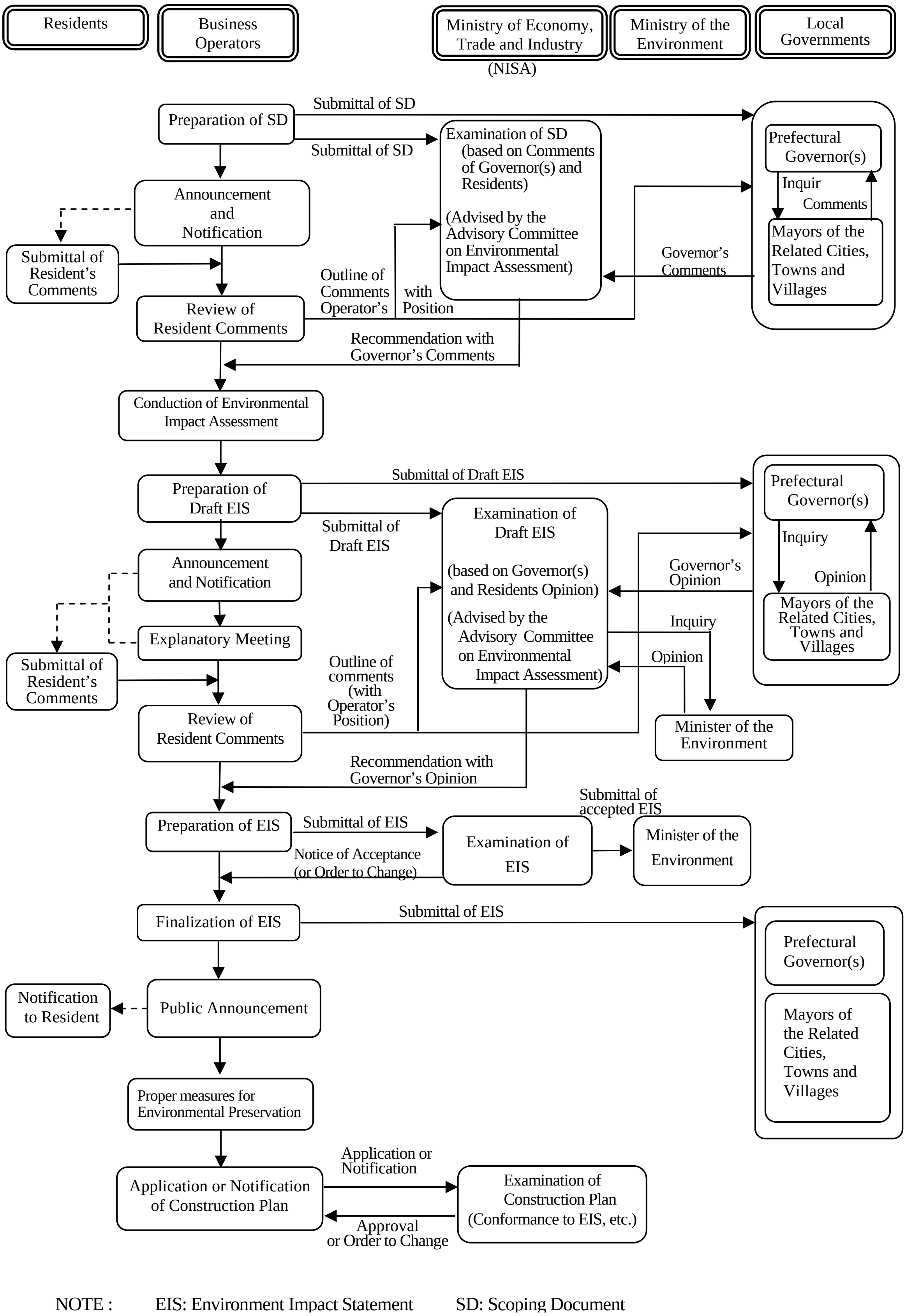


Fig.17-1 Outline of the Environmental Impact Assessment on Nuclear Power Plant

Article 18 Design and Construction

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

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

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

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

Nuclear facilities in Japan (light water reactors and fast breeder reactors) were designed, constructed and operated based on the safety design concept, which are common to most Western countries, adopting almost the same defense in depth system as prescribed in the Nuclear Safety Standards "NUSS" of the IAEA. Moreover, the knowledge obtained from operating experiences and various kinds of examination, analyses, research and development are utilized to realize of safer and easier facilities to carry out the maintenance management. Furthermore, this new knowledge is reflected appropriately and successively on planning and revising of guidelines etc. in order to improve the safety and reliability of nuclear reactors.

18.1 Licensing Process at the Design and Construction Stages of Nuclear Facilities

Licensing process at the design and construction stage for commercial power reactor in Japan are described in the report of Article 7 with relevant laws and regulatory requirements applied. Confirming safety and safety assessment at the design and construction stage for commercial power reactor are described in the report of Article 14 with relevant laws and evaluation guidelines applied.

When design alteration of licensed commercial power reactor is required, the licence holder must undergo verification of the safety affected by the alteration and inspection of the altered segment including the safety analysis influenced by the design alteration, in the same procedure as the licensing process as licensing a new installation.

18.2 Realization of Defense with Multiple Steps and Methods (Defense in Depth) and Confinement of Radioactive Materials at Design and Construction Stage

Commercial power rectors (light water reactors (BWRs and PWRs)) in Japan are designed, constructed and operated based on the safety design principals, which are common among most Western countries and almost the same concept of "defense in depth" as prescribed in the Nuclear Safety Standards (NUSS) of the IAEA.

In this section the first 3 levels of defense in depth concepts which are closely related to design and construction of nuclear installations are discussed, forth and fifth levels of defense in depth concept which are severe accident management and emergency preparedness are discussed in sections 18.4 and report on Article 16.

Original design of light water reactors in Japan was introduced from the United States. But, the later design of reactors has been improved the facilities to be safer and easier in maintenance management through series of Improvement and Standardization Program led by METI (then MITI), reflecting the operating experiences of those who have obtained license for reactor establishment (hereinafter called as the “licence holders”) and knowledge obtained in research and development program of nuclear power industries.

(1) Implementation of the Defense in Depth Concept

The principle of "defense in depth" is as follows:

- Prevention of deviating from normal operation restraint with conservative design, manufacturing and construction of the nuclear plant in accordance with the relevant 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. And
- Control of the progression of accident and mitigation of its consequences by assuming that progression to an accident is not prevented at the preceding stage.

In order to apply these fundamentals to design of nuclear facilities, the Regulatory Guide for Safety Design (see Table 18-1) that was established by the NSC, stipulates the following items; The first defense is to prevent the occurrence of an abnormal event. More specifically, as stated in the requirements in guidelines 1 to 10 (overall nuclear reactor facility) of the Regulatory Guide for Safety Design, the first defense 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. The Regulatory Guide for Classification of the Importance of Safety Functions for Light Water Nuclear Power Reactor Facilities requires that the quality control during design and manufacturing be conducted corresponding to the importance of safety function.

The second defense is to prevent the progression of the abnormal event. More specifically, as stated in the requirements in guidelines 15 to 18 (Reactor Shutdown System), and 34 to 40 (Safety Protection System) of the Regulatory Guide for Safety Design, the second defense implies the early detection of the abnormal condition, its correction or taking measures in advance to prevent the progression into an accident.

The third defense is to mitigate the consequence of an accident. More specifically, as stated in the requirements in guidelines 25 (Emergency Core Cooling System) and 28 to 33 (Reactor Containment) of the Regulatory Guide for Safety Design, the third defense implies taking measures to secure the safety of the public in the vicinity by controlling the progression of the accident and mitigating its consequence.

The safety of nuclear facilities is ensured through rigorous safety ensuring measures on the basis of the defense in depth concept, which includes 1) preventing the occurrence of an abnormal event, 2) detection of the abnormal event and the preventing progression into an accident, and 3) mitigating an accident consequence. Consequently, 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 facility at a sufficiently low level. Based on such a status, preparation of the accident management is positioned as a measure to reduce the low risk further beyond these protection levels. In addition, preparation of the accident management and the emergency measures, which has been carried on in Japan, are described in section 18.4, and in Article 16, respectively.

(2) Confinement of Radioactive Materials (or Three Barriers of Radiation Protection Walls)

Nuclear facilities shall be 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 Safety Design etc. and the outcome of the design improvements in them are as follows:

1) Fuel (Including Claddings)

The fuel assembly shall be so designed that a) the integrity will be retained under the various conditions that could occur in the nuclear reactor in service; b) 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 an abnormal transient during operation; c) 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.

Regarding item a), the design requirements are stipulated in guidelines 11 and 12 of the Regulatory Guide for Safety Design. Regarding item b), the design requirements are stipulated in guidelines 34 to 40 (Safety Protection System). Regarding item c), the design requirements are stipulated in guidelines 12, 14 and 25. The requirements for safety evaluation are also 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.

2) Reactor Coolant Pressure Boundary

The reactor coolant pressure boundary shall be so designed that the integrity will be maintained during normal and abnormal operating conditions; that the boundary will not exhibit brittle behavior or develop rapid brittle fracture during normal operation, maintenance, testing, or abnormal conditions; that the leakage will be detected immediately and surely; that tests and inspections will verify its integrity throughout the service life of the nuclear reactor, which are required in guidelines 19 to 22 of the Regulatory Guide for Safety Design. Pressure on reactor coolant pressure boundary will not exceed the specified value during reactivity insertion events, which is required in guideline 14 of the Regulatory Guide for Safety Design.

3) Reactor Containment

The reactor containment shall be so designed that it will withstand the loads of design basis accident and the appropriate design basis earthquake; that it will prevent leakage exceeding the predetermined leakage rate; that it will allow periodic testing on the leakage rate; that its boundary will not exhibit brittle behavior or develop rapid brittle fracture during normal operation, maintenance, testing and in abnormal conditions; and that isolation valves should be placed in the pipelines that penetrate its walls, which are required in guidelines 28 and 29 of the Regulatory Guide for Safety Design.

18.3 Prevention of Accidents and their Mitigation Systems (Regulatory Guide for Reviewing Classification of Importance of Safety Functions for Light Water Nuclear Power Reactor Facilities)

In Japan, the Regulatory Guide for Reviewing Classification of Importance of Safety Functions for Light Water Nuclear Power Reactor Facilities (hereinafter called as " Regulatory Guide for Classification of Importance") prescribe the system for preventing the occurrence of abnormalities and the system for mitigating the impact of abnormalities. That is, since the Regulatory Guide for Safety Design used at the safety examination must be appropriately applied according to the safety importance of the subject structures, systems and components, safety functions and the classification of importance of the structures, systems and components are defined in this " Regulatory Guide for Classification of Importance".

(1) The Concept of the Classification of Importance for the Safety Design

The importance of the safety function of the structures, systems and components are classified into the following two classes and shown in the Regulatory Guide for Classification of Importance.

A) Those of which loss of the function could result to cause an abnormality of the nuclear reactor facility, which causes excessive radiation exposure on general public or the working personnel (the system for preventing the occurrence of abnormalities, hereinafter called as "PS"). B) Those that have the function to prevent the propagation of abnormality or terminate it quickly in an abnormal situation of a nuclear reactor facility, and to protect general public or the working personnel from possible excessive radiation exposure (the system for mitigating the impact of abnormalities, hereinafter called as "MS"). The structures, systems and components, which belong to these PS and MS respectively, are classified into three classes in accordance with the importance of their safety function. It stipulates, from the standpoint to ensure the safety function, that the basic objective for each class shall meet the following requirements according to the technologies of design, construction and tests, and operation management.

Class 1: Secure and maintain as high as reasonably achievable level of reliability.
Class 2: Secure and maintain a high level of reliability.
Class 3: Secure and maintain a level of reliability equal to or higher than that for general industry.

The classifications of the structures, systems and components and their safety functions are listed in Table 18-2.

(2) Installation of the PS and MS

The PS and MS installed in the light water reactors in Japan are as follows.

After grouping all light water reactors, currently installed in Japan, based on the reactor type and the containment type, the essential system for PS and MS which are installed in each nuclear reactor facilities are shown in Table 18-3 and Table 18-4 for BWR and PWR respectively. These tables summarize the system configuration and their classification of reactor shutdown system, emergency core cooling system and heat removal system, the number of diesel generators and the containment shape, as essential systems for preventing the occurrence of abnormalities and system for mitigating the impact of abnormalities.

18.4 Preparation of Accident Management Policy

Since the TMI-2 accident, the researches on phenomena of severe accidents and PSA have been conducted extensively worldwide. The NSC decided "Accident Management as a Measure for Severe Accident at Light Water Nuclear Power Reactor Facilities" in 1992, and revised it in 1997. Licence holders in Japan also have voluntarily implemented their own measures for preventing severe accidents and for mitigating their consequences at the request of the MITI (then) based on the the NSC's decision.

As embodiment of the accident management measures for operating commercial power reactors, licence holders have been developed the accident management in orderly manner, substantiate the equipment during the outage of the periodic inspection and establishing operational measures such as implementing system, procedures, education of personnel, etc. *And the accident management related to the internal events for 52 units of commercial power reactors under operation has already completed the preparation.*

The accident management measures that were prepared by licence holders 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.

While licence holders were developing accident management measures, NISA requested NUPEC (then) to evaluate the effectiveness of the accident management measures, and established the "Accident Management Workgroup" under the Nuclear and Industrial Safety Subcommittee to obtain the opinion of specialists, and evaluation report was compiled and issued in October 2002. The report was submitted to the NSC by NISA in the same month.

The PSA results of the internal events for all commercial power reactor facilities under operation (excluding representative reactor types) were reported to NISA by the licence holders in March 2004.

The development programs of the accident management for the commercial power reactors under construction (three units) were reported to NISA by the licence holders in July 2003, and the evaluation results etc. were reported to the NSC by NISA in September 2003. The NSC evaluated the report and concluded it was reasonable in December 2003. In addition, the accident management measures for the reactor facilities concerned are being prepared by the licence holders.

18.5 Measures to Ensure the Technical Reliability by Experience, Test and Analysis

In Japan, in order to enhance the safety and reliability of commercial power reactors, those activities such as feedback of the operating experience and utilization of the technical knowledge obtained through testing and analysis have been conducted, as describe below.

Those insights newly obtained through these activities have been timely incorporated in existing guidelines and used to develop new guidelines.

(1) Feedback of Operating Experiences of Commercial Power Reactors

- The good practices and in-compliances identified through periodic inspections, as well as the experience in design, construction and operation of domestic and foreign commercial power reactors, were analyzed, and the results are incorporated in design modification, improvement of construction methods, etc., if recognized to be effective, through the establishment license, approval of construction plans and pre-service inspections, if necessary.
- For an accident or a failure occurred in a commercial power reactor, including foreign reactors, the corrective measures are implemented after identifying the cause of failure.
- From the standpoint of the comprehensive preventive maintenance of nuclear reactor facilities, periodic safety review is performed for each commercial power reactor with the interval of approximately ten years. And its safety and reliability are confirmed, reflecting the results of comprehensive evaluation on operating experiences and the latest technical knowledge. The situation of periodic safety review is described in Article 14.

(2) Feedback of the Knowledge Obtained Through Test and Analysis

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

1) Implementation of Safety Research, Verification Test and Analysis

Since the 1976 fiscal year, the NSC has decided the safety research annual program upon three fields of nuclear facilities etc., environmental radioactivity and radioactive wastes as a five-year plan, and conducted the safety researches at JAERI etc., periodically looking over the contents. The 6th five-year research program is going on now.

On the other hand, METI has also entrusted and implemented various kinds of tests, analysis, etc. to NUPEC, JAPEIC, etc. in order to demonstrate and verify the safety of nuclear facilities.

These verification tests and researches include safety researches on refinement of fuels, safety researches on aging plants, various kinds of researches on the severe accident, researches on the probabilistic safety assessment, researches on human and organization factors, researches on decommissioning, researches on the nuclear emergency preparedness, seismic verification tests, and vibration tests of steam generator tubes, etc.

The NSC has developed a new safety research plan (important safety research programs). In the plan, the NSC clarified the important research programs that should be implemented in the five years starting from 2005 in order to improve nuclear safety regulations. In the plan, the safety verification tests are deliberated as to be included as important safety research programs.

Regarding the analysis, the safety analysis codes necessary for the evaluation performed by persons other than the applicant for a reactor establishment license are prepared and improved by NUPEC *(then , now JNES),* and safety analysis for the newly applied commercial power reactor and regulatory evaluation of the measures of accident management policy of operating nuclear power reactors, etc. are performed using those codes.

2) Reliability Enhancement Activity by Licence Holders

Licence holders and manufacturers, etc. are also playing an active role in developing the technology through the Improvement and Standardizing Program and introducing new technology. CRIEPI is also conducting the research such as human factor.

The remarkable results of the Improvement and Standardization Program are reflected to the design of Advanced BWR (ABWR) and Advanced PWR (APWR).

For ABWR, two units are already in operation, two units are under construction, and four units are in preparation for construction at this time. Features of ABWR design includes elimination of the large diameter re-circulation piping connected to the reactor vessel by adoption of reactor internal pumps, alteration of the control rod drive mechanism during normal operation from hydraulic to motor driven mechanism that is possible to make fine control of the position, and so on.

On the other hand, For APWR, two units are in preparation of construction at this time. The basic design of APWR was developed based on the outcome of the Improvement and Standardization Program, and also reflecting latest new technologies and operation and maintenance experience. APWR has the features such as simplification of the in-core structure by adoption of neutron reflectors which replaces with the baffle and former structure, upgrading of the emergency core cooling system, and so on.

For BWRs, up to now, as for improvements of component reliability, improvement of structural materials, removal of residual stresses, improvement of water chemistry, etc. have been carried out, in order to prevent the stress corrosion cracking of the component which consists of reactor core internals or the reactor coolant pressure boundary.

For PWRs, modifications such as improvements of heat transfer tube materials and improvements of water quality of the secondary loop, etc. have been carried out to prevent damages of steam generator heat transfer tubes.

Overall digitization has been carried out for instrumentation and control facilities including the safety protection system of the new plants for both of BWRs and PWRs.

18.6 Consideration of Human Factors and the Man-Machine Interface

It is the safety requirements regarding operating management to make commercial power reactor more reliable, more stable and more easily manageable taking into human factors and man-machine interface. 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 to approach these requirements are described in the report of Article 12.

Table 18-1 Individual guidelines established in the NSC Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities (1/2)

(General requirements for nuclear reactor facilities)
Guideline 1. Applied standard and standards
Guideline 2. Design considerations against natural phenomena
Guideline 3. Design considerations against external human initiated events
Guideline 4. Design considerations against internal missile
Guideline 5. Design considerations against fire
Guideline 6. Design considerations environmental conditions
Guideline 7. Design considerations for share use
Guideline 8. Design considerations against operator actions
Guideline 9. Design considerations for reliability
Guideline 10. Design considerations for testability

(Nuclear reactor and reactor shutdown system)
Guideline 11. Core design
Guideline 12. Fuel design
Guideline 13. Reactor characteristics
Guideline 14. Reactivity control system
Guideline 15. Independence and testability of reactor shutdown system
Guideline 16. Reactor shutdown margin by control rods
Guideline 17. Shutdown capability of reactor shutdown system
Guideline 18. Reactor shutdown system capability at the accident

(Reactor cooling system)
Guideline 19. Integrity of reactor coolant pressure boundary
Guideline 20. Prevention of reactor coolant pressure boundary failure
Guideline 21. Detection of the reactor coolant pressure boundary leaks
Guideline 22. In-service test and inspection of reactor coolant pressure boundary
Guideline 23. Reactor coolant make-up system
Guideline 24. Systems for removing residual heat
Guideline 25. Emergency core cooling system
Guideline 26. System for transporting heat to ultimate heat sink
Guideline 27. Design considerations against loss of power

(Reactor containment)
Guideline 28. Function of reactor containment
Guideline 29. Prevention of reactor containment boundary failure
Guideline 30. Isolation function of reactor containment
Guideline 31. Reactor containment isolation valves
Guideline 32. Reactor containment heat removal system
Guideline 33. System for controlling containment atmosphere

(Safety protection system)
Guideline 34. Redundancy of safety protection system
Guideline 35. Independence of safety protection system
Guideline 36. Function of safety protection system during transients
Guideline 37. Function of safety protection system during the accident
Guideline 38. Function of safety protection system at time of failure
Guideline 39. Separation of safety protection system from instrument and control system
Guideline 40. Testability of safety protection system

Table 18-1 Individual guidelines established in the NSC Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities (2/2)

(Control room and emergency facility)
Guideline 41. Control room
Guideline 42. Reactor shutdown function from outside of control room
Guideline 43. Design considerations for control room habitability
Guideline 44. On-site emergency station
Guideline 45. Design considerations for communications equipment
Guideline 46. Design considerations for evacuation route

(Instrumentation and control system and electrical system)
Guideline 47. Instrumentation and control system
Guideline 48. Electrical system

(Fuel handling system)
Guideline 49. Fuel storage and handling system
Guideline 50. Prevention of fuel criticality
Guideline 51. Monitoring of fuel handling area

(Radioactive waste processing facility)
Guideline 52. Radioactive gaseous waste processing facility
Guideline 53. Radioactive liquid waste processing facility
Guideline 54. Radioactive solid waste processing facility
Guideline 55. Radioactive solid waste storage facility

(Radiation management)
Guideline 56. Environmental radiation protection
Guideline 57. Radiation protection for personnel engaged in radiation work
Guideline 58. Radiation management for personnel engaged in radiation work
Guideline 59. Radiation monitoring

Table 18-2 Definitions and functions with respect to classifications of importance of safety function (1/2)

Classification		Definition	Function
Class 1	PS-1	Structures, systems and components where there is concern that (a) a conspicuous damage to the core, or (b) significant damaging the core may occur, due to an event caused by such damage or malfunction.	(1) Reactor coolant pressure boundary function (2) Excessive reactivity insertion prevention function (3) Core shape maintenance function
	MS-1	(1) Structures, systems and components that implement an emergency shutdown of the nuclear reactor, remove the residual heat, prevent excess pressure in the reactor coolant pressure boundary and prevent an impact of excessive radiation on the public in the site vicinity, at the occurrence of an abnormal condition.	(1) Reactor emergency shutdown function (2) Sub-criticality maintenance function (3) Function to prevent over-pressurization of reactor coolant pressure boundary (4) Cooling function after reactor shutdown (5) Core cooling function (6) Radioactive material confinement function, shielding of radiation and release reduction functions
		(2) Other essential safety related structures, systems and components	(1) Generation function of an actuation signal for the engineered safety features and to the reactor shutdown system (2) Specially important safety related functions
Class 2	PS-2	(1) Structures, systems and components for which there is no concern of the immediate causing of conspicuous reactor damage or significant fuel damage due to an event that occurs due to such a damage or malfunction, however, for which there is a concern of excessive release of radioactive materials outside the site vicinity.	(1) Function the builds in reactor coolant (However, this excludes small diameter piping, such as instrumentation, etc., excluded from the reactor coolant pressure boundary and those that are not connected directly to the boundary.) (2) Components not directly connected to the reactor coolant pressure boundary, which have the radioactive materials storage function (3) Function for the safe handling of fuel
		(2) Structures, systems and components which must be actuated during normal operation and upon an abnormal transient during operation for which there is a high potential that core cooling will be lost due to the concerned malfunction.	(1) Safety valve and relief valve reclosing function

Reference : "Examination Guideline for Classification of Importance of Safety Functions for Light Water Reactor Facilities", decision by the NSC in August 30, 1990.

Table 18-2 Definitions and functions with respect to classifications of importance of safety function (2/2)

Classification		Definition	Function
	MS-2	(1) Structures, systems and components for adequately reducing the impact of radiation on the general public in the vicinity of the site, due to damage or malfunction in the structures, systems and components of the PS-2.	(1) Fuel pool water supply function (2) Function to prevent the discharge of radioactive materials
		(2) Structures, systems and component with a specially important function in the response of abnormal situations.	(1) Function for determining the situation of the plant at the time of an accident (2) Function for mitigation of abnormal situations (3) Function for safe shutdown from outside the control room
Class 3	PS-3	(1) Structures, systems and components where initiating events of abnormal situations take place, and which are other than PS-1 and PS-2 components.	(1) Reactor coolant preserving function (components other than PS-1 and PS-2) (2) Reactor coolant circulation function (3) Radioactive material storage function (4) Power supply (excluding emergencies) (5) Plant instrumentation and control function (excluding safety protection function) (6) Plant operation supporting functions
		(2) Structures, systems and components which hold the concentration of the radioactive materials in the reactor coolant to a level low enough not to impair normal operation	(1) Function for preventing the diffusion of fission products into the reactor coolant (2) Reactor coolant purification function
	MS-3	(1) Structures, systems and components which mitigate events in conjunction with the MS-1 and MS-2, even when there is an abnormality during operation	(1) Function for mitigation of reactor pressure increase (2) Function to control the power increases (3) Reactor coolant make-up function
		(2) Structures, systems and components required for the response of abnormal situations	(1) Important for emergency response and function for recognizing abnormal situations

Table 18-3 Establishment situation of prevention and mitigation system (BWR nuclear installation) (1/2)

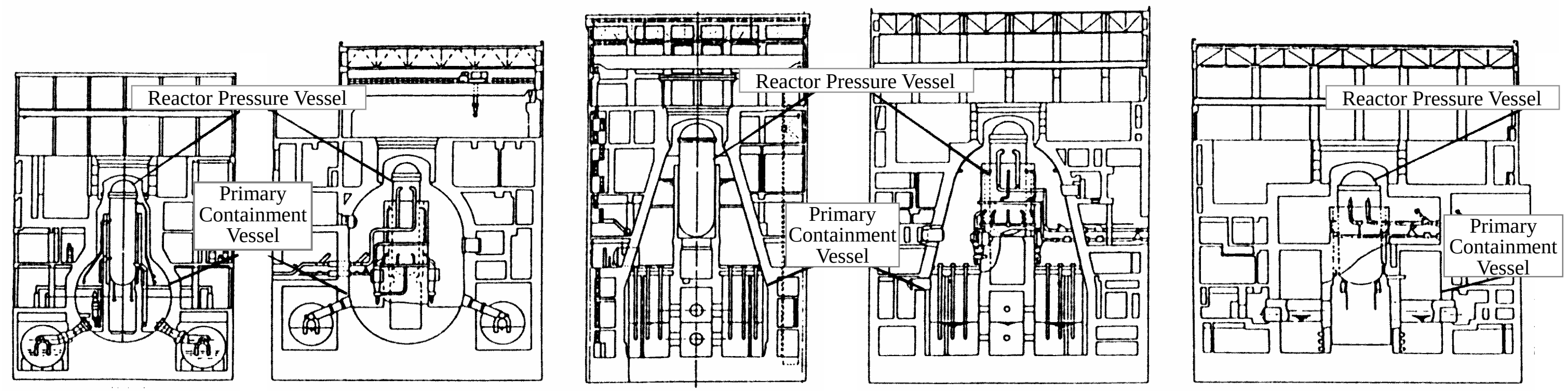
Plant type	BWR 2 & 3	BWR 4	BWR 5	ABWR
Containment type	MARK-I	MARK-I	Improved MARK-I , MARK-II and Improved MK-II	RCCV
Name of power station	Unit 1 of Tsuruga PS (BWR2) Unit.1 Fukushima Daiichi, (BWR 3)	Unit 1of Hamaoka NPS Unit 1of Onagawa NPS Unit 1 of Shimane NPS Unit 2 of Fukushima Daiichi NPS Unit 3 of Fukushima Daiichi NPS Unit 4 of Fukushima Daiichi NPS Unit 5 of Fukushima Daiichi NPS Unit 2 of Hamaoka NPS	Unit 1 of Shika NPS (Improved MK-I) Unit 2 of Shimane NPS (-ditto-) Unit 2 of Onagawa NPS (-ditto-) Unit 3 of Onagawa NPS (-ditto-) Unit 3 of Hamaoka NPS (-ditto-) Unit 4 of Hamaoka NPS (-ditto-) Tokai Daini (MK-II) Unit 6 of Fukushima Daiichi NPS, (-ditto-) Unit 1 of Fukushima Daini NPS (-ditto-) Unit 1 of Kashiwazaki Kariwa NPS (-ditto-) Unit 2 of Fukushima Daini NPS (Improved MK-II) Unit 3 of Fukushima Daini NPS (-ditto-) Unit 4 of Fukushima Daini NPS (-ditto-) Unit 2 of Kashiwazaki Kariwa NPS (-ditto-) Unit 3 of Kashiwazaki Kariwa NPS (-ditto-) Unit 4 of Kashiwazaki Kariwa NPS (-ditto-) Unit 5 of Kashiwazaki Kariwa NPS (-ditto-)	Unit 6 of Kashiwazaki Kariwa NPS Unit 7 of Kashiwazaki Kariwa NPS
Reactor shutdown system	SCRAM system Stand-by Liquid Control System	SCRAM system Stand-by Liquid Control System	SCRAM system Stand-by Liquid Control System	SCRAM system Stand-by Liquid Control System
Containment shape	 MARK-I, Improved MARK-I, MARK-II, Improved MARK-II, Advanced BWR (RCCV)			

Table 18-3 Establishment situation of prevention and mitigation system (BWR nuclear installation) (2/2)

Plant type	BWR 2 & 3	BWR 4	BWR 5	ABWR
Containment type	MARK-I type	MARK-I type	Improved MARK-I type, MARK-II type and Improved MARK-II types	RCCV type
System configuration of ECCS and heat removal system	HPCI IC / IC CS, CS / CS, CS CCS, CCS / CCS, CCS SHC / SHC ADS	RCIC, CS / HPCI, CS LPCI, LPCI / LPCI, LPCI RHR / RHR ADS	HPCS RCIC, LPCS, LPCI/RHR / LPCI, LPCI/RHR ADS	HPCF, LPFL/RHR RCIC, LPFL/RHR / HPCF, LPFL/RHR ADS
Divisions of system configuration	2 partitions	2 partitions	3 partitions	3 partitions
Number of D/G	2	2	3	3

IC: Isolation Condenser.
CS: Core Spray Sys.
CCS: Containment Cooling Sys.
RHR: Residual Heat Removal Sys.
SHC: Shutdown Cooling Sys.
HPCI: High Pressure Core Injection Sys.
LPCI: Low Pressure Coolant Injection Sys.
HPCF: High Pressure Core Flooder
RCIC: Reactor Core Isolation Cooling Sys.
ADS: Automatic Depressurization Sys.
HPCS: High Pressure Core Spray Sys.
LPFL: Low Pressure Core Flooder

Table 18-4 Establishment situation of prevention and mitigation systems (PWR nuclear installation) (1/2)

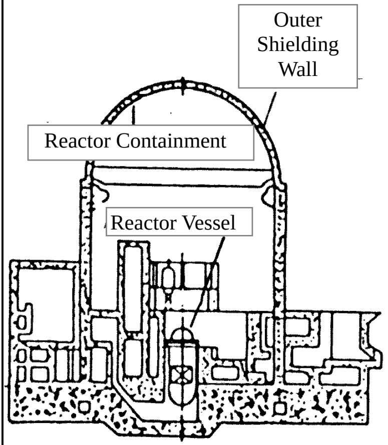
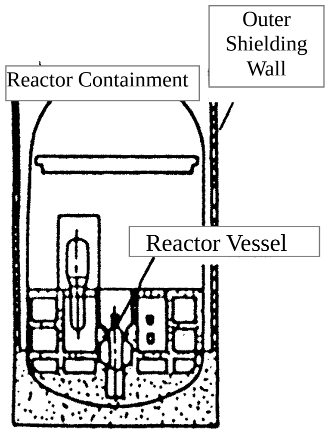
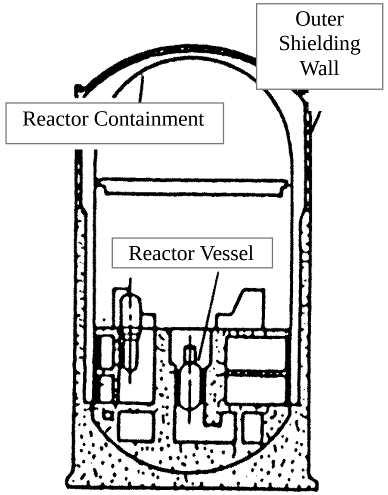
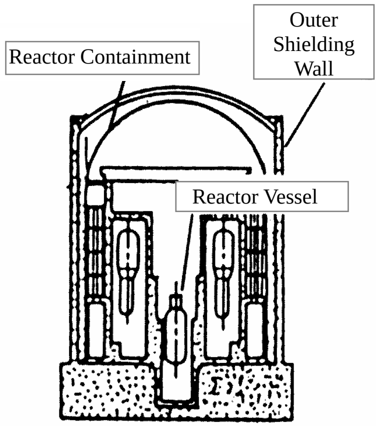
Plant Type	4 Loop	2 Loop	3 Loop	4 Loop
Containment type	PCCV type	Dry type	Dry type	Ice condenser type
Name of power station	Unit 3 of Ohi PS Unit 4 of Ohi PS Unit 2 of Tsuruga PS Unit 3 of Genkai NPS Unit 4 of Genkai NPS	Unit 1 of Ikata PS Unit 2 of Ikata PS Unit 1 of Mihama PS Unit 2 of Mihama PS Unit 1 of Genkai NPS Unit 2 of Genkai NPS Unit 1 of Tomari PS Unit 2 of Tomari PS	Unit 1 of Takahama PS Unit 2 of Takahama PS Unit 3 of Takahama PS Unit 4 of Takahama PS Unit 3 of Mihama PS Unit 1 of Sendai NPS Unit 2 of Sendai NPS Unit 3 of Ikata PS	Unit 1 of Ohi PS Unit 2 of Ohi PS
Reactor shutdown system	Scram system Boric acid injection system	Scram system Boric acid injection system	Scram system Boric acid injection system	Scram system Boric acid injection system
Containment shape	PCCV type 	Dry type  Freestanding steel type (no top dome)	 Freestanding steel type (with top dome)	Ice condenser type 

Table 18-4 Establishment situation of prevention and mitigation systems (PWR nuclear installation) (2/2)

Plant Type	4 Loop	2 Loop	3 Loop	4 Loop
Containment type	PCCV type	Dry type	Dry type	Ice condenser type
System configuration of ECCS and heat removal system	ACC 4 units HPIS / LPIS (/RHR) / AFWS (motor driven) | HPIS / LPIS (/RHR) / AFWS (motor driven) AFWS (turbine driven)	ACC 2 units HPIS / LPIS (/RHR) / AFWS (motor driven) | HPIS / LPIS (/RHR) / AFWS (motor driven) AFWS (turbine driven)	ACC 3 units HPIS (/CHP) HPIS (/CHP) / LPIS (/RHR) / AFWS (motor driven) | HPIS (/CHP) / LPIS (/RHR) / AFWS (motor driven) AFWS (turbine driven)	ACC 4 units HPIS / HPIS (/CHP) / LPIS (/RHR) / AFWS (motor driven) | HPIS / HPIS (/CHP) / LPIS (/RHR) / AFWS (motor driven) AFWS (turbine driven)
Divisions of system configuration	2 systems	2 systems	2 systems	2 systems
	HPIS boosting unnecessary	HPIS boosting necessary	HPIS boosting necessary	HPIS boosting necessary
Number of D/Gs	2	2	2	2

ACC: Accumulator, AFWS: Auxiliary Feed Water Sys, LPIS: Low Pressure Coolant Injection ., HPIS: High Pressure Injection Sys.
RHR: Residual Heat Removal Sys., CHP: Charging Pump

Article 19 Operation

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

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

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

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

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

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

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

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

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

Licence holder is allowed to commence operation after the license conditions specified by the Reactor Regulation Law etc. are complied in the stage from licensing for establishment to the construction of commercial power reactors.

As legal regulations for licence holders to operate reactors safely, it is obliged to provide the Operational Safety Programs approved by the Minister of METI before commencement, and to observe necessary measures for operation and maintenance of commercial power reactors like Periodic Inspection etc., all through operating life time.

After the last reporting, demarcation of the Periodic Inspection and the Licensee's Periodic Inspection were clarified, and the scheme of the Periodic Safety Management Review is newly established.

Moreover, quality assurance activities, maintenance management activities, Periodic Safety Review, etc. are decided to be included into the Operational Safety Program.

As an inspection to verify the integrity of equipment, licence holders conduct Licensee's Periodic Inspections of facilities that are designated by the ordinance of the METI, and NISA (or JNES) perform his Periodic Inspection attending the Licensee's Periodic Inspection of important facilities for the public safety, or confirming the record of the Licensee's Periodic Inspection for verification of the safety. As for the Licensee's Periodic Inspection, it is obliged for licence holders to inspect periodically and to record and keep the results.

Furthermore, JNES examines the implementation system of the Licensee's Periodic Inspection (Periodic Safety Management Review), and notifies these results to NISA. NISA makes comprehensive evaluation on the implementation system of the Licensee's Periodic Inspection based on the notification by JNES.

As for the inspection to verify the licensee's observance of activities for safe operation, the Nuclear Safety Inspection is conducted by NISA, and NISA verifies whether processes such as implementing systems of licensee's activities for safe operation are appropriate in the light of quality assurance.

In addition, NISA has initiated the reexamination of the inspection system to evaluate the possibility to utilize *risk assessments and/or performance evaluations.*

19.1 Initial License

Licence holders in Japan are required by the Reactor Regulation Law to take the necessary measures for safe operation of reactor facility and protection of specified nuclear fuel materials. Pursuant to this principle, basic design (items in the main text of establishment license application document) approved by the Minister of METI must be observed throughout each stage of detailed design, construction and operation. In addition to the conditions in the application main text, major items in the attachments are to be observed as well.

Licence holders are also required to observe the conditions of establishment license in the application of construction plan (or design approval for fuel assembly), in which detailed design for each facility of a commercial power reactor is reviewed. Before the commissioning of a commercial power reactor, NISA conducts pre-service inspections to ensure the compliance with the licensing conditions.

After fulfilling regulatory procedures up to the construction stage shown in Fig. 7-3 of Article 7, licence holder is allowed to commence the operation of commercial power reactor.

The regulatory requirements for safe operation are prescribed in the Reactor Regulation Law. Thus, licence holders must develop safety measures necessary for operation and maintenance of the reactor, transportation and disposal of radioactive waste, prepare the Operational Safety Program and obtain approval of them from the Minister of METI and comply with them, assign Chief Engineers of Reactors and designate a Person Responsible for Operation who is responsible to the specified activities for safe operation and to make and keep operational records.

Moreover, in accordance with the Electricity Utilities Industry Law, it is specified that a Chief Electrical Engineer and a Boiler and Turbine Chief Engineer shall be assigned and submitted notice to the authority and also obliged that Licensee’s Periodic Inspection, Periodic Inspection and Periodic Safety Management Review shall be undergone within the interval not exceeding 13 months.

19.2 Limiting Conditions for Operation

Operation and maintenance of commercial power reactors are carried out in accordance with the Operational Safety Program approved by the Minister of METI in Japan.

Shown in Table 19-1 are the items included in Operational Safety Program. In item 3 of the program, the Limiting Conditions for Operation such as shutdown margin and reactor thermal limits, etc. are included. Table19-2 shows the items of the Limiting Conditions for Operation for commercial power reactors in Japan. If the LCO should not be complied, the Minister of METI could order the licence holder to suspend the operation of the nuclear facility and so forth by the Reactor Regulation Law.

In Japan, commercial power reactor facilities were allowed to be operated only within the rated electrical power. In December 2001, NISA reexamined the regulatory requirements, etc. and allowed the plant operation at the rated thermal power to those plants, where the Operational Safety Program is revised, where the safety is verified, where the operation manual is prepared, and where the operator training is implemented.

19.3 Regulations for Operation, Maintenance, Inspection and Testing

NISA posts a resident nuclear safety inspector at each commercial power reactor by the Reactor Regulation Law to supervise the licence holder's observance on the Operational Safety Program, etc.

and conducts the Nuclear Safety Inspections four times a year.

Moreover, NISA is authorized to access to the nuclear facility and examine the records, documents and other necessary matters at any time when the Minister of METI recognized it is necessary.

Licence holders are obliged to include matters concerning quality assurance in the Operational Safety Program in accordance with rules under the Reactor Regulation Law. Licence holders must establish the organization to implement the quality assurance, and also must plan, implement, evaluate and improve the activities for safe operation.

Licence holders are obliged to define maintenance management in the Operational Safety Program, and must define and implement policies, objectives, implementation plan, evaluation of the results, corrective actions, and the record of maintenance management.

NISA confirms the implementing of quality assurance and maintenance management through the Nuclear Safety Inspection.

Licence holders prepare various kinds of operation and test manuals in accordance with the Operational Safety Program to define actual detailed operating procedures.

Licence holders set up a committee to discuss important matters related to safe operation such as the modification of the Operational Safety Program and of documented procedures beforehand.

Chief Engineers of Reactors qualified by governmental examination is assigned to each reactor by the licence holder, and any appointment or dismissal is to be notified to NISA. The Chief Engineer of Reactor is authorized to express his view on safe operation to the site superintendent if he thinks it is necessary, to gives advice or recommendation to site staff and to participate in planning the safe operation.

Persons responsible for operation are appointed by the licence holder and assigned to every nuclear reactor. His essential task includes patrolling through the premises regularly and recognizing the operational conditions and safe operation etc. of the commercial power reactor under his responsibility.

Operational records about the inspection of fuel assemblies and nuclear reactor, reactor operation, radiation management, maintenance, incidents or failures and meteorology should be prepared and kept by the licence holder, by the Reactor Regulation Law.

Moreover, the Electricity Utilities Industry Law provides that the subject, method, result, etc. of the inspection are also required to be recorded and kept concerning the Licensee's Periodic Inspection result.

Licence holders must conduct a Licensee's Periodic Inspection in order to verify that facilities conform to the technical standard. When a crack/(s) in important components is(are) discovered by the inspection, the licence holder shall evaluate the impact of the crack(s) on the fitness for services of facility, and the result shall be recorded, kept and also reported to NISA at the same time. Moreover, the safety related critical component must undergo and pass the Periodic Inspection conducted by NISA and JNES.

The Periodic Inspection and the Licensee's Periodic Inspection are conducted in shutdown condition at the interval not exceeding 13 months from the date of commissioning or completion of the last inspection.

Furthermore, licence holders must apply for the Periodic Safety Management Review on the implementation system of his Licensee's Periodic Inspection to JNES, in accordance with the

Electricity Utilities Industry Law. JNES report the result of the Periodic Safety Management Review to NISA, and NISA evaluates the result. The scope of the succeeding safety management review may be varied by JNES, with reflecting the NISA's evaluation for licence holder's performance.

Licence holders perform checks based on the Operational Safety Program in order to verify the compliance to limiting conditions to operation.

Licence holders conduct a Periodic Safety Review of each reactor every 10 years, *based on the Reactor Regulation Law*, as described in Article 14.

Before 30 years operation after commissioning, technical evaluation on aging is performed and the next ten-year maintenance program should be planned, the ten-year maintenance program must be re-evaluated every ten years thereafter.

For more effective and efficient inspection system, harmonizing to the basic policy of the NSC, NISA intends to study on introduction of techniques of risk assessment or performance evaluation which are already introduced in Europe and US into the Periodic Inspection and the maintenance management for commercial reactors.

For this purpose, as the first step, the regulatory fields and the items in which the risk assessment and performance evaluation should be utilized, are to be clarified, as the second step, the basic framework and/or the roadmap of system introduction for short- and mid-terms, will be studied, then, as the third step, the concrete design of institutional arrangement will be discussed later.

19.4 Response to Accidents and Anticipated Operational Occurrences

Licence holders are required to include "operation of nuclear reactor facility" in the Operational Safety Program, in which the operational procedures for accidents and anticipated operational occurrences (abnormal events) as well as normal operation are described to cope with any incidents or abnormal events smoothly.

In the procedures of "measures for any abnormal events", such procedures on recognition of the situation, remedy to the cause, emergency measures, and a measure after reactor automatic scram and manual startup of an emergency AC power supply and a gas processing system are included.

Moreover, licence holders are required to prepare "emergency measures " in " operation of nuclear reactor facility ".

As "emergency measures", the licence holder defines, establishment of the nuclear emergency preparedness organization, preparation of resources necessary to nuclear emergency preparedness, maintenance of the communication system among the related parties, implementation of nuclear emergency exercises, official announcement of the emergency system, and the clearance of the emergency preparedness organization, etc. in accordance with the requirements of the Special Law of Emergency Preparedness for Nuclear Disaster.

The details of an emergency preparedness are described in Article 16.

19.5 Engineering and Technical Support: Application of the Results of Research and Development

METI has been promoting reliability verification test and research programs on major components and systems to enhance the safety of commercial power reactors. For example, NUPEC (then) had completed the demonstration test on the replacement method of BWR core shroud in 1997 and the results have been utilized to confirm the reliability of the installation method and the welding method for actual replacement. And the demonstration test on the replacement method of PWR reactor core internals was performed, and the outcome is to be utilized for actual replacement of the PWR internals 2004.

MEXT has been conducting safety research program as a part of nuclear science research. For example, the research on deterioration and damage of the major components important to safety, such as reactor pressure vessel under condition of the neutron irradiation is under way in JAERI, accumulating the basic data for decision-making on the safety of long-term operation of power reactors.

Safety assurance as prerequisite, and in order the nuclear power to play the role of a basic load electric power, the licence holders are making efforts in technology developments for further improvement in economical efficiency and for the long life operation of light water reactors. For example, measures for aging management covering the whole plant life, for major plant equipment of commercial power reactors are systematically developed aiming for efficient operation and maintenance. Specifically, the study on material property data, development of monitoring technologies for degradation diagnosis, development of life evaluation method, technology development for inspection, repair and replacement of core internals etc. has been performed.

Various private sectors also have been conducting complementary activities. For example, JSME has been developing and refining standards of industry associations for power generating components based on the principle of neutrality, fairness and transparency. The rule to evaluate the structural integrity of the nuclear equipment with flaws or cracks is provided in the "Rules on Fitness-for-Service for Nuclear Power Plants" which was established in 2000 (partially revised in 2002) by JSME.

As the fitness-for-service assessment system was introduced in October 2003, the Rules on Fitness-for-Service for Nuclear Power Plants has been adopted as the evaluation standard, and NISA has confirmed it is technically acceptable.

In addition to the standard of JSME, many efforts to decide various kinds of industrial standards have been made by Atomic Energy Society of Japan and Japan Electric Association. In order to use industrial guidelines practically, rules for quality assurance and maintenance management, which Japan Electric Association has developed, was verified by the regulatory body that they meet requirements of quality assurance for commercial power reactors in December 2003.

19.6 Reporting of Incidents

Reactor Regulation Law and the Electricity Utilities Industry Law require licence holders to report the situation and measures taken to the incidents or failures occurred in commercial power reactors to NISA. The reporting criteria prescribed in these laws are shown in Table 19-3.

Licence holders are making efforts to perform feedback of the lesson learned from the situation and measures taken to these incidents, the corrective actions which were derived by root cause analysis to other commercial power reactors.

The frequency of unplanned reactor shutdowns per year of commercial power reactors in Japan is around 0.2 times per reactor-year in recent years and well below the average of the world.

The International Nuclear Event Scale (INES) was introduced in August 1992 to assess events occurred in commercial power reactors. Since then, no incident or accident of level 2 or above has occurred in nuclear power plants and the most of events occurred are rated as level 0. INES results in Japan are shown in Appendix 2.5.

19.7 Collection, Utilization and Sharing of Operating Experience Information

NISA makes public of the incidents or failures immediately upon receiving the report and announces the causes and recurrence-preventive measures when finalized. NISA assesses each incident or failure in detail to abstract 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. *For example, the pipe rupture accident of the Unit 1 of Hamaoka NPS occurred on November 7, 2001 was evaluated to be caused by the excessive pressure force caused by rapid combustion of the non condensable gas (hydrogen) collected in the piping, and the pipe resulted in ductility fracture. And the lesson learned was feed-backed, such as removal of the piping etc., so that hydrogen gas might not be accumulated in the safety related piping of BWR plants in Japan.*

JNES has the system to collect and analyze safety information in and outside of the country. JNES provides collected safety information and results of analysis quickly to NISA and share them with NISA. JNES and NISA jointly established "Safety Information Review Meeting" to evaluate them and to take adequate regulatory measure. Safety Information Review Meeting is held periodically.

In regard to international information exchange, the mechanism has been established to share the information on nuclear incidents and failures with the IAEA and OECD/NEA as well as in the bilateral corporations with China, France, Korea, Sweden and the United States.

Meanwhile, licence holders collect and analyze information on domestic and foreign operating experiences by themselves and through CRIEPI. Concerning to the safety information of domestic plants, they developed a tool, "NUCIA" that is a nuclear information disclosure library, with which information including minor events can be shared by all over Japan, and it is on the Internet since October 2003. Moreover, overseas information exchange is performed through the institute of nuclear power operation (INPO) and the World Association of Nuclear Operators (WANO) Tokyo Center. Furthermore, each licence holder utilizes individual agreements on information exchange with utilities and manufacturers in France, Germany and the United States. As a lessons learned form JCO Criticality Accident, recognizing the importance to share safety information and foster safety culture in all nuclear industries, all of the relevant nuclear industries established a private organization "Nuclear Safety Network" in December 1999, as described in Article 10.

There are many feedback of operating experience by licence holders, 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 upper head of reactor vessel.

19.8 Management of Spent Fuel and Radioactive Waste

Details are described in the National Report of Japan (September 2003) for the "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management".

Table 19-1 Items to be Included in the Operational Safety Program

1) The duties of personnel engaged in the operation and management of the nuclear reactor facility, and the organization
2) The following items with respect to safe operation education for personnel engaged in the operation and management of the nuclear reactor facility
   a. Policy for the safe operation education (including preparation of education program)
   b. The contents of safe operation education as follows
      i) Relevant laws and the Operational Safety Program
      ii) Structure, performance and operation of the nuclear reactor facility
      iii) Radiation management
      iv) Handling of nuclear fuel materials and objects contaminated by them
      v) Measures to be taken in emergencies
   c. Other necessary items for safe operation education of the nuclear reactor facility
3) Operation of the nuclear reactor facility
4) Safety reviews on the operation of the nuclear reactor facility
5) Designation of radiation controlled areas, access controlled areas and environment monitoring areas, and restriction of access to these areas
6) Ventilation and drainage monitoring equipment
7) 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
8) Management of radiation measuring instruments
9) Patrols and checks of the nuclear reactor facility and their associated measures
10) Receipt, delivery, transport, storage and other handling of nuclear fuel materials
11) Disposal of radioactive waste
12) Measures to be taken in an emergency
13) Records on safe operation of the nuclear reactor facility (including compliance of the Operational Safety Program)
14) *Maintenance management of the nuclear reactor facility (except those contained in the next item)*
15) *Periodic assessment of the nuclear reactor facility*
16) *Quality assurance of the nuclear reactor facility*
17) Other necessary items for safe operation of the nuclear reactor facility

Table 19-2 (Part 1) Items of Limiting Conditions for Operation (BWR)

System	Item
Reactivity control system	Shutdown margin, Reactivity monitoring, Control rod motion monitoring, Control rod scram time, Control rod operation, Boron water injection system
Power distribution	Reactor thermal limit, Reactor thermal power and core flow
Control & Instrumentation	Instrument and control equipment
Reactor coolant system	Reactor re-circulation pump, Jet pump, Main steam relief and safety valve, Reactor coolant leak rate, System pressure monitoring of the emergency core cooling system and reactor isolation cooling system, Concentration of Iodine 131 in reactor coolant, Reactor shutdown cooling system, Limit of temperature & temperature change rate limit of primary coolant, Reactor pressure
Emergency core cooling system	Emergency core cooling system, Reactor core isolation cooling system
Reactor containment vessel system	Main steam isolation valve, Reactor containment vessel & Isolation valve, Vacuum break valve from suppression chamber to drywell, Average temperature of suppression pool, Flammability control system, Oxygen concentration in containment vessel, Reactor building, Reactor building H&V isolation valve, Standby gas treatment system
Plant system	Cooling system and cooling sea water system for residual heat removal system, Emergency diesel generator cooling system, Cooling system and cooling sea water system for Diesel generator of High pressure core spray system, Water level & temperature of spent fuel pool, Central control room H&V system
Emergency power supply system	Offsite power supply system, Emergency diesel generator, Emergency diesel fuel, DC power supply, Station power system
Others	Withdrawal of single control rod during reactor shutdown Removal of single control rod drive mechanism, Inspection with withdrawal of multiple control rods, In-service leak-rate or hydrostatic test, Inspection with switching of reactor mode

Table 19-2 (Part 2) Items of Limiting Conditions for Operation (PWR)

System	Item
Reactivity control system	Shutdown margin, Critical boron concentration, Moderator temperature coefficient, Control rod motion function, Control rod insertion limits, Control rod position indication, Physics tests, Chemical and volume control system (function of boron concentration)
Power distribution	Reactor thermal power limit, Heat flux hot channel factor, Nuclear enthalpy rise hot channel factor, Axial neutron flux difference, Quadrant power tilt ratio
Control & Instrumentation	Instrument and control equipment
Primary coolant system	DNB ratio, Temperature & pressure and temperature change rate of primary coolant, Primary coolant system, Pressurizer, Pressurizer safety valve, Pressurizer relief valve, Low temperature over-pressurization protection, Primary coolant leak rate, Steam generator tube leak monitoring, Leak monitoring to residual heat removal system, Iodine 131 concentration in primary coolant
Emergency core cooling system	Accumulator tank, Emergency core cooling system, Refueling water storage tank, Boron injection tank
Reactor containment	Reactor containment vessel, Reactor containment vessel vacuum relief valve, Reactor containment vessel spray system, Annulus air cleanup system, Annulus
Plant system	Main steam safety valve, Main steam isolation valve, Main feedwater isolation valve, Main feedwater control valve, Main feedwater bypass control valve, Main steam relief valve, Auxiliary feedwater system, Condensate water tank, Component cooling water system, Sea water system for component cooling water system, Emergency circulation system of control room, Air cleanup system of safety auxiliary equipment room, Air cleanup system of fuel handling building
Emergency power supply system	Offsite power supply, Diesel generator, Emergency diesel fuel & lubricating oil and starting air for emergency diesel generator, Emergency DC power supply, Station bus bar for emergency
Others	Boron concentration in primary coolant, Water level of reactor cavity, Reactor containment penetrations, Water level & temperature of spent fuel pit

Table 19-3 Reporting Criteria of Incidents and Failures Provided in Legislations

Provision of the Reactor Regulation Law
1. When nuclear fuel material was stolen or lost. 2. When a reactor was shut down by failure of a reactor facility or when it became necessary to shut down a reactor during operation, *or when reactor power output changes more than 5%, or when reactor power output change of more than 5% was required. Except when it was one of the following and the licence holder 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 Utilities Industry Law (Law No. 170, 1964) i.e. the failure in the equipments that the functional and operational conditions of the failed equipment cannot be checked under the reactor shutdown condition.* *ii) When the failure did not cause any deviation from the limit of operation (it is a requirement defined in the Operational Safety Program for operation of the nuclear reactor facility, and when it cause any deviation from the concerned conditions the measure that the licence holder should take is also defined in the Operational Safety Program, the same in this paragraph), and there is no change observed related with the concerned failure, and when the licence holder performs inspection of the failed equipment concerned.* *iii) When the reactor output change is required to follow the limit of operation.* *3. When a licence holder checked the equipment and structure important to the safety of the nuclear reactor facility provided by the Minister of METI (hereinafter called as "equipment etc. important to safety" in this paragraph as), 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 (Ordinace No. 62 of MITI, 1965), or when it was considered that it does not have function to ensure safety of the nuclear reactor facility.* *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. Except for the preceding three items, when deviation from the limit of operation by the failure of a the nuclear reactor facility (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 reactor facility or occurrence of other undetermined 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 reactor facility 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 undetermined 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. *Other than those above items,* when persons are injured or could be injured in the the nuclear reactor facility (except when the injury was other than radiation hazard *and was not necessary for hospitalization*).
Provision of the Electricity Utilities Industry Law
1. *Fatal and injury accidents associated to electric shock, or breakdown of the electric structure of a nuclear power generation, or miss-operation, or omission of the necessary operation of the electric structure of a nuclear power generation (limited to the case of death or being hospitalized at hospital or clinic for treatment).* 2. *Electric fire accident (limited to the case of more than the partial destruction by fire. Except matters referred to in the previous item and the next to the fifth item).* 3. *Causing damage to public property due to failure of the electric structure of a nuclear power generation, or miss-operation, or omission of necessary operation of the electric structure, accident by which usage of road, park, school and other institution or structure were made impossible or accident which did influence socially (except referred to previous two items).* 4. *Breakdown accident of main electric structures (except referred to previous three items and the next item).* 5. *Incident that influenced other electric utility to force suspension of electric power supply of than 7,000 kW and less than 70,000 kW for more than one hour, or suspension of electric power supply more than 70,000 kW for more than ten minutes, associated to the breakdown of the electric structure of a nuclear power generation, or miss-operation, or omission of operation necessary for the electric structure of a nuclear power generation.*