Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

National Report of Japan
for the Fourth Review Meeting

October, 2011

Government of Japan

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on the Safety of Spent Fuel Management
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Table of Contents

Acronyms

ACNRE	Advisory Committee for Natural Resources and Energy
AIST	National Institute of Advanced Industrial Science and Technology
ANRE	Agency of Natural Resources and Energy
BWR	Boiling Water Reactor
CATV	Cable Television
CRIEPI	Central Research Institute of Electric Power Industry
CSD-B	Colis Standard de Dechets Boues
CSD-C	Colis Standard de Dechets Compactes
ERSS	Emergency Response Support System
FBR	Fast Breeder Reactor
FNCA	Forum for Nuclear Cooperation in Asia
GNEP	Global Nuclear Energy Partnership
HLW	High level radioactive wastes
HRD	Human Resource Development
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IFNEC	International Framework of Nuclear Energy Cooperation
INES	International Nuclear and Radiological Event Scale
JAEA	Japan Atomic Energy Agency
JAEC	Japan Atomic Energy Commission
JAPCO	Japan Atomic Power Company Inc.
JNES	Japan Nuclear Energy Safety Organization
JNFL	Japan Nuclear Fuel Limited
LLW	Low level radioactive wastes
LWR	Light Water Reactor
METI	Ministry of Economy, Trade and Industry
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MHLW	Ministry of Health, Labour and Welfare
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MOFA	Ministry of Foreign Affairs
NISA	Nuclear and Industrial Safety Agency, METI
NISS	Nuclear and Industrial Safety Subcommittee
NPO	Non Profit Organization
NPS	Nuclear Power Station
NSC	Nuclear Safety Commission of Japan

NUMO	Nuclear Waste Management Organization of Japan
OECD/NEA	Nuclear Energy Agency of Organisation for Economic Co-operation and Development
PCV	Primary Containment Vessel
PFSB	Pharmaceutical and Food Safety Bureau, MHLW
PWR	Pressurized Water Reactor
RCIC	Reactor Core Isolation Cooling System
RPV	Reactor Pressure Vessel
RM	Relationship Management
RWMC	Radioactive Waste Management Funding and Research Center
STPB	Science and Technology Policy Bureau, MEXT
TEPCO	Tokyo Electric Power Company

Definitions

Advisory Committee on Mid- and Long-term Measures	Advisory Committee on Mid- and Long-term Measures at the Fukushima Dai-ichi NPS of Tokyo Electric Power Co. Inc.
Category 1 waste disposal	Geological disposal for high-level radioactive waste and TRU waste for geological disposal.
Category 2 waste disposal	Disposal for low-level radioactive wastes other than geological disposal.
Contaminated Water	Accumulated water with high concentration of radioactive materials
Designated Radioactive Wastes	High-level radioactive wastes generated from spent fuel reprocessing
Disposal operator	Professional operator who has sufficient economic and technical abilities
Final Disposal Act	Designated Radioactive Waste Final Disposal Act
Investigation Committee	Investigation Committee on the Accidents at the Fukushima Nuclear Power Station of Tokyo Electric Power Company
JEAC 4111-2009	JEAC 4111-2009, "Rules of Quality Assurance for Safety of Nuclear Power Plants"
Long-term Program	Long-term Program for Development and Utilization of Nuclear Energy
June Report	Report of the Japanese Government to the IAEA Ministerial Conference on Nuclear Safety
Medical Care Act, etc.	The Medical Care Act, the Clinical Laboratory Technicians and Health Laboratory Technicians Act and the Pharmaceutical Affairs Act
MOX fuel	Uranium and Plutonium Mixed Oxide fuel
Nuclear Emergency Preparedness Act	Act on Special Measures Concerning Nuclear Emergency Preparedness
Off-Site Center	Emergency Response Key Facility
Preliminary Investigation Areas, etc.	Preliminary Investigation Area, Detailed Investigation Area and Construction Site for Final Disposal Facility
Radiation Disease Prevention Act	Act on Prevention of Radiation Disease due to Radioactive Isotope, etc.
Reactor Regulation Act	Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Nuclear Reactors
Subsurface disposal	Disposal in the underground deeper than 50 meters. This disposal method is classified in Category 2 waste disposal.
Specified Radioisotope	Sealed radioisotope that exceeds criteria of a certain quantity and has a possibility of bearing serious influence to human health
TRU wastes	Low-level radioactive wastes generated from MOX fuel fabrication or reprocessing facilities. Also known as “long-lived low-heat-generating radioactive wastes” in the radioactive waste regulation in Japan. Generally, this waste contains Trans Uranic material.
Waste from research facilities, etc.	Low level radioactive wastes generated from the facilities such as research institutes and medical facilities.

Section A Introduction

A1 Current status of management of spent fuel and radioactive waste in Japan

A1.1 Status of utilization and management of nuclear energy in Japan

Nuclear facilities in Japan are listed in Table A1-1, the details of which are described in Section D.
The overview of spent fuel management and radioactive waste management and the current status of the preparation of radioactive waste disposal regulation system are shown in Table A1-2 and Table A1-3 respectively.

A1.2 Activities in the nuclear facilities in Japan since the last report

1. The start of construction in Recycle-Fuel Storage Center

The Recyclable-Fuel Storage Company jointly established by the Tokyo Electric Power Company Inc. (TEPCO) and the Japan Atomic Power Company Inc. (JAPCO) filed an application for license to Minister of Economy, Trade and Industry (METI) in March 2007 based on the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Nuclear Reactors (hereinafter referred to as “Reactor Regulation Act”) for the Recyclable-Fuel Storage Center (See Fig.L5-1 and Fig.L5-2) to be established in Mutsu City of Aomori Prefecture. And the application was licensed in May 2010. Application for the design and construction approval was submitted to the Minister of METI in June 2010, and it was approved in August 2010, and the construction work started. The Recyclable-Fuel Storage Center has the maximum storage capacity of about 3,000 tons (metallic uranium prior to irradiation) to store spent fuels generated from Boiling Water Reactors (BWRs) and Pressurized Water Reactors (PWRs) in metallic dry casks (See Fig.L5-3), and is scheduled to start commercial operation in July 2012.

2. Start of decommissioning of Hamaoka Nuclear Power Station Unit 1 and 2 of the Chubu Electric Power Co., Inc.

In November 2009, the Chubu Electric Power Co., Inc. received the approval (modified in February 2011) from METI, for the decommissioning plan for the Unit 1 and 2 which described a basic policy for the entire period of decommissioning and the items to be carried out during the first stage of “Period of preparation for dismantling”. According to the decommissioning plan, the Company will continue to ship out fuel and start the survey and evaluation of contamination status, system decontamination, and dismantling and removal of equipment/components located outside the radiation controlled areas in the first stage of “Period of preparation for dismantling”. The Company expects to complete the decommissioning in 2030s.

3. Issuance of clearance certificate for modification of former JRR-3

The Japan Atomic Energy Agency (JAEA) intended to handle 4,000 tons of concrete fragments generated from the JRR-3 (research reactor for neutron utilization) modification activities as extremely low radioactive materials that does not need to be dealt with as radioactive waste (items below clearance level). Therefore, in November 2007, JAEA applied for approval of the methods for measuring and assessing radioactivity concentrations in concrete fragments for clearance purpose to the Minister of Education, Culture, Sports, Science and Technology (MEXT), and received the approval in July 2008. MEXT confirmed the radioactivity concentrations for about 758 tons of the concrete fragments, and issued each clearance certificate for about 377 tons in May 2010, and for about 381 tons in December 2010.

4. Status of Rokkasho nuclear fuel cycle facilities

Japan focuses its nuclear policy on nuclear fuel cycle in “the Framework for Nuclear Energy

Policy (2005)" to reprocess spent fuel and to effectively utilize the recovered uranium and plutonium. The Japan Nuclear Fuel Limited (JNFL) has its nuclear fuel cycle facilities (uranium enrichment facility, reprocessing facility, uranium-plutonium mixed oxide fuel (hereinafter referred to as MOX fuel) manufacturing facility, waste storage facility and low level radioactive waste (LLW) disposal facility) in Rokkasho Village of Aomori Prefecture. Among those facilities, uranium enrichment facility, waste storage facility and LLW disposal facility are already in operation.

Among reprocessing facilities, spent fuel receipt and storage facility has been in operation since 1999. The pre-service tests of the main part of the reprocessing plant are now implemented by Nuclear and Industrial Safety Agency (NISA), and the completion is planned in October 2012. As of April 2011, the modification work for the improvement of temperature control in the glass melting furnace for vitricification process of high level radioactive waste has been completed and the restart of performance verification test is in preparation.

The construction of MOX fuel manufacturing facility started in October 2010 and it is scheduled to be completed in March 2016.

A 1.3 Response to the items pointed out at the last review meeting

1. Establishment and implementation of regulatory system for subsurface disposal

NISA amended the Reactor Regulation Act in June 2007, in order to make two classifications in the regulatory system. The conventional radioactive waste disposal of LLW including subsurface disposal was categorized as "Category 2 waste disposal" and disposal of HLW was categorized as "Category 1 waste disposal" and in March 2008, amended the related ministerial order, which specifies safety requirements.

The Nuclear Safety Commission (NSC) issued the "Policy of the Safety Assessment of Subsurface Disposal after the Period for Active Control" in April 2010, and the "Basic Guide for Safety Review of Category 2 Radioactive Waste Disposal" in August 2010.

The regulatory system for subsurface disposal is reported in Section H.

2. Implementation of radioactive waste disposal in non-nuclear power areas

The Committee on the Research and Development in Nuclear Field under the Research Plan/Assessment Subcommittee of the Council for Science and Technology issued a report on the framework to implement the disposal of low level radioactive wastes generated from the facilities such as research institutes and medical facilities (hereinafter referred to as "waste from research facilities, etc.") in September 2006.

In response to this report, MEXT amended a part of the "Law for the Incorporated Administrative Agency, JAEA", in June 2008, and JAEA was designated as the implementing entity of the disposal of the waste from research facilities, etc.

MEXT issued the "Basic Policy for Implementation of Waste Disposal" together with METI in December 2008. JAEA established the "Plan for Implementation of Waste Disposal" according to the Basic Policy and received approval from Ministers of MEXT and METI in November 2009. JAEA is proceeding with the work toward full-scale disposal operation according to the annual plan.

The implementation of radioactive waste disposal in non-nuclear power areas is reported in Section B.

3. Selection of final disposal site for high level radioactive waste and establishment of the safety regulation

The "Plan for Designated Radioactive Waste Final Disposal" that was approved in the Cabinet meeting in March 2008, requests NUMO to select areas for detailed investigation areas around mid 2010's and select the site for repository construction around 2030.

NSC's Advisory Board on High-level Waste Repository Safety issued the report on "Safety Communication on Geological Disposal" in January 2011. This report is based on the Committee's recognition that it is important, in confidence building of the safety of geological disposal, to establish a safety communication system, which enables stakeholders or their

representatives to participate in the process to establish the confidence in long-term safety, as well as a regulatory framework that fully takes account of ensuring the robustness of long-term safety functions of waste disposal facilities.
Selection of final disposal site for high level radioactive waste and establishment of the safety regulation are described in Section B and E.

4. Consideration of long-term management of sealed radioactive sources unreturnable to manufacturers

Almost all of the sealed radioactive sources have been originated and imported from abroad and they are to be returned to the foreign manufacturers after the usage. Thus there exist very few unreturnable sealed radioactive sources to originated country, and the management of them has been executed appropriately under "the Act on Prevention of Radiation Disease due to Radioactive Isotope, etc." (hereinafter referred to as "Radiation Disease Prevention Act"). It is considered that there exist no specific issues concerning to the unreturnable sealed sources.
The long-term management of sealed radioactive sources unreturnable to manufacturers is reported in Section J.

5. Consideration of clearance system for Uranium waste

NSC issued the report titled "Clearance Level for Uranium Processing Facilities" in October 2009.
In response to this report, NISA investigated the matter in the Radioactive Waste Safety Subcommittee under the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy (hereinafter referred to as NISS/ACNRE) in order to incorporate metals generated from uranium processing facilities into the current clearance system. As a result, NISA published "Establishment of the Clearance System for Uranium Processing Facilities" in November 2010. Based on the results of these investigations, the relevant ordinance was amended in June 2011. MEXT prepared a report titled "Confirmation of the Clearance Level for Uranium Processing Facilities" at the Technical WG of the Research Reactor Safety Regulation Study Committee, etc., and amended the relevant ordinance in February 2011 based on the report.
The clearance system for Uranium waste is reported in Section B.

A 1.4 Systematic activities for safety improvement

1. Continuation of research for enhancing the confidence in waste disposal technology

The Japan Nuclear Energy Safety Organization (JNES), JAEA and the National Institute of Advanced Industrial Science and Technology (AIST) concluded the "Cooperation Agreement for the Safety Research on Geological Disposal of Radioactive Wastes" in accordance with the system for implementing the research activities presented in the report titled "Research Activities to Support Regulation of Management and Disposal of Radioactive Wastes (fiscal years 2010 - 2014)" issued by the Radioactive Wastes Safety Subcommittee under the NISS/ACNRE in October 2009. Under this Agreement, these organizations are continuously conducting joint-studies such as "Study on the Applicability of Performance Assessment Methods for the Horonobe Underground Research Laboratory Project", according to NISA's regulatory needs.
The research for enhancing the confidence in waste disposal technology is reported in Section K.

2. Operation of sealed radioactive source tracking system

MEXT amended the Rules for the enforcement of the Radiation Disease Prevention Act in October 2009 to introduce "National Registration System of Radioactive Sources" based on the IAEA's "Code of Conduct on the Safety and Security of Radioactive Sources", and started its formal operation in January 2011.
The sealed radioactive source tracking system is reported in Section K.

A 1.5 Responses to all recommendations adopted at the previous Review Meeting

For the following action items listed in the executive summary of the previous Review Meeting:

- Establishment of comprehensive regulatory framework;
- Effective independence of regulatory bodies;
- Implementation of strategic plan which sets forth clear milestones;
- Financial resources for ensuring waste management;
- Education and recruitment of competent staff and personnel; and
- Geological repository for high level radioactive waste.

Necessary actions have already been taken or are being taken by the responsible organizations. The details are described in relevant Sections of this report.

Table A1-1 Nuclear facilities in Japan

Nuclear facility	Number
Nuclear power rector	54
Nuclear power rector under construction	3
Nuclear power rector at decommissioning stage	4
Nuclear fuel fabrication facility	6
Spent fuel reprocessing facility	2
Radioactive waste storage facility	2
Radioactive waste disposal facility	2
Operating research reactor	15
Research reactor at decommissioning stage	7
Nuclear fuel material utilization facility*	15

*: The facilities that use nuclear fuel material and are prescribed in Article 41 of the Enforcement ordinance of the Reactor Regulation Act.

Table A1-2 Overview of Policy and Practice on Spent Fuel Management and Radioactive Waste Management

Type of Liability	Long-term management policy	Funding	Current practice / Facilities	Planned Facilities
Spent fuel	Reprocessing	Utility pays fund for reprocessing	Domestic reprocessing plants	Interim storage facility
Nuclear fuel cycle waste	Geological, intermediate depth or near surface disposal	Utility pays fund for disposal of waste	HLW Storage Facility / LLW Disposal Facility	Geological, subsurface or near surface disposal facilities
Non-power waste	Geological, intermediate depth or near surface disposal	Operator pays	On site storage	near surface disposal facilities
Decommissioning liabilities	Decommissioning of NPP	Operators pays into reserve fund	Decommissioning underway	-
Disused Sealed Source	Return to manufacturer / Long-term storage	User	Return to manufacturers / Storage inside facilities	-

Table A1-3 Classification of basic concepts for disposal and status of activities preparing relevant regulations

Classification			JAEC		NSC						Legislation etc. on safety regulations		
			Disposal method	System and Responsibility	Fundamental concept of safety regulation			Upper bound of radioactive waste disposal		Safety review guidelines	Law	Government order	Rules
High level radioactive waste			**Completed** "Policy on processing and disposal of radioactive wastes" (Interim Report) (August 1984) "Basic policy toward disposal of high level radioactive wastes" (May 1998)		**Completed** "Basic policy of safety regulation on high level radioactive waste disposal " (November 2000) "Environmental requirements to be considered at the selection of the preliminary investigation areas for high level radioactive waste disposal" (September 2002) "Licensing procedure relating to the safety regulation of specified radioactive waste disposal and involvement of Nuclear Safety Commission in these activities" (Interim Report) (May 2007) "Safety Communication on the Geological Disposal" (January 2011)		**Completed** Commonly Important Issues for the Safety Regulations of Radioactive Waste Disposal,(June, 2004).			**Future discussion**	The Reactor Regulation Act* Radiation Disease Prevention Act	**Published** "Enforcement Ordinance for the Reactor Regulation Act" (April 2008)	**Published** "Rules for category 1 waste disposal for nuclear fuel material or material contaminated with nuclear fuel material" (April 2008)
Low- level radioactive waste	Long Half Lives Low Heat Radioactive Waste (TRU waste)		**Completed** "Basic policy of processing and disposal of radioactive wastes containing transuranic nuclides" (March 2000) "Geological disposal of long half lives low heat radioactive waste, Technical feasibility of co-disposal with high level radioactive waste" (April 2006)		**Completed** "Basic policy of safety regulation on low level radioactive waste disposal" (Interim Report) (July 2007) "Policy of the safety assessment of subsurface disposal after the period for active control" (April 2010)			**Completed** "Upper Bounds of Radioactive Concentration for Burial of Low-Level Radioactive Solid Waste" (May 2007)		**Partially Completed** Basic guide for safety review of category 2 radioactive waste disposal, (August 2010) **Future discussion** Guide for geological disposal			**Partially Published** "Rules of category 1 waste disposal for nuclear fuel material or material contaminated with nuclear fuel material" (April 2008) "Rules for category 2 waste disposal of nuclear fuel material or material contaminated with nuclear fuel material" (April 2008)
	Waste from power reactor facility	Waste of Core Structures etc. (Relatively higher radioactive waste)	**Completed** "Basic policy of disposal of low level radioactive waste that exceeds the concentration limit value in the ordinance" (October 1998)		**Completed** "Basic policy of safety regulation on low-level radioactive waste disposal that exceeds the concentration limit value in the ordinance" (July 2007) "Policy of the safety assessment of subsurface disposal after the period for active control" (April 2010)	**Completed** Basic Policy for Safety Regulations on Low-Level Radioactive Waste disposal (Interim Report), (July 2007)		**Completed** "Reference radionuclide concentration values for safety regulations of land disposal of low-level radioactive solid waste" (Third Report) (September 2000)	**Completed** "Upper Bounds of Radioactive Concentration for Burial of Low-Level Radioactive Solid Waste"(May, 2007)	**Completed** Basic guide for safety review of category 2 radioactive waste disposal, (August 2010)		**Published** "Enforcement Ordinance for the Reactor Regulation Act" (December 2000)	**Published** "Rules for category 2 waste disposal for nuclear fuel material or material contaminated with nuclear fuel material" (April 2008)
		Low level radioactive waste (Relatively lower radioactive waste)	**Completed** "Policy on processing and disposal of radioactive wastes" (Interim Report) (August 1984)	**Completed** "Policy on processing and disposal of radioactive wastes" (Final Report) (October 1985)	**Completed** "Basic policy of safety regulation for land disposal of low-level solid radioactive waste" (October 1985)			**Completed** "Reference radionuclide concentration values for safety regulations of land disposal of low level radioactive solid waste" (Interim Report) February 1987), ib. (Second Interim Report) (June 1992)		**Completed** Basic guide for safety review of category 2 radioactive waste disposal, (August 2010)		**Published** "Enforcement Ordinance for the Reactor Regulation Act" (March, 1987), (September 1992)	
		Very low level Radioactive waste Concrete, etc.						**Completed** "Reference radionuclide concentration values for safety regulations of land disposal of low level radioactive solid waste" (Second Interim Report) (June 1992)		**Completed** Basic guide for safety review of category 2 radioactive waste disposal, (August 2010)		**Published** "Enforcement Ordinance for the Reactor Regulation Act" (September 1992)	
		Metal, etc.						**Completed** "Reference radionuclide concentration values for safety regulations of land disposal of low level radioactive solid waste" (Third Interim Report) (September 2000)				**Published** "Enforcement Ordinance for the Reactor Regulation Act" (December 2000)	
	Uranium waste		**Completed** "Basic policy of processing and disposal of Uranium wastes" (December 2000)		**Partially Completed** "Basic concept of safety regulation for near surface disposal of solid radioactive waste generated from research laboratories, etc." (April 2006)			**Future discussion**				**Published** "Enforcement Ordinance for the Reactor Regulation Act" (April 2008)	**Future discussion**
	Waste from research facilities, etc.		**Completed** "Fundamental concept of processing and disposal of wastes generated at research laboratories, etc."(May 1998) The report on "The approach to realize the disposal of radioisotopes and waste from research facility etc. (to be disposed of near surface)"(October, 2006) "The promotion of the approach to realize the disposal of waste from research facility etc." (February 2008)		**Completed** "Basic policy of safety regulation of near surface disposal of solid radioisotope wastes generated from radioactive isotope use facility" (January, 2004) "Basic policy of safety regulation for near surface disposal of solid radioactive waste generated from research laboratories, etc." (April, 2006)	*2		**Completed, except for radioisotope waste disposal facility** "Upper Bounds of Radioactive Concentration for Burial of Low-Level Radioactive Solid Waste" (May 2007)		**Completed, except for radioisotope waste disposal facility** Basic guide for safety review of category 2 radioactive waste disposal, (August 2010)		**Published** "Enforcement Ordinance for the Radiation Disease Prevention Act" (May 2005) "Enforcement Ordinance for the Reactor Regulation Act" (April 2008)	**Partially Published** "Rules for the enforcement of Radiation Disease Prevention Act" (June 2005) "Rules for category 2 waste disposal for nuclear material contaminated with nuclear fuel material" (April 2008)
Materials that need not be treated as radioactive wastes (Waste equivalent to clearance)			**Completed** "Policy on processing and disposal of radioactive wastes" (Interim Report) (August 1984) "Basic policy of processing and disposal of uranium wastes" (December 2000)		**Under discussion since May 1997** a: Completed: Major nuclear reactor facilities (March 1999), Heavy water reactors, fast neutron reactors, etc. (July 2001), Nuclear fuel material use facilities (facilities dealing with irradiated fuels and materials) (April 2003), Radionuclide concentrations for materials not requiring treatment as radioactive wastes, generated from dismantling etc. of reactor facilities and nuclear fuel use facilities" (December 2004), (Partial amendment, March, 2005), Uranium processing facilities (October 2009) b. Under discussion: TRU facilities c. Future discussion: Radioisotope facilities							**Published** "Enforcement Ordinance for the Reactor Regulation Act" (December 2005)	**Partially Published** Rules for the confirmation of radioactivity concentration within the materials used in the factory of licensee defined in clause 4 of Article 64-2 of Reactor Regulation Act(December 2005), (June 2011) "Rules for confirmation, etc. on radioactivity of reactors, etc. for use of research and development" (November 2005), (February 2011)

*1): Waste from research facilities, etc. includes not only the waste regulated under the Reactor Regulation Act but also the waste regulated under the Radiation Disease Prevention Act, the Medical Care Act or the Pharmaceutical Affairs Act.

*2): "Basic concept of safety regulation on low-level radioactive waste burial" (Interim Report) (July 12, 2007)

A2 Main theme of the National Report

A2.1 Policies and Practices

ANRE amended Designated Radioactive Waste Final Disposal Act (hereinafter referred to as “Final Disposal Act”), reviewed the total research and development program at the “Geological Disposal Basic Research and Development Coordinating Council” and compiled “Overall Research Programme on Basic R&D of Geological Disposal of HLW”. The Agency is to promote international cooperation in this field using the frameworks of IAEA, OECD/NEA, International Framework of Nuclear Energy Cooperation (IFNEC), etc.

MEXT amended the “Law for the Incorporated Administrative Agency, JAEA” in June 2008, and JAEA was designated as the implementing entity for disposal of “wastes from research facilities, etc”. MEXT issued the “Basic Policy for Implementation of Waste Disposal” with METI in December 2008. JAEA established an implementation plan according to the Basic Policy, and received approval from the Ministers of MEXT and METI in November 2009.

The Recyclable-Fuel Storage Company received operation license for the Recyclable-Fuel Storage Center from the Minister of METI in May 2010, received approval for the design and construction methods in August 2010, and started construction of the facility. The Recyclable-Fuel Storage Center has the storage capacity of about 3,000 tons (as metallic uranium prior to irradiation), and is scheduled to start operation in July 2012.

The Chubu Electric Power Co., Inc. received approval for the decommissioning plan for Hamaoka Nuclear Power Station Unit 1 and 2 in November 2009. The Company expects to complete the decommissioning in 2030s.

JAEA received certificate for clearance confirmation, from the Minister of MEXT based on the Reactor Regulation Act in May and December 2010, for about 758 tons out of 4,000 tons of concrete fragments generated from the modification work of JRR-3 which is a research reactor for neutron utilization.

Based on the progress of the Nuclear Energy Policy and the outside and inside situations, etc. surrounding the nuclear energy in Japan, the Japan Atomic Energy Commission (JAEC) decided in November 2010 to initiate efforts to compile a new policy plan setting up the New Nuclear Policy-planning Council under the Commission to conduct surveys and deliberations on matters necessary for formulating the new policy. As a result of the accident of Fukushima Dai-ichi NPS of TEPCO, JAEC decided interruption of deliberations in April 2011. And then in August JAEC again decided to resume the activities, and now deliberations are being conducted to formulate the new policy.

A2.2 Decommissioning

Power Reactors in the process of being decommissioned include Tokai Power Station of JAPCO, the Advanced Thermal Reactor “Fugen” of JAEA and the unit 1 and 2 at Hamaoka NPS of Chubu Electric Power Co., Inc.

JAPCO applied for decommissioning plan approval for the Tokai Power Station (gas cooled reactor) in March 2006 and received approval from the Minister of METI in June 2006. As it took much time to prepare for the installation of a conveyer for dismantled equipment, JAPCO decided 3 years’ prolongation of the schedule for this preparatory work. As a result, JAPCO notified NISA, in July 2010, of the modification of the decommissioning plan to change the schedule for dismantling work of reactor area.

JAEA terminated commercial operation of advanced thermal reactor “FUGEN” in March 2003 and received approval based on the Reactor Regulation Act from the Minister of METI for decommissioning plan in February 2008. With this, “FUGEN” entered into decommissioning stage. The “Advanced Thermal Reactor Fugen Power Station” was renamed as “Decommissioning Research and Development Center”.

In November 2009, the Chubu Electric Power Co., Inc. received approval from the Minister of METI for the decommissioning plan for Hamaoka Nuclear Power Station Unit 1 and 2, which describes the basic policy for decommissioning plan over the entire period and the items to be carried out during the first stage of “Period of preparation for dismantling”. In the first stage, the Company will continue to ship out fuel and start the survey and evaluation of contamination conditions, system decontamination, and dismantling and removal of equipment/components outside the radiation controlled areas.

Moreover, a total of 8 Research Reactors in the process of being decommissioned or planned to be decommissioned include JRR-2 of JAEA, the Reactor Facilities of The First Nuclear Ship (Mutsu) and Deuterium Criticality Assembly (DCA) of JAEA, and Hitachi Training Reactor (HTR) of Hitachi Ltd., Training Reactor-1 (TTR-1) of Toshiba Corporation, Rikkyo University Institute for Atomic Energy (RUR), Tokyo City University (former Musashi Institute of Technology) Research Reactor (MITRR), The University of Tokyo Research Reactor (Yayoi).

A2.3 Legal and Regulatory systems

1. Development of legal systems for the final disposal of HLW

As a step for facilitating nuclear fuel cycle, the government of Japan amended relevant laws in 2007 in order to take necessary measures for steady implementation of the disposal of high level radioactive wastes and long-lived low-heat-generating radioactive wastes (hereinafter referred to as “TRU wastes”) generated in the processes of nuclear fuel cycle.
The laws amended and their outlines are shown below:

(1) Amendment of the Final Disposal Act

In addition to the HLW, the following wastes are also added to the waste that is disposed of NUMO.

a. TRU wastes generated from spent fuel reprocessing and from MOX fuel fabrication process
b. HLW to be returned from abroad (as exchanged wastes) in exchange for TRU wastes originally planned to be returned

In addition, TRU waste disposal costs were added to the disposal reserve fund that is paid to NUMO by the licensees of nuclear power plants and of reprocessing facility as the costs for the final disposal of Designated Radioactive Wastes.

(2) Amendment of the Act for Deposit and Administration of Reserve Funds for Reprocessing of Spent Fuel from Nuclear Power Generation.

An amendment was made to add the provisions to adjust the reserve fund for the decrease of the radioactive waste storage and disposal costs due to receiving of the exchanged wastes

(3) Amendment of the Reactor Regulation Act

Since the operation of disposal of high level radioactive waste (vitrified waste) became foreseeable, the Nuclear Emergency Preparedness Subcommittee under the NISS/ACNRE studied the approach to nuclear material safeguard related to radioactive waste disposal operation and issued a report titled “Approach to Nuclear Material Safeguard for Radioactive Waste Disposal” in October 2007. In response to this report, the Reactor Regulation Act was partially amended to add the provisions for the safeguard measures related to the final disposal of high level radioactive waste, and the Enforcement Order for the Reactor Regulation Act and some of the relevant ministerial ordinances were also partially amended as necessary rulemaking for implementing the Act in 2008.

2. Quality improvement of regulatory activities of NISA
NISA started to develop a management system for the quality improvement of regulatory activities in fiscal 2006 and has been implementing the system since fiscal 2007.
Addressing to the report of the Basic Policy Subcommittee of NISS/ACNRE titled as "Identification of Nuclear Safety Regulation Issues" that points out the following five items for future challenges concerning nuclear safety regulation, NISA discussed the system and policy for the approach to these challenges. NISA reflected the discussion result to the "Mission and action plan of NISA" (Mission Paper) that is revised annually.

- Use of experience and findings from safety regulation ;
- Anticipation of possible changes of the object of regulation ;
- Response to changes of economic and international situations ;
- Improvement of communication with stakeholders ;
- Undertaking toward functional regulatory body.

A2.4 General provisions

1. Undertaking for securing human resources
The regulatory bodies and nuclear industries in Japan are striving to develop human resources as a part of ensuring future nuclear safety infrastructure.

In 2006, NISA established the Subcommittee for Nuclear Safety Infrastructure under the NISS/ACNRE and the Subcommittee is discussing measures for developing and ensuring human resources for nuclear safety area.

As part of human resource development, NISA established the Nuclear Safety Training Center in Hitachinaka City, Ibaraki Prefecture in April 2008, to enhance the training for fostering and skill up of NISA staff. In addition, the capability management system was incorporated into the education and training program in 2009. This system not only provides the staff with the opportunities for training courses or OJT for acquiring knowledge necessary for their duties, but also prepares customized education and training programs, with the involvement of their superiors, so that they can be sure to take courses and to build up experience. NISA continues mid-career recruiting of personnel who have practical experience in nuclear power industry. This approach has been proven to be effective for upgrading the total technical competence of NISA.

MEXT and ANRE of METI have been implementing "Nuclear Energy Human Resources Development Program" since 2007, focusing on the research activities in the areas of basic nuclear technology. Also, from 2010, MEXT has been carrying on International Nuclear Human Resource Development Initiative to support cross-sectional Human Resource Development (HRD) activities among the nuclear-related organizations in academy, industry and government. The "Japan Nuclear Human Resource Development Network" was established in November 2010, with the aim of enhancing this mutual cooperation among academy, industry and government, and to create an all-Japan nuclear HRD system.

A2.5 Safety of spent fuel management

1. Development of safety regulation system for spent fuel storage and transportation
Joint Working Group ("Intermediate storage WG under Nuclear Fuel Cycle Safety Subcommittee" and "Transport WG") deliberated about the inspection to confirm the integrity of metallic cask and its contents during the storage of spent fuel and the rational inspection program at the time before the transport of the spent fuel contained cask after the termination of storage. The Joint WG summarized the result in "Long term integrity of the cask and its contents during the interim spent fuel storage facility using metallic casks (June 2009)"

Addressing the report, NISA amended the relevant regulations that enable Holistic Approach to cope with the taking out of metallic cask without opening the sealed boundary of metallic cask lids after the interim storage of spent fuel at interim storage facilities.

A2.6 Safety of radioactive waste management

1. Development of safety regulation system for radioactive waste

NSC studied the clearance level for nuclides such as uranium based on the concept of regulatory exemption and issued the report titled “Clearance Level for Uranium Processing Facilities” in October 2009. On the basis of this report, NISA requested the Radioactive Wastes Safety Subcommittee of the NISS/ACNRE to discuss the clearance system, in order to incorporate metals generated from the uranium handling facilities into the existing clearance system, and issued the report titled “Establishment of the Clearance System for Uranium Processing Facilities” in November 2010, on which basis NISA amended relevant ministerial ordinances. MEXT amended relevant ministerial ordinances in February 2011, on the basis of the report titled “Confirmation of the Clearance Level for Uranium Processing Facilities” issued by the Technical WG of the Research Reactor Safety Regulation Study Committee.

NSC issued the “Policy of the Safety Assessment of Subsurface Disposal after the Period for Active Control” in April 2010, which incorporated risk-based safety assessment in order to appropriately address uncertainties in the long-term prediction after the period for active control. NSC also issued the “Basic Guide for Safety Review of Category 2 Radioactive Waste Disposal” in August 2010, by adding the safety assessment of subsurface disposal to the safety assessment of near surface disposal of low level radioactive waste which was already in practice in Japan.

2. Implementing entity for disposal of “waste from research facilities, etc.”

MEXT designated JAEA as the implementing entity of disposal of wastes generated from research facilities, etc. by amending a part of the “Law for the Incorporated Administrative Agency, JAEA”, in June 2008. JAEA established the annual plan according to the “Basic Policy for Implementation of Waste Disposal” and the ”Plan for Implementation of Waste Disposal”, and is proceeding with the actual disposal activities.

A2.7 Disused sealed sources

1. Establishment of the National Registration System of Sealed Radioactive Sources

Based on the IAEA’s “Code of Conduct on the Safety and Security of Radioactive Sources”, the National Registration System of Sealed Radioactive Sources has been introduced by the amendment of the Rules for Enforcement of the Radiation Disease Prevention Act in October 2009 and enforced in January 2011. The system requests the concerned licensee to report to MEXT, the information on specification, receipt, delivery, etc. of sealed radioactive sources that exceed criteria of a certain quantity and have a possibility of affecting serious influence to human health.

A2.8 Systematic activities for enhancing safety

1. Coordination of safety research and research activities to support regulation

The regulatory needs were reaffirmed in view of the changing situations surrounding safety regulation of radioactive wastes such as amendment of the Reactor Regulation Act and reconsideration of the Regulatory Guides by NSC. Based on such reaffirmation, the Radioactive Wastes Safety Subcommittee under the NISS/ACNRE developed the report “Research Program to Support Regulation of Management and Disposal of Radioactive Wastes (from FY 2010 to FY 2014)” in October 2009, and the Decommissioning Safety Subcommittee developed the report “Research Program to Support Regulation of Decommissioning (from FY 2010 to FY 2014)” in November 2009. In addition, the “research programs to support regulation of management/disposal of radioactive wastes and decommissioning (from FY 2010 to FY 2014)" were developed to define yearly research plans that fit the regulatory needs.

A3 The Accident at Fukushima Nuclear Power Stations (NPSs) of TEPCO due to the Tohoku District-off the Pacific Ocean Earthquake and the resulting tsunamis

A3.1 The incidence and development of the accident at Fukushima Dai-ichi NPS of TEPCO

In terms of the operating status at Fukushima NPSs before the earthquake on March 11, 2011 Unit 1 was under operation at its rated electric power, Units 2 and 3 were under operation at their rated thermal power, and Units 4, 5 and 6 were under periodic inspection.
At the Fukushima Dai-ichi NPS, Units 1 to 3 which were under operation automatically shut down at 14:46 on March 11. All six external power supply sources were lost because of the earthquake. This caused the emergency diesel power generators to start up. However, seawater pumps, emergency diesel generators and distribution boards were submerged because of the tsunami strike, and all emergency diesel power generators stopped except for one generator in Unit 6. For that reason, all AC power supplies were lost except at Unit 6. One emergency diesel power generator (an air-cooled type) and the distribution board escaped submersion and continued operation at Unit 6. In addition, since the seawater pumps were submerged by the tsunami, residual heat removal systems to release the residual heat inside the reactor to the seawater and the auxiliary cooling systems to release the heat from various equipments to the seawater lost their functions.

TEPCO's operators followed TEPCO's manuals for severe accidents and urgently attempted to secure power supplies in cooperation with the government, in order to recover various kinds of equipment within the safety systems while the core cooling equipment and the water-injection equipment, which had automatically started up, were operating. However, ultimately power supplies could not be secured.
Since the core cooling functions using AC power were lost in Units 1 to 3, core cooling functions not utilizing AC power were put into operation, or, alternately, attempts were made to put them into operation. These were operation of the isolation condenser in Unit 1, the operation of the reactor core isolation cooling system (RCIC) in Unit 2 and the operation of the RCIC and the high pressure coolant injection system (HPCI) in Unit 3.
These core cooling systems that do not utilize AC power supplies stopped functioning thereafter, and were switched to alternative injections of freshwater or sea water by fire extinguishing lines, using fire engine pumps.

Concerning Units 1 to 3 of Fukushima Dai-ichi NPS, as the situation where water injection to each the Reactor Pressure Vessel (RPV) was impossible to continue for a certain period of time, it seems that the nuclear fuel in each reactor core was not covered by water but was exposed, leading to a core melt. There is a possibility that part of the melted fuel stayed at the bottom of the RPV.
It seems that a large amount of hydrogen was generated by chemical reactions between the zirconium of the fuel cladding tubes, etc. and water vapor. In addition, the fuel cladding tubes were damaged and radioactive materials therein were discharged into the RPV. Further, it seems that these hydrogen and radioactive materials were discharged into the Primary Containment Vessel (PCV) during the depressurization process of the RPV.
Injected water vaporizes after absorbing heat from the nuclear fuel in the RPV. Accordingly, it seems that the inner pressure rose in the RPVs which had lost their core cooling functions, and this water vapor leaked through the safety valves into the PCV. Due to this, the inner pressure within the PCVs in Units 1 to 3 rose gradually, with PCV wet well vent operations carried out a number of times, in which the gases in the PCVs were released from the gas phase area in the suppression chamber into the atmosphere, through the ventilation stack, for

the purpose of preventing damage to the PCV caused by the pressure therein.

After the wet well venting of the PCVs, explosions presumably caused by hydrogen which had leaked from the PCV occurred in the upper area of the reactor buildings, ruining the operation floor in the reactor buildings of Units 1 and 3. As a result of these incidents, a lot of radioactive materials were discharged to the atmosphere. Following the ruination of the Unit 3 building, an explosion probably caused by hydrogen occurred in the reactor building of Unit 4, ruining its upper area. In Unit 4, all core fuels had been transferred to the spent fuel pool for periodic inspection before the earthquake. During this time, various measures, including the PCV vent operation, were being taken along with water injection, however a big impulsive sound was observed.

The most urgent task at the site, along with recovery of the power supply and the continuation of water injection to reactor vessels, was water injection to the spent fuel pools. In the spent fuel pool in each unit, the water level continued to drop on account of the evaporation of water caused by the heat of the spent fuel in the absence of the pool water cooling function, due to the loss of power supply. Water injection to the spent fuel pool was carried out by the Self-Defense Forces, the Fire and Disaster Management Agency and the National Police Agency, using helicopters and water cannon trucks. Concrete pump trucks were ultimately secured, which led to stable water injection using freshwater from nearby reservoirs after the initial seawater injection.

A3.2 Current status of Fukushima Dai-ichi NPS of TEPCO and future efforts to settle the situation regarding the Accident

Regarding the current status of the Fukushima Dai-ichi NPS, as of the end of August 2011, freshwater has been injected to the RPVs through feed water systems using temporary installed electricity driven pumps at Units 1, 2 and 3 and has been continuously cooling the fuel in the RPVs. This has helped the temperature around the RPVs stay less than 100 degree Celsius in Unit 1, 130 degree Celsius in Unit 2 and 120 degree Celsius in Unit 3 at the lower part of RPVs. From June 27, recirculation water cooling has started, that the contaminated water (accumulated water) retained within the buildings are processed and injected to reactor. Although the RPV and PCV of Unit 1 have been pressurized to some extent, steam generated in some units such as Units 2 and 3 seems to have leaked from the RPV and PCV, which appears to have condensed to form accumulations of water found in many places, including the reactor buildings, and some steam seems to have been released into the atmosphere. To respond to this issue, the status has been checked by dust sampling in the upper part of the reactor buildings, and discussion and preparation for covering the reactor buildings has been underway, together with securing a variety of depository for the accumulated water. As for Unit 1, the construction of the structure to cover up the reactor building started in June 28. Cold shutdown of Units 5 and 6 has been maintained using residual heat removal systems with temporary seawater pumps.

TEPCO published the “Roadmap towards Restoration from the Accident at Fukushima Dai-ichi Nuclear Power Station” on April 17. In the Roadmap, Step 1 as “Radiation dose steadily decreasing” and Step 2 as “Release of radioactive materials is under control and radiation dose is being significantly held down” are to be implemented as the target. Time period for Step 1: around 3 months, and the time period for Step 2: about 3 to 6 months after the Step 1 were mentioned as the target.

TEPCO published revised editions of Current Status of “Roadmap towards Restoration from the Accident at Fukushima Dai-ichi Nuclear Power Station” on May 17 and June 17 reflecting the evolution of the situation of the NPS.

The Government Nuclear Emergency Response Headquarters published “Summary of Progress Status of Roadmap towards Restoration from the Accident at Fukushima Dai-ichi Nuclear Power Station, TEPCO” on May 17. In it Government announced of the basic policy as “By bringing the reactors and spent fuel pools to a stable cooling condition and mitigating the release of radioactive materials, we will make every effort to enable evacuees to return to their homes and for all citizens to be able to secure a sound life”. And the progress status is revised in the Summary on June 17.

On July 19, the government and TEPCO jointly published the revised edition of ““Summary of Progress Status of Roadmap towards Restoration from the Accident at Fukushima Dai-ichi Nuclear Power Station, TEPCO”.
The Nuclear Emergency Response Headquarters confirmed that the roadmap to settle the situation regarding the accident will transition from Step 1 to Step 2. This was the result of a comprehensive assessment of the situations including that the radiation doses indicated by monitoring posts, etc. were steadily on the decrease, efforts to cool the reactors and spent fuel pools have progressed, the treatment of stagnant water has progressed, etc.

Under Step 2, from October of 2011 to January of 2012, efforts will be made to achieve a situation in which the release of radioactive materials is under control, and the radiation exposure dose is being significantly held down through the realization of the cold shutdown of the rectors etc. The Nuclear Emergency Response Headquarters positioned Step 2 as an effort to be undertaken by the Government-TEPCO Integrated Response Office, and that the government will be sufficiently engaged to settle the accident, including efforts to improve the life and work environment for workers, the enhancement of radiation control and the medical system, and the training of staff. The government will make its utmost efforts to surely achieve the goals of Step 2 and settle the accident as soon as possible.
As the specific situation so far, regarding the cooling of the spent fuel pools, by August 10, “more stable cooling” (a target in Step 2) was achieved before others, as circulating cooling with heat exchangers has been implemented in all Units (1, 2, 3 and 4). In order to implement the treatment of stagnant water and more stable and efficient injection of treated water into the reactor, as second-line treatment facilities, a cesium adsorption treatment facility (SARRY) has been installed and has begun treatment on August 19 and treatment began with evaporative concentration equipment, which reinforces the desalination process.
After that, the Government and TEPCO published the progress on August 17 and September 20. (See Annex L7)

At the Fukushima Dai-ichi NPS where the recent nuclear accident occurred, there are plans to aim to remove the spent fuel and debris and, ultimately, to take measures for decommissioning. To achieve these objectives, the Mid- and Long-term Response Team of the Government-TEPCO Integrated Response Office is discussing for efforts to address these mid- and long-term challenges at “Advisory Committee on Mid- and Long-term Measures at the Fukushima Dai-ichi NPS of Tokyo Electric Power Co. Inc.,” (hereinafter referred to as “Advisory Committee on Mid- and Long-term Measures”) of the Atomic Energy Commission along with addressing issues by dividing them into mid-term challenges and long-term challenges.
Mid-term challenges include consideration of preventive measures against sea contamination by way of the groundwater, integrity and seismic safety evaluation, and the removal of spent fuel from the spent fuel pools. The Mid- and Long-term Response Team is currently discussing and designing the construction of underground boundaries on the ocean-side of the NPS site in order to prevent the expansion of sea contamination by way of the groundwater, etc. For the present, the removing spent fuels from the spent fuel pools, etc. will be tackled for the next three years, with preparations now underway, including the installation of equipment necessary to clear rubble scattered atop the reactor buildings and remove spent fuel, and modifications to the common pool to which spent fuels in the spent fuel pools are to be transferred.
Long-term challenges include the construction of reactor containment boundaries, the extraction of debris, and the disposal of radioactive waste..

"Advisory Committee on Mid- and Long-term Measures" of the JAEC is currently discussing and putting together basic policies for efforts to address these mid- and long-term challenges and a set of research and development issues that are expected to be useful and helpful in pursuing those efforts. This Advisory Committee is identifying and sorting out technical challenges to be solved so that debris can be removed from the RPV and then put under control, using examples from the activities at Unit 2 of the Three Mile Island nuclear power plant in the United States.

A3.3 Investigation of the cause of, and derivation and sharing of the lessons learned from, the accident of Fukushima Dai-Ichi NPS of TEPCO

The Japanese Government published the "Report of the Japanese Government to the IAEA Ministerial Conference on Nuclear Safety (hereinafter referred to as "June Report")" on June 7, 2011 (See Annex L7), as a preliminary accident investigation report, that was prepared by the Nuclear Emergency Response Headquarters on the evaluation of the accident and the lessons learned mainly in the areas of nuclear safety and nuclear emergency preparedness, based on the domestic investigation of the accident. The June report has shown 28 lessons learned together with specific measures, including enhancement of severe accident prevention measures, enhancement of severe accident management measures, enhancement of preparedness and response to nuclear disaster, strengthening of infrastructure to ensure safety, and strengthening of safety culture.

Japan is making its greatest possible efforts to address the 28 "lessons learned" indicated in the June report. The state of progress among these items is not uniform, with some items already having been fully implemented, others now in the process of being implemented, and still others that are to be newly planned in the future. Japan will prevent the recurrence of such an accident as this by addressing each item steadily and thoroughly based on the idea of "defense in depth," which is the most important basic principle in securing nuclear safety. In addition, while the NISA has given directions of immediate emergency measures to operators since March 30 based on the findings about this accident as of the time point, it is contemplating that the contents which are supposed to respond to each of the lessons need to be further reviewed based on extensive knowledge in Japan and overseas from now on and be improved and reinforced.

The Government established the "Investigation Committee on the Accidents at the Fukushima Nuclear Power Station of Tokyo Electric Power Company" (hereinafter referred to as "Investigation Committee") in order to provide an overall investigation of the utility of countermeasures being taken against the accident. Aspects stressed within this Investigation Committee are independence from Japan's existing nuclear energy administration, openness to the public and the international community, and comprehensiveness in examining various issues related not only to technical elements but also to institutional aspects. These concepts are used as the basis for strictly investigating all activities undertaken so far, including activities by the Government in terms of countermeasures against the accident.

As for the accident investigation by the international agency, IAEA conducted a preliminary investigation, under the agreement between IAEA and the Japanese Government, to make fact-finding of the accident at TEPCO's Fukushima Dai-Ichi Nuclear Power Station, to identify preliminary lessons learned, and to disseminate the information to the international nuclear community. The expert mission from IAEA visited Japan and made investigation including on-site survey on May 24 through June 1. The result of the investigation was published on June 16, and was reported at the IAEA Ministerial Conference which was held on June 20-24.

The government recognizes that it is incumbent upon Japan to continue to provide accurate information regarding the accident to the international community, including lessons learned through the accident. In accordance with this approach the Government of Japan decided to compile information on the state of affairs subsequent to the June report in the form of an additional report and submit it to the IAEA on the occasions of the Board of Governors meeting and the General Conference held in September this year.(See Annex L7)

A4 Other Topics

A4.1 International activities

It is a policy of Japan to use nuclear energy only for peaceful purposes. In line with this policy, Japan has been participating in and will further contribute to the IAEA's activities as a framework for international cooperation. For instance, the IAEA's safety standard committees have been working for developing and updating the safety standards topped by the Safety Fundamentals (SF-1) and Japan has been striving to introduce those standards into deliberation on the nation's policies for peaceful use of nuclear energy.
Japan, recognizing the importance of international cooperation in ensuring safety in spent fuel and radioactive waste management, will continuously take part in the activities of the IAEA and OECD/NEA.

In Asian region, Radioactive Waste Safety Management project (Radioactive Waste Management project to 2008) has been implemented within the framework of the Forum for Nuclear Cooperation in Asia (FNCA), formerly called the International Conference for Nuclear Cooperation in Asia (ICNCA) from 1995 through 2000. This project is intended to contribute to the safety improvement of radioactive waste management in Asian region through exchanging and sharing the experience, findings and information on radioactive waste management among participating countries. Japan has been playing a leading role for this activity. Particularly, this project prepares and updates, as appropriate, a consolidated report on radioactive waste management that summarizes the activities in the participating countries by using this Convention as a reference.

The Radioactive Waste Management Topical Group of the Asian Nuclear Safety Network (ANSN), which is being operated as a part of the IAEA's Extra-Budgetary Program for Asia, helps non-contracting countries to prepare for becoming contracting parties to this Convention by using the results of FNCA activities. Japan has been actively working in support of the Joint Convention. As part of such activity, Japan hosted an IAEA-sponsored workshop on the Joint Convention in Tokyo in September 2010, to facilitate understanding and ratification of the Joint Convention. Ten Southeast Asian countries, including Malaysia, Thailand, and Vietnam participated in the workshop.

A4.2 Impacts of Niigataken Chuetsu-Oki earthquake

The Niigataken Chuetsu-Oki earthquake that occurred on July 16, 2007, affected Kashiwazaki-Kariwa Nuclear Power Station of the TEPCO. The operating units were automatically shut down by detecting the earthquake and safety of the station was ensured. However, a number of impacts were identified by the post-earthquake investigation. As for the impact on spent fuel management, some equipment held on the inner wall surface of the spent fuel pool dropped down on the fuel storage racks, however, the investigation confirmed that there was no effect or damage to the spent fuel stored in the pool and thus safety was ensured.
As for the impact on radioactive waste management, drums that contained radioactive wastes and were stored in the solid waste depository fell down on the floor and lids of some drums came off, however, there was no release of radioactive material to the outside of the depository and no safety problem was caused by this occurrence. These occurrences were evaluated as "below scale" in the International Nuclear Event Scale (INES).
Since the water in the spent fuel pool overflowed due to sloshing, TEPCO estimated quantity of the overflowing water and its impacts. NISA verified the estimation revealed that, although the water level of the pool was lowered, it was kept well above the spent fuel storage racks

which are installed to keep the spent fuel submerged, and that the pool water can be made up by the suppression pool water via residual heat removal system.

A5 Preparation of the report

A5.1 Structure of the report

This report describes the steps taken in Japan for implementing the obligations under the "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management" in accordance with the provision of Article 32 of the Convention.

The report was prepared in accordance with "the Guidelines regarding the Form and Structure of National Reports". The text of each Article of the Convention is indicated at the top of the section.

In principle, this report compiles the information available as of the end of March 2011, unless otherwise specified. However, it compiles the information of the accident of Fukushima NPS of TEPCO as of the end of August 2011.

This report is structured as described below for the purpose of comprehensive and systematical explanation of the spent fuel management and radioactive waste management activities in Japan. Section B describes the policy of the Government of Japan for facilitating management of spent fuel and radioactive waste and the activities of the Licensees in line with the policy. Section E describes the legal systems to facilitate management of spent fuel and radioactive wastes as well as the legal systems for safety regulation and the organizations responsible for safety regulation. The relevant organizations other than the regulatory bodies are also described in Section E. Section F describes, as in the previous national report, general activities for ensuring safety, not to specific to spent fuel management and radioactive waste management. Section G describes the safety regulation of spent fuel storage, as an example of the safety regulatory system for spent fuel management. Section H describes safety regulation of "waste disposal" which mainly deals with radioactive wastes, as an example of the radioactive waste management defined in the Convention.

The major items that made progress or was newly implemented during the period covered by the report are outlined in Section A. In the section, the outline of the Fukushima Dai-ichi NPS Accident due to the Tohoku District - off the Pacific Ocean Earthquake and the resulting tsunamis is also described.

A5.2 Organizations involved in the preparation of the report

The report has been prepared by the NISA of METI. The major organizations involved in the preparation of the report are as follows:

Governmental organizations

- The Japan Atomic Energy Commission (JAEC) and the Nuclear Safety Commission of Japan (NSC) of the Cabinet Office
- Agency for Natural Resources and Energy (ANRE) and Nuclear and Industrial Safety Agency (NISA) of Ministry of Economy, Trade and Industry (METI)
- Research and Development Bureau, Research Promotion Bureau and the Science and Technology Policy Bureau of the Ministry of Education, Culture, Sports Science and Technology (MEXT)
- The Pharmaceutical and Food Safety Bureau and Health Policy Bureau of the Ministry of Health, Labor and Welfare (MHLW)
- Ministry of Foreign Affairs (MOFA)
- Minister's Secretariat and Environmental Management Bureau, Minister of Environment*[1]
- Nuclear Sufferers Life Support Team, The Government Nuclear Emergency Response Headquarters*[1]

Business operators

- The Federation of Electric Power Companies*[2]
- The Nuclear Waste Management Organization of Japan (NUMO)
- Japan Atomic Energy Agency (JAEA)

In addition, cooperation was obtained from the following organizations in preparing the report.

- Japan Nuclear Energy Safety Organization (JNES)
- Radioactive Waste Management Funding and Research Center (RWMC)

*[1]:Minister's Secretariat and Environmental Management Bureau, Minister of Environment and Nuclear Sufferers Life Support Team, the Government Nuclear Emergency Response Headquarters were involved in measures for decontamination and radioactive waste management due to the accident at Fukushima NPSs of TEPCO. In addition, Nuclear Sufferers Life Support Team is such an organization that was established on March 29, 2011 under the Government Nuclear Emergency Response Headquarters on the basis of the determination of the head of the Government Nuclear Emergency Response Headquarters, in order to respond to refuge of the sufferers and securement of acceptance of them, transportation of commodities to emergency evacuation areas, etc. and other challenges of information service, etc. due to the accident.

*[2]:The Federation of Electric Power Companies consists of 10 electric power utilities, i.e., Hokkaido Electric Power Co. Inc., Tohoku Electric Power Co. Inc., Tokyo Electric Power Co. Inc., Hokuriku Electric Power Co., Chubu Electric Power Co. Inc., Kansai Electric Power Co. Inc., Chugoku Electric Power Co. Inc., Shikoku Electric Power Co. Inc., Kyushu Electric Power Co. Inc., and Okinawa Electric Power Co. Inc. In preparing the report, the Federation of Electric Power Companies also provided information on the activities of the Japan Atomic Power Company, Japan Nuclear Fuel Limited and the Recyclable-Fuel Storage Company.

Section B Policies and Practices

Article 32

1. In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:
   - (i) spent fuel management policy;
   - (ii) spent fuel management practices;
   - (iii) radioactive waste management policy;
   - (iv) radioactive waste management practices;
   - (v) criteria used to define and categorize radioactive waste.

Section B describes the national policy for promoting the spent fuel management and radioactive waste management in Japan and the operator's actions based on that policy. The policy and actions for the safety of spent fuel management and radioactive waste management are described in "Section G Safety of Spent Fuel Management" and "Section H Safety of Radioactive Waste Management", respectively.

In Japan, on the basis of the basic principle provided in "the Framework for Nuclear Energy Policy", ANRE of METI established concrete policies for the utilization of nuclear energy as energy source, and MEXT established concrete policies for the utilization of nuclear energy and radioisotopes for science and technology and Ministry of Foreign Affairs formulates and establishes foreign policy with regard to international cooperation in the field of nuclear energy area.

B1 Spent Fuel Management Policy

In the Framework for Nuclear Energy Policy, JAEC evaluated the "Basic Concepts of the Nuclear Fuel Cycle from the following ten viewpoints: safety, technical feasibility, economic viability, energy security, environmental protection, nuclear non-proliferation, international trends, issues resulting from policy changes, social acceptability, and adaptability to emerging circumstances (adaptability to future uncertainty).." and the Framework concluded "When promoting nuclear power generation in Japan, we should comprehensively consider such matters as ensuring economic viability, working to create a sound material-cycle society, ensuring energy security, and ensuring the capability to respond to future uncertainty." "We have reached the conclusion that our basic policy is, aiming at using nuclear fuel resources as effective as reasonably achievable, to reprocess spent fuel and to effectively use the recovered plutonium and uranium, while ensuring safety, nuclear non-proliferation, environmental protection, and paying attention due to economic viability. Spent fuel will be reprocessed, within the available reprocessing capacity, for the time being, and the surplus volume exceeding the capacity will be stored intermediately."

In accordance with the basic principle provided by the Framework for Nuclear Energy Policy, the "Act for Deposit and Administration of Reserve Funds for Reprocessing of Spent Fuel from Nuclear Power Generation" (see Section E) was established that requires the operators to deposit the funds for spent fuel reprocessing in a fund administration corporation. The objective of "the Act" is to ensure the proper implementation of spent fuel reprocessing, disposal of radioactive wastes generated from reprocessing, and disassembling of reprocessing facilities. The amount of reserve by the end of March 2011 is about 2,400 billion yen by 10 electric utilities. As a part of such steps, The Minister of METI designated "Radioactive Waste Management Funding and Research Center" (public interest incorporated foundation) as a non-profit "fund administration corporation" (October 2005) that is supervised by the Minister through supervisory orders and on-the-spot inspection.

B2 Spent Fuel Management Practices

1. Reprocessing of spent fuel generated from nuclear power generation

Electric utilities had sent spent fuel to British and French reprocessing companies since 1969. And the export of spent fuel to foreign reprocessing plants closed in July 2001. Approximately 7,100MTU of spent fuel had been exported.

A part of national demand for reprocessing had been covered by the reprocessing plant (reprocessing capacity: 0.7MTU per day) of the incorporated administrative agency, JAEA, which was commissioned in December 1980, in Tokai village in Ibaraki Prefecture. This plant was built for the purpose of establishing reprocessing technology and of training and fostering engineers and technicians in Japan. However, the plant terminated the reprocessing service contracted by the electric utilities in the end of March 2006. Since then, it has been utilized as a facility for developing technologies for reprocessing spent MOX fuel in light water reactors (LWRs), spent fuel in an advanced thermal reactor and spent fuel in a fast breeder reactor. The plant has reprocessed a total of approximately 1,100MTU of spent fuel since the commissioning.

In response to the amendment of the Reactor Regulation Act in 1979, a private reprocessing company, the Japan Atomic Fuel Service Co., Ltd. (presently, the Japan Nuclear Fuel Ltd.) was established in 1980, funded by the electric utilities. This company commenced construction of a commercial reprocessing plant with annual reprocessing capacity of 800 MTU in Rokkasho village, Aomori Prefecture in 1993, based on the operating experience of the reprocessing plant of JAEA, considering the trends of domestic demand for reprocessing, and introducing technologies and experiences accumulated in the leading countries in the field of reprocessing. Spent fuel storage has already begun in a plant, completed in 1999, with the storage capacity of 3,000MTU. This plant has accepted a total of approximately 3,300MTU by the end of March 2011. As of the end of March, 2011, the amount of spent fuel stored in nuclear power plants of LWR in Japan amounts to approximately 14,000MTU. The reprocessing plant started pre-service inspection using actual spent fuel in 2006 aiming at commencement of operation in 2012. The plant has reprocessed a total of approximately 430MTU for the pre-service inspection at the end of March 2011.

2. Offsite interim spent fuel storage

The Reactor Regulation Act was amended in 1999 to incorporate provisions on interim spent fuel storage. In response to this amendment, TEPCO and JAPCO jointly established “Recyclable-Fuel Storage Company”. The “Recyclable-Fuel Storage Company” applied to the Minister of METI for the license for the construction and operation of Recyclable-Fuel Storage Center at Mutsu city, Aomori Prefecture, which is the Japan’s first offsite interim spent fuel storage facility (See Fig.L5-1, L5-2) in March 2007, based on the Reactor Regulation Act. The application was accepted in May 2010. The application for the design and method of construction was made to the Minister of METI in June 2010, and was approved in August 2010. Upon receipt of the approval, the construction was started. The Recyclable-Fuel Storage Center is a facility to store spent fuel generated in BWRs and PWRs in metallic dry casks (See Fig. L5-3), and is capable of storing maximum of approximately 3,000 t (metric tons of metal uranium before irradiation) of spent fuel. This facility is scheduled to start the operation in July 2012.

3. Management of spent fuel from research reactor facilities

The spent fuel from research reactor facilities is either returned to the USA, or is reprocessed or stored in Japan.

B3 Radioactive Waste Management Policy

Radioactive wastes may need extraordinarily long time for their effects to attenuate to an insignificant level and disposal of them has to be governed by four principles; “principle of generators’ liability”, “principle of minimization of radioactive wastes”, “principle of reasonable treatment and disposal” and “principle of implementation based on mutual understanding with the public”. On the basis of such recognition, JAEC deems it important to appropriately categorize the wastes so that they may be safely treated and disposed of according to the categorization. From such viewpoint, JAEC categorized the wastes into “radioactive wastes subject to geological disposal” and “radioactive wastes subject to disposal with active control” and indicated basic strategies for each category. In accordance with such strategies, the government of Japan developed the policy for promoting radioactive waste disposal as described below.

1. Radioactive waste subject to geological disposal

(1) High level radioactive waste

In Japan, a site for geological disposal of high level radioactive waste is determined through three steps of the selection of “preliminary investigation areas”, “detailed investigation areas” and “construction site of final disposal facility”, in accordance with the “Final Disposal Act” (See Section E). Pursuant to the Act, the Cabinet approved the “Basic Policy for Final Disposal” and the “Final Disposal Plan” and the Nuclear Waste Management Organization of Japan (NUMO) was established as an organization to implement final disposal. In addition, utilities have been deposited the reserve funds for final disposal to NUMO. The amount of reserve by the end of March, 2011 is about 840 billion yen. Appeal to the public for candidate areas for literature survey on possible installation of final disposal facility was conducted by NUMO, but the literature survey has not yet been commenced.

Under such situation, JAEC stated that the current activities should be enhanced to obtain understanding and cooperation of the electricity consumers who are benefitted with nuclear power generation as well as the local residents of various sectors of local communities, including local authorities, across the country.

In response to that, the Radioactive Waste Subcommittee under the Nuclear Energy Subcommittee of Electricity Business Subcommittee prepared an interim report on the enhancement of the activities to promote the final disposal. The report requires that the government should, by itself, ask local governments to conduct literature survey, while maintaining the present procedure of open solicitation of candidate areas. The report also asks the government, NUMO and electric utilities to enhance national and regional public relations, to propose regional development plans, to enhance research and development and international cooperation for promoting the public understanding.

Specifically, publicity works are conducted in each prefecture in Japan and workshops are organized in association with non profit organizations (NPOs). It is proposed to build a “geological disposal concept demonstration facility” with ground and underground facilities, that facilitate public understanding of geological disposal concept and clarifies its engineering feasibility as well as long-term behaviors. This demonstration facility will be used for the demonstration of the emplacement of wastes, installation techniques, monitoring technology, and retrieval technology. The “Coordination Council for Basic Research and Development of Geological Disposal” organized by ANRE discussed and made up a master plan for the basic research on geological disposal (December 2006), to facilitate effective and efficient implementation of the total research and development program by the government, JAEA and other research organization. As for international cooperation, Japan has been studying, and using as reference, the cases in foreign countries where the selection of disposal site is in progress, and will continue to exchange views with the countries that have final disposal programs and also to promote multinational cooperation using cooperative frameworks of the

IAEA, OECD/NEA, IFNEC, etc.

(2) Long-lived low-heat generating radioactive wastes (TRU wastes) to be geologically disposed of

As for TRU wastes, JAEC stated that the interaction in the case of geological disposal of TRU wastes together with the high level radioactive wastes (single-site disposal: See Fig. L6-4) should be evaluated and necessary implementation steps, including function of the implementing body and government involvement, should be studied on the basis of the evaluation results.

In response to that, ANRE amended the Final Disposal Act. According to this amendment, TRU wastes from reprocessing that need to be geologically disposed of and high level radioactive wastes that are returned from overseas reprocessing plants in exchange for TRU wastes were added to the wastes to be finally disposed of by NUMO, and generators of such radioactive wastes were legally requested to provide the cost needed for final disposal.

2. Radioactive wastes subject to disposal with active control

In Japan, disposal with active control is categorized in the following three type; namely "near surface trench disposal", "near surface pit disposal" and "subsurface disposal." JAEC stated in the Framework for Nuclear Energy Policy that It is often effective and efficient to manage and dispose of radioactive waste in an integrated fashion according to the properties of the waste material regardless of the generators or waste sources, and therefore, the Government should coordinate various systems accordingly.

Low level radioactive wastes generated in nuclear power plants that are subject to near surface trench disposal and near surface pit disposal are already being disposed of with such methods.

JAEC, considering the results of operator's investigation and tests, indicated that necessary systems for implementing subsurface disposal including safety regulation system should be established without delay. In response to that, the Radioactive Waste Safety Subcommittee under the NISS/ACNRE prepared an interim report on safety regulation of subsurface disposal of low level radioactive waste in January 2008. This report shows the outline of safety regulation and further technical study items. Considering the results of the study, NISA developed an Ordinance of the METI based on the Reactor Regulation Act.

3. Ban on sea dumping of radioactive waste

In compliance with the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972) and its amendment to Annex I in 1993, JAEC decided "the government of Japan will eliminate the option of sea dumping as a principle of low level radioactive waste in the future. However, JAEC may consider reviewing of the above-mentioned policy in case political and social situations significantly change in the future." Based on this decision, the Reactor Regulation Act was amended in May 2005, and sea dumping of radioactive waste was banned.

B4 Radioactive Waste Management Practices

Operators, recognizing their responsibility concerning radioactive waste management, shall manage radioactive waste generated at their facilities in compliance with The Reactor Regulation Act, the Radiation Disease Prevention Act and relevant regulations.

B4.1 High Level Radioactive Waste Management Practices

In Japan, spent fuel has been reprocessed by the Rokkasho Reprocessing Plant of JNFL,

Tokai Reprocessing Plant of the JAEA and reprocessing plants in France and the United Kingdom. JNFL is conducting active test of the vitrification facility of HLW, attached to its reprocessing plant, at the Rokkasho. This facility will be completed in October 2012 and 118 vitrified radioactive waste canisters generated during the test have been stored.
High level liquid waste generated at the Tokai Reprocessing Plant of JAEA is stored in tanks within the facility. The vitrification facility started operation in January 1995. As of March 2011, about 380 cubic meters of liquid waste and 247 vitrified waste canisters are in storage.

Utilities in Japan have concluded reprocessing contracts with British and French companies for a total of 5,600 MTU of spent fuel from light water reactors and 1,500 MTU of spent fuel from a gas cooled reactor. In accordance with these contracts, vitrified waste canisters are returned to the utilities and are stored by JNFL. As of the end of March 2011, 1338 vitrified canisters had been returned from UK and France. Return shipment of the vitrified waste canisters from UK started in 2010, and will be continued for more than ten and several years. As a result, a total of ca. 2,200 canisters is planned to be returned from UK and France.
Vitrified HLW will be disposed of by geological disposal. Based on the Final Disposal Act, NUMO, the responsible implementing organization, will start disposal in mid 2030s after three steps procedure of site determination, that is, selection of the preliminary investigation areas, detailed investigation areas and final disposal facility. NUMO, in 2002, started the first step by open solicitation of candidate of sites for the preliminary investigation areas, and published the “application format”, “outline of the disposal facility”, “investigation items” and “coexistence of disposal facility and local community”. In case of receiving proposal of candidate areas, NUMO will assess validity of the candidates by conducting survey of the site with existing literature on volcanic activities, active faults and other geological conditions. NUMO will decide the preliminary investigation areas based on the assessment.

NUMO, as the implementing organization, has conducted public offering for areas for literature survey which is the first stage for selection of disposal site since December 2002.
Study meeting on HLW disposal had been organized by Toyo town, etc. in Kochi Prefecture since September 2006, and subsequently, an application form was submitted to NUMO by the town in January 2007. Responding to the application by Toyo town, NUMO received the permission of final disposal plan by ANRE on the basis of the provisions of the Final Disposal Act. However, since the Toyo town turned down the application in April 2007, the literature survey has not been commenced yet.
In the government decision of “Plan on Final Disposal of Designated Radioactive Waste” in March 2008, selections of the Detailed Investigation Areas and the Construction Site for Final Disposal Facility are planned to be conducted at mid 2010s and at around 2040, respectively.

NUMO decided to publish a technical report, titled “Safety Assurance of Geological Disposal Activities 2010 - for Achieving Safe Geological Disposal Based on the Reliable Technologies-” in order to extensively present its commitments to securing safety which has formed a foundation for NUMO to promote its activities, and to demonstrate that the technologies required for accomplishing geological disposal have been steadily developing, including the achievements of the relevant research organizations in Japan. Prior to publication of this report, NUMO published the “Safety Assurance Concept 2009” to show the principles and policies for the safe promotion of its activities. “Safety Assurance of Geological Disposal Activities 2010” consists of two volumes. That is “Activities” in which commitments by NUMO for safety assurance of geological disposal as an implementing entity are presented, and “Technologies” in which status of progress of geological disposal technologies is presented. A briefing session was held in October 2010, where a draft version of the report for review was released. The contents of this draft version are expected to be further enhanced based on the reviews conducted by the Atomic Energy Society of Japan, the Science Council of Japan, etc.

B4.2 Low Level Radioactive Waste Management Practices

LLW is classified into waste from power reactors, TRU waste, uranium waste and waste from medical, industrial and research facilities. The waste management strategy for each of these categories is as follows, while gaseous and liquid radioactive wastes are discharged under monitoring, after attenuation of radioactivity, filtering, adsorption and/or distillation. (See H.6.5)

1. Waste from Power Reactors

As of March 2011, fifty-five nuclear power reactors were in operation*. Liquid waste concentrate is solidified with cement in drums after evaporation. Paper, clothing and other combustibles are placed in drums after incineration. Plastics, metals and other non-combustibles are placed in drums after compaction. These drums are stored in the on-site storage facilities. Replaced steam generators and other large-volume solid wastes are placed in depository. Replaced control rods and channel boxes, etc. are stored in spent fuel pools and spent ion exchange resins are stored in tanks. Near-surface disposal of drums (solidified liquid waste and compacted and solidified non-combustible wastes) started in 1992 at the disposal facility of JNFL at Rokkasho Village in Aomori Prefecture.

The Clearance system is in operation since December 2005 after the amendment of The Reactor Regulation Act and other related cabinet and ministerial ordinances. In June 2006, JAPCO filed an application for “the methods for measurement and assessment of radioactivity concentration of waste generated from dismantling of the Tokai Power Station” in accordance with the amended Reactor Regulation Act and obtained approval of the government in September 2006. Clearance measurement was conducted on the waste in the Tokai Power Station and application for confirmation by the regulatory body was filed in April 2007. In June, the certified materials cleared from regulatory control (cleared material) were carried out from the Tokai Power Station for the first time after getting the confirmation certification. For the time being, the cleared material is recycled at the site related to the nuclear installations, namely they will be used as shielding material, bench and so on. Past records of approval of the methods for measurement and assessment of radioactivity concentrations of radioactivity materials, and those of issuance of the confirmation certificates of the radioactivity concentrations are as follows:

- September 2006: Approval of the methods for measurement and assessment of radioactivity concentrations of materials (applied for approval in June 2006);
- May 2007: Issuance of the confirmation certificate of radioactivity concentrations of radioactive materials (applied for confirmation in April 2007)
- May 2008: Issuance of the confirmation certificate of radioactivity concentrations of materials (applied for confirmation in March 2008)

The clearance system would be applied to the wastes generated from the operation of light water reactors and the dismantling of “ATR-Fugen”, etc.

JNFL, as a part of study on subsurface disposal of waste from power reactors, conducted research on geological features, underground water and ground from 2001 to 2006 at the site of uranium enrichment and waste disposal facilities. (See Fig.L6-3-4)

*: A period from the first criticality to the time before decommissioning. The Monju which is now under construction is included in those in operation due to the fact that it already accomplished the criticality.

2. TRU Waste

At present, in Japan, the reprocessing of spent fuel is in progress at the Tokai Reprocessing Plant of JAEA.

Liquid TRU waste generated at the Tokai Reprocessing Plant of JAEA is stored in tanks and concentrated by evaporation, and a portion of it is solidified in drums. Segmented fuel cladding, used filters and sampling bottles are put in containers and other solid waste is put in

drums. These drums and the containers are being held in storage at on-site depositories.
The reprocessing plant of JNFL at Rokkasho Village, Aomori prefecture is now performing the integrated operational test (active test) using actual spent fuel in preparation for completion of the reprocessing plant of JNFL in October 2012, and generation of waste at full-scale is expected in the near future.

As Japan had sent spent fuel to France and UK under contracts of reprocessing spent fuel, the waste generated from reprocessing plants in these countries is gradually returned to Japan. TRU waste generated at spent fuel reprocessing plant in France is scheduled to be returned to Japan from around 2013, as compacted waste form (hereinafter referred to as "CSD-C") and vitrified low level radioactive waste form (hereinafter referred to as "CSD-B").
Under these circumstances, NISA investigated the basic safety of CSD-C and CSD-B at the Radioactive Waste Safety Subcommittee under the NISS/ACNRE, and published "the Safety of Compacted Waste Form (CSD-C) among Returned Low Level Radioactive Waste Form" in March 2008, and "the Safety of Returned Low Level Waste Form (CSD-B)" in August 2010. Because CSD-C is a type of waste sealed in the canister, "the Rules on Disposal of Nuclear Fuel Materials, etc. Outside the Plant or Office" was amended so that waste sealed in the canisters can be accepted at the plant in addition to the waste solidified in the canisters.
In March 2010, the government of Japan, the Federation of Electric Power Companies and the JNFL requested the government of Aomori Prefecture to accept the waste returned from overseas, taking into consideration political importance and urgency of returned waste storage and management. The government of Aomori Prefecture established" the Review Commission on Safety Check Regarding Acceptance of Returned Waste from Overseas" and issued the review results in July 2010. Finally, the governor of Aomori Prefecture accepted the proposal based on the review results and opinions of all levels and all quarters of people in the Prefecture.

In October 2010, JNFL applied for the approval of alteration in the waste management activities in order to store the returned low level radioactive waste in the High-Level Radioactive Waste Storage and Management Center. In response to this request, NISA started the review.
TRU waste generated from the fabrication of MOX fuel in Nuclear Fuel Cycle Engineering Laboratories of Tokai Research and Development Center is held in storage at on-site depositories as well as TRU waste from reprocessing.
Research and development programs on TRU waste disposal have been promoted mainly by JAEA and the Federation of Electric Power Companies.

3. Uranium Waste

Liquid waste containing uranium generated from enrichment or fuel fabrication facilities of JAEA or other private facilities are stored in tanks. Solid uranium waste and ash resulting from incineration are put in drums. They are held in storage at on-site depositories.
NSC issued the report titled "Clearance Level for Uranium Processing Facilities" in October 2009. In response to this report, NISA investigated the matter in the Radioactive Waste Safety Subcommittee under NISS/ACNRE in order to incorporate metals generated from uranium processing facilities into the current clearance system. As a result, NISA published "Establishment of the Clearance System for Uranium Processing Facilities" in November 2010. Based on the results of these investigations, the relevant ordinance was amended in June 2011. MEXT prepared a report titled "Confirmation of the Clearance Level for Uranium Processing Facilities" at the Technical WG of the Research Reactor Safety Regulation Study Committee, etc., and amended the relevant ordinance in February 2011 based on the report.

4. Waste from Research Facilities, etc.

Waste generated from research and medical facilities is safely stored in the purpose-built facilities after compacted or incinerated, as appropriate.
In November 2007, the incorporated administrative agency, JAEA applied for approval of "the

methods for measurement and assessment of radioactivity concentrations" of approximately 4,000 tons of concrete fragments generated in association with modification of the former JRR-3, taking advantage of the previously mentioned clearance system, and obtained approval from the national government in July 2008. Up until today, clearance measurement and application for confirmation was carried out, and the confirmation certificates were issued for about 377 tons in May 2010, and about 381 tons in December, 2010, respectively. Cleared materials are planned to be reused as roadbed material, etc. in the JAEA site, after issuance of the confirmation certificate.

B5 Criteria used to define and categorize radioactive waste

In Japan, radioactive waste is categorized as shown in Table B5-1.

1. Upper bounds of concentration of low level radioactive waste

In May 2007, NSC published "Upper Bounds of Radioactivity Concentration for Burial of Low-Level Radioactive Solid Waste" concerning low level radioactive waste except uranium waste. Conventionally, the upper bounds of radioactivity concentrations had been specified only for the waste generated in power stations. In this document NSC expanded the subject of disposal to include the low level radioactive waste except uranium waste, and proposed the upper bound for each category of subsurface disposal, near surface pit disposal and near surface trench disposal. Concerning calculation of the upper bounds of concentrations, the upper bounds of radionuclide concentrations of the waste packages are recommended considering the distribution of radionuclide concentrations of the waste disposed, based on the assessment of the public exposure due to the radioactive nuclides in the waste disposed of and the radioactivity concentrations to be the reference dose level, according to the previous concept by NSC*[1]. Furthermore, the parameters used to calculate the upper bounds of radioactivity concentrations are in conformity with the latest knowledge in the international community. Based on these concepts, disposal of radioactive waste is categorized into Category 1 Waste Disposal (geological disposal) and Category 2 Waste Disposal (subsurface disposal, near surface pit disposal and near surface trench disposal).(See Fig.L6-1)

*[1]: "Reference Radionuclide Concentration Values for Land Disposal of Low-Level Radioactive Solid Waste (interim report)", NSC, December 1986, "Reference Radionuclide Concentration Values for Land Disposal of Low-Level Radioactive Solid Waste (2nd interim report)", NSC, June 1992, and "Reference Radionuclide Concentration Values for Land Disposal of Low-Level Radioactive Solid Waste (3rd interim report)", NSC, September 2000

2. Criteria to clarify materials not requiring management as radioactive wastes

Concerning "materials not requiring management as radioactive wastes", NSC has studied the clearance level of radionuclide concentrations and its calculation method. NSC referred to IAEA-TECDOC-855*[2] for calculation method, and to the ICRP document (Pub. 46, 1985) for target value of dose. The results are reported as "Clearance Level for Major Nuclear Facilities" (March 1999), "Clearance Level for Heavy Water Reactors, Fast Neutron Reactors, etc." (July 2001), and "Clearance Level for Nuclear Fuel Use Facilities (Facilities dealing with irradiated fuels and materials" (April 2003).

In accordance with the IAEA issued the safety guide "Application of the Concepts of Exclusion, Exemption and Clearance", Safety Standards Series No. RS-G-1.7 (2004), NSC has made a re-evaluation of the above mentioned three reports on the clearance level. The results were issued as a report "Radionuclides Concentrations for Materials not Requiring Treatment as Radioactive Wastes, Generated from Dismantling etc. of Reactor Facilities and Nuclear Fuel Use Facilities" in December 2004. NSC concluded that as the re-evaluated values and the values of exemption level provided in the IAEA safety guide are comparable, it is suitable to use the values in the IAEA safety guide. The Radioactive Wastes Safety Subcommittee of the Nuclear and Industrial Safety Subcommittee and Technical WG of the Research Reactor

Regulation Study Committee, etc. also studied this matter and concluded that it is essentially suitable to use the values of the IAEA safety guide ("Establishment of the Clearance System for Nuclear Facilities (December 2004)") and "Technical Requirement concerning Check and Qualifying Clearance Revel from Research Reactor Facilities, etc (July 2005)").

Through this process, related ministerial order was formulated to provide clearance levels of 33 nuclides of wastes from reactor facilities and 49 nuclides of wastes from nuclear fuel material utilization facilities (hot laboratory facilities).

[*2]: "Clearance levels for radionuclides in solid materials, Application of exemption principles, Interim report for comment" (January 1996)

3. Public dose criteria after the period for management of radioactive solid waste disposal site

The Radiation Council published a report titled "the Basic Principles Concerning Radiological Protection for Radioactive Solid Waste Disposal and Clearance" in January 2010. This report suggests that, based on the policies of ICRP and IAEA, it is appropriate to define the public dose criteria after the period for management of radioactive solid waste disposal site to be a dose constraint of 300μSv/year, regardless of the disposal methods. Also it suggests that 10μSv/year is appropriate as an individual dose criteria used for calculation of the clearance level.

4. Criteria to categorize radioactive wastes

NSC specified the basic concept to distinguish "Solid wastes that are not radioactive wastes" from radioactive wastes in the report "Reference Radionuclides Concentration Values for Safety Regulations of Land Disposal of Low-Level Radioactive Solid Waste (The 2nd interim report)" (June 1992). The report clarified that "solid wastes that are not radioactive wastes" are those materials; such as materials clearly identified as not contaminated or not activated, material where significantly contaminated portion is identified and is deleted or contamination of the remaining portion is negligible, and materials where significantly activated operation is evaluated and is deleted and activation of the remaining portion is negligible.

In July 2009, due to the necessity to establish a practical judgment method for wastes generated from the material or structure that is installed or used in the radiation controlled area of nuclear facility, in consideration of the past practices, NISA determined a practical judgment method on the management of "non radioactive waste", deliberating the concept of "non radioactive waste", protective methods to contamination, detection limit, guideline to select a portion of "non radioactive waste", on-site survey, etc.

5. Clearance level of nuclides such as uranium

NSC investigated the clearance level of nuclides such as uranium based on the concept of exclusion and published "Clearance Level for Uranium Processing Facilities" in October 2009. In response to this report, NISA investigated the matter in the Radioactive Waste Safety Subcommittee under NISS/ACNRE in order to incorporate metals generated from uranium processing facilities into the current clearance system. As a result, NISA published "Establishment of the Clearance System for Uranium Processing Facilities" in November 2010. Based on the results of these investigations, the relevant ordinance was amended in June 2011. MEXT prepared a report titled "Confirmation of the Clearance Level for Uranium Processing Facilities" at the Technical WG of the Research Reactor Safety Regulation Study Committee, etc., and amended the relevant ordinance in February 2011 based on the report.

6. Introduction of clearance system into the Radiation Disease Prevention Act

MEXT carried out technological studies that can contribute to amendment of the Radiation Disease Prevention Act, based on "the Basic Principles of the Institutional Design Concerning Incorporation of the Clearance System," "the Basic Principles for Establishing the Clearance Level Provided in the Radiation Disease Prevention Act," and "the Basic Principles

Concerning Investigation of Clearance Judgment Method," which were published in July 2009 for the introduction of the clearance system into the Radiation Disease Prevention Act . As a result of studies, MEXT specified the investigation results concerning establishment of the clearance level, a method to judge clearance and the condition of activation products caused by the radiation generator and also the major items required for introducing the clearance system ("The Technological Studies for Introducing the Clearance System into the Radiation Disease Prevention Act" (Second Interim Report)." (January 2010)) Subsequently, based on the Second Interim Report, MEXT studied the concrete clearance levels to be specified in the Radiation Disease Prevention Act," and proposed the clearance levels (criteria of radioactivity concentrations) for 53 nuclides for the materials contaminated in association with use of radioisotopes, and 37 nuclides for the activated materials generated in association with operation of a radiation generator. ("Clearance Levels to be Designated in the Radiation Disease Prevention Act," (November 2010))

In addition to the amendments to the Radiation Disease Prevention Act (May 2010), further investigation will be conducted to contribute to establishment of technical standards and clearance levels for ordinances and notices. Studies will be conducted to establish the operational criteria required for starting the operation of the clearance system.

Table B5-1 Classification of Radioactive Wastes

Classification			Example	Origin of Waste
High-Level Radioactive Waste			Vitrified Waste Canister	High radioactivity liquid waste or vitrified waste canister that contains fission products like Sr-90 and Cs-137 and Actinides elements like Am-241 and Np-237 separated from spent fuel during the reprocessing
Low Level Radio-active Waste	Waste from Power Reactors	Waste of Core Structures etc.	Control Rods, Core Internals	Waste Generated at Power Reactors
		Low Level Radioactive Waste	Liquid Waste, Filters, Used Equipment, Expendables	
		Very Low Level Radioactive Waste	Concrete, Metals	
	Long-lived Low-Heat -Generating Radioactive Waste (TRU Waste)		Sludge, Filters, Used Equipment, Expendables	Low Level Radioactive Waste Generated from the Operation and Dismantling of Reprocessing Facilities and MOX Fuel Fabrication Facilities
	Uranium Waste		Expendables, Sludge, Used Equipment	Radioactive Waste Generated from Enrichment and Fuel Fabrication Facilities
	Waste from Research Facilities, etc.		Liquid waste, Metals, Concrete, Plastics, Filters, Disposable Syringe	Radioactive Waste Generated from Research Facilities, Medical Facilities, etc.
Material that need not be treated as radioactive waste (Waste below the Clearance Level)			Concrete, Metals	Those waste generated from the operation and dismantling of nuclear installations and the radioactivity concentration of the waste is so low that no measures to avoid radiation hazards is necessary. (From May 2012 onward, waste generated at the facilities regulated by the Radiation Disease Prevention Act will also be included in this category.)

B6 Measures for decontamination and waste due to the Accident at Fukushima Nuclear Power Stations (NPSs) of TEPCO*

1. Processing and disposal of the waste affected by the accident at Fukushima Dai-ichi NPS of TEPCO

NSC proposed the following policy regarding the management of waste affected by the accident at Fukushima Dai-ichi NPS and the criteria in the “Near-term policy to ensure the safety for treating and disposing contaminated waste around the site of Fukushima Dai-ichi Nuclear Power Station of Tokyo Electric Power Company (June 3, 2011)”.

As to the materials which were affected by the accident at Fukushima Dai-ichi Nuclear Power Station of TEPCO and which are to be disposed of (materials such as debris, sludge from the water and sewerage treatment, incinerated ash, trees and plants and soil resulted from the decontamination activities, etc.), it is necessary that the disposal of those materials be finally accomplished after the safety of residents living in the vicinity of the facilities and workers are fully considered, and after the treatment and storage of these materials are pursued under the proper management.

A part of the above mentioned materials affected by this accident may be considered to be subject for reuse. As to the products manufactured from these reused materials, it is necessary to check that the concentration of radioactive materials is managed appropriately, before the products are circulated in the market, so that the concentration is lower than the standard level corresponding to 10μSv/year employed for the clearance level.

When the materials concerned is treated in recycling, incineration and melting facilities, and temporary storage facilities or areas, it is important to take measures in consideration of the particularity of this accident that the level of radiation exposure dose of residents living in the vicinity of the facilities and the workers engaged in the treatment of contaminated materials should be kept as low as reasonably achievable, based on the fundamental idea of the radiation protection indicated by NSC.

In particular, special care is necessary to prevent radiation exposure of the residents living in the vicinity of the facilities caused by the treatment of contaminated materials from exceeding 1mSv/year, by performing the improvement measures of environment for the periphery of treating facilities. Furthermore, the radiation dose of workers exposed by the treatment of those materials is desirable to be controlled possibly less than 1mSv/year. It is considered that the waste of relatively high radioactivity concentration is generated in the processes such as incineration and melting, therefore such processes should be performed under the proper management of radiation protection for the worker, in compliance with "The Ordinance on Prevention of Ionizing Radiation Hazards (Ordinance of the Ministry of Labor No.41 of September 30, 1972)".

Furthermore, for the exhaust and drainage from treating facilities, it is important to confirm that the level of radioactivity concentration is less than the limit shown in "Notification for Dose Equivalent Limits on the Basis of the Rules for Commercial Power Reactors (Public notice of METI No.187 of March 21, 2001)".

In the final disposal, based on full understanding of the basic information such as shape and quantity of the waste, type of radioactive material and radioactivity concentration, it is necessary to select a proper method of disposal depending on radioactivity level, to set a method and a period of necessary management depending on the type and concentration of radioactive materials, and to evaluate the long-term safety of disposal facilities.

*: The waste described in this item means waste contaminated by radioactive materials discharged by the nuclear power station accident associated with the Tohoku District – Off the Pacific Ocean Earthquake that Occurred on March 11, 2011.

Even when disposing waste affected by this accident, the NSC considers that there are scientific basis of ensured safety after the terminating active control, if scenario depending on an adopted disposal method is set followed by conducting proper assessment, and if the result of the assessment satisfies the "target dose" for each scenario indicated in "Basic Guide for Safety Review of Category 2 Radioactive Waste Disposal.

2. Enactment of the Act on measures for radioactive wastes and the basic policy of decontamination

(1) The Act on measures for radioactive wastes

The Diet enacted the “Act on Special Measures concerning Handling of Radioactive Pollution” on August 26, 2011. In light of the fact that contamination of the environment has been occurring on account of radioactive materials discharged by the recent accident, the Act intends to reduce impacts on human health and/or living environment promptly by establishing measures to be taken by the national and local governments and relevant licensees, etc. Specifically, it stipulates that the national government is to establish the basic principles regarding the handling of contamination of the environment by radioactive materials, and, giving due consideration to the degree of significance of the contamination, designate areas where it is necessary to take measures including decontamination by the national government and so on.

a Outline of the Act on Special Measures

The “Act on Special Measures concerning the Handling of Environment Pollution by Radioactive Materials Discharged by the NPS Accident Associated with the Tohoku District – Off the Pacific Ocean Earthquake That Occurred on March 11 (Act No. 110 of 2011)” was submitted to the 177th Diet by the Chairman of the Committee on Environment of the House of Representatives, on August 23 and was enacted on August 26, promulgated on August 30, with portions of it having entered into effect on the same day.

Subsequent to its enactment, the basic principles and standards based on this Act will be established; decontamination plans made by the national government or by local public institutions grounded in this Basic Principles will be stipulated from January 1, 2012; and decontamination works will be advanced.

The overview of the systems prescribed by the Act on Special Measures is as follows.

○Development of the Basic Principles

The Minister of the Environment develops a draft of the basic principles regarding the handling of the environment pollution caused by radioactive materials, and requests a resolution at a Cabinet Meeting

○Implementation of monitoring and measurement of contamination of the environment caused by radioactive materials

The national government promptly prepares and implements a system of unified monitoring and measurement to figure out the situation of environment pollution.

○Measures including decontamination and disposal of wastes contaminated by radioactive materials discharged by the accident

(i) Measures, etc. taken by the relevant nuclear power producer (the nuclear power producer discharged radioactive materials)

Relevant nuclear power producer shall carry out disposal, etc. of wastes at the NPS. Also, based on requests of the national or local governments, relevant nuclear power producer shall take necessary measures such as the dispatch of personnel, etc.

(ii) Disposal of wastes contaminated by radioactive materials

①The Minister of the Environment designates areas where wastes may be contaminated by radioactive materials, to such a degree that special control is required.

②The Minister of the Environment develops a plan regarding disposal, etc. of wastes in the area of ①.

③The Minister of the Environment designates wastes which are located outside the area of ① and whose state of contamination by radioactive materials exceeds a certain level.

④Disposal of the wastes in the area of ① and the wastes designated as ③ is carried out by the national government on the basis of the standard.

⑤As for the disposal of wastes with low levels of contamination except those of ④, the regulation of the Waste Disposal and Public Cleansing Law is adapted.

(iii) Measures for decontamination of soils, etc. (including vegetation, workpieces) contaminated by radioactive materials

①The Minister of the Environment, giving due consideration to the degree of contamination, designates areas where it is necessary for the national governments to carry out measures for decontamination, etc.

②The Minister of the Environment develops a plan to carry out these measures for decontamination, etc. in the area of ①, and the national government carries out the measures for decontamination, etc. on the basis of the standard.

③The Minister of the Environment designates areas other than ① where decontamination conditions are expected not to conform to requirements.

④As for zones recognized as not conforming to the requirements through an investigation on the state of contamination in the area of ③, the governor of the prefecture (including the mayor of the municipality designated by Cabinet order), develops plans designating matters regarding the measures for decontamination, etc.

⑤Based on the plan of ④, the national government, the governor of the prefecture, the mayor of the municipality, etc. carry out measures for decontamination, etc. on the basis of the standard.

⑥The national government, as requested by the governor of the prefecture, the mayor of the municipality, etc., and when it is recognized as necessary, shall carry out measures of decontamination, etc. based on the plan of ④ on behalf of the said prefecture and municipality, etc.

b Preparation towards full-scale enforcement of the Act on Special Measures

Hereafter, taking into account of the results of verification projects of decontamination and other issues, the national government is scheduled to arrange matters needed for enforcement of requirements to specify regions, the standards including the disposal standards, by the end of this year.

(2) "Basic Concept for Pushing Ahead with Decontamination Works" and "Basic Policy for Emergency Response on Decontamination Works"

As decontamination is an urgent issue to be tackled immediately, the Government Nuclear Emergency Headquarters established the "Basic Policy for Emergency Decontamination Work" on August 26, 2011 without waiting until the related part of the above-mentioned Act fully comes into force in January, 2012. It summarized specific targets and working principles in carrying out decontamination, including that estimated annual exposure dose of general public in residence areas is to be reduced approximately 50% in the next two years, and so on.

<Basic Concepts>

a) By directly pushing ahead with decontamination works with focus on the areas where the annual exposure dose is estimated at greater than 20 mSv, the national government aims to reduce the estimated annual exposure dose to less than 20 mSv;

b) Even in areas with an estimated annual exposure dose of less than 20 mSv, the national government will work with municipalities and local residents to conduct effective decontamination work, so that the estimated annual exposure dose will be closer to 1 mSv; and

c) By putting a high priority on thorough decontamination work in children's living spaces (such as schools or parks), the government aims to reduce their estimated annual exposure dose closer to 1 mSv as early as possible and continue with further reductions .

<Immediate targets>

a) Long-term targets are decided to reduce the additional annual exposure dose to less than 1 mSv in the region of existing exposure situation, and for implementing decontamination in the radiation-contaminated areas, it is targeted to reduce the estimated annual exposure dose by approximately 50% for general public and by roughly 60% for children in particular within the next two years. (IV-2-13)

b) With this regards, as to the future impacts of radioactive materials, based on advice from the Nuclear Safety Committee, trial calculations was carried out with consideration for the physical reduction of radioactive materials as well as reduction by the natural factors such as weather based on the past actual measurement values, and the result has been come out that the estimated annual exposure dose at the time after two years past decrease about 40 % compared to the one at this point.

In order to promote these efforts by coordinating with the local areas the government launched "Fukushima Decontamination Promotion Team" and enhanced its on-site system on August 24. Also, on August 25, the Office of Response to Radioactive Materials Contamination was established within the Cabinet Secretariat and a system for comprehensively promoting decontamination, the disposal of radioactive wastes, and the health investigation of residents is to be prepared. In addition, a coordination meeting to facilitate close coordination among relevant ministries and agencies will be launched, as well as a radioactive materials contamination response advisory meeting, to be comprised of persons of knowledge and experience on the establishment of standards regarding radiation. Hereafter, the government intends to appropriate about 220 billion yen for these decontamination activities from reserve fund provided under a secondary supplementary budget for this fiscal year.

Section C Scope of Application

Article 3

1. This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.
2. This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.
3. This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.
4. This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

The government of Japan declared, pursuant to Article 3, Paragraph 1, of the Convention, that reprocessing is part of spent fuel management, acceded to the Convention. Therefore Japan includes the spent fuel stored in reprocessing facilities in these scope of the Convention.
The government of Japan did not make declarations provided for in Article 3, Paragraphs 2, and 3, of the Convention.

Section D　Inventories and Lists

Article 32

2 This report shall also include:

(i) a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features;

(ii) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

(iii) a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

(iv) an inventory of radioactive waste that is subject to this Convention that:

  (a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;
  (b) has been disposed of; or
  (c) has resulted from past practices.

this inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

(v) a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

D1　List of spent fuel management facilities

Spent fuel from power reactor facilities is being held in storage at spent fuel storage facilities within power reactor facilities or Tokai Reprocessing Plant of Tokai Research and Development Center, Nuclear Fuel Cycle Engineering Laboratories, JAEA and Rokkasho Reprocessing Plant of JNFL. Spent fuel from research reactor facilities is being held in storage at spent fuel storage facilities of the research reactor facilities.　The locations, main purposes and essential features of these spent fuel management facilities are listed in Tables D1-1 and D1-2.

Table D1-1　List of Spent Fuel Management Facilities (Related to Power Generation)

Nuclear facilities where spent fuel management facilities are located	Location	purpose	features
JAPCO Tokai-No.2 Power Station	Ibaraki	Storage	Wet storage (partly stored in dry casks)
JAPCO Tsuruga Power Station	Fukui	Storage	Wet storage
Hokkaido Electric Power Co., Inc. Tomari Power Station	Hokkaido	Storage	Wet storage
Tohoku Electric Power Co., Inc. Onagawa NPS	Miyagi	Storage	Wet storage
Tohoku Electric Power Co., Inc. Higashidori NPS	Aomori	Storage	Wet storage
TEPCO Fukushima Daiichi NPS	Fukushima	Storage	Wet storage (partly stored in dry casks)
TEPCO Fukushima Daini NPS	Fukushima	Storage	Wet storage
TEPCO Kashiwazaki Kariwa NPS	Niigata	Storage	Wet storage
Chubu Electric Power Co., Inc. Hamaoka NPS	Shizuoka	Storage	Wet storage
Hokuriku Electric Power Co., Inc. Shika NPS	Ishikawa	Storage	Wet storage
The Kansai Electric Power Co., Inc. Mihama Power Station	Fukui	Storage	Wet storage
The Kansai Electric Power Co., Inc. Takahama Power Station	Fukui	Storage	Wet storage
The Kansai Electric Power Co., Inc. Ohi Power Station	Fukui	Storage	Wet storage
The Chugoku Electric Power Co., Inc. Shimane NPS	Shimane	Storage	Wet storage
Shikoku Electric Power Co., Inc.	Ehime	Storage	Wet storage

Ikata Power Station			
Kyushu Electric Power Co., Inc. Genkai NPS	Saga	Storage	Wet storage
Kyushu Electric Power Co., Inc. Sendai NPS	Kagoshima	Storage	Wet storage
JAEA Fugen Decommissioning Engineering Center（Fugen）	Fukui	Storage	Wet storage
JAEA Tokai Research and Development Center Nuclear Fuel Cycle Engineering Laboratories Tokai Reprocessing Plant	Ibaraki	Storage	Wet storage
JNFL Rokkasho Reprocessing Plant	Aomori	Storage	Wet storage
JAEA Fast Breeder Reactor Research and Development Center (Monju*1)	Fukui	Storage	Wet storage

*1: Pre-service inspection stage (As of the end of March 2011)

Table D1-2 List of Spent Fuel Management Facilities (Research Reactors)

Nuclear facilities where spent fuel management facilities are located	Location	purpose	features
JAEA Tokai Research and Development Center Nuclear Science Research Institute	Ibaraki	Storage	Wet storage (partially dry storage)
JAEA Oarai Research and Development Center	Ibaraki	Storage	Wet storage
Kyoto University Research Reactor Institute	Osaka	Storage	Wet storage

(As of the end of March 2011)

D2 Inventories of spent fuel

Spent fuel stored in above-mentioned spent fuel management facilities are shown in Table D2-1.

Table D2-1 Spent Fuel Inventory

Nuclear facilities Categories	Types of Fuel Elements	Inventory
Commercial Nuclear Power Plants	Uranium Oxide Fuel Elements	13,920ton
Power Reactors at the stage of Research and Development	Uranium Oxide Fuel Elements and Mixed Oxide Fuel Elements	70 ton
Reprocessing Plants	Uranium Oxide Fuel Elements and Mixed Oxide Fuel Elements	2,875 ton
Research Reactors	Uranium Oxide Fuel Elements and Mixed Oxide Fuel Elements	34 ton

(As of the end of March 2011)

D3 List of radioactive waste management facilities

Radioactive waste management facilities within power reactor facilities include the followings: waste treatment facilities where waste generated at the reactor facility is treated; solid waste depositories where drums (homogeneous solidification, fill-up solidification, miscellaneous solid and others), etc. filled with treated waste are being held in storage; depositories where the replaced steam generators and other large solid wastes are being held in storage; spent fuel pools etc. where the disused control rods, the disused channel boxes, etc. are being held in storage; and tanks where the spent ion exchange resin is being held in storage.
Radioactive waste management facilities within enrichment and fuel manufacturing plants include the followings; waste treatment equipments that treats waste generated at the plants; and solid waste depositories where drums filled with treated waste are held in storage.

Radioactive waste management facilities within spent fuel reprocessing plants include the followings; waste treatment equipments that treats waste generated at the plant; waste depository where vitrified waste and high level liquid waste are being held in storage; and waste depository where low level liquid waste and low level solid waste are being held in storage.
Radioactive waste management facilities licensed under the waste related activities include the followings; radioactive waste dispose facilities where radioactive waste is disposed of, Waste Storage facilities being held in storage before disposal, waste treatment facilities where radioactive waste is treated.
Radioactive waste management facilities within research reactors and major fuel material use facilities include the followings; waste treatment equipments that treats low level radioactive waste generated at those facilities; and solid waste depositories where drums filled with treated waste are being held in storage.

Main radioactive waste management facilities licensed with waste management business under the Radiation Disease Prevention Act include storage facilities etc., where drums, etc. filled with processed waste generated at radioisotopes use facilities, etc. are being held in storage.

Radioactive waste management facilities licensed on the basis of the Medical Care Act etc. include the storage facilities, etc., where drums, etc. filled with processed radioactive medical waste generated from medical facilities, etc. are being held in storage.

The locations, main purposes and essential features of these radioactive waste management facilities are listed in Tables D3-1 and D3-2.

Table D3-1 List of Radioactive Waste Management Facilities (Power Reactors)

Nuclear facilities where radioactive waste management facilities are located	Location	Purpose	Features
JAPCO Tokai Power Station	Ibaraki	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
JAPCO Tokai-No.2 Power Station	Ibaraki	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
JAPCO Tsuruga Power Station	Fukui	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
Hokkaido Electric Power Co., Inc. Tomari Power Station	Hokkaido	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
Tohoku Electric Power Co., Inc. Onagawa NPS	Miyagi	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
Tohoku Electric Power Co., Inc. Higashidori NPS	Aomori	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
TEPCO. Fukushima Daiichi NPS	Fukushima	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
TEPCO. Fukushima Daini NPS	Fukushima	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
TEPCO. Kashiwazaki Kariwa NPS	Niigata	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
Chubu Electric Power Co., Inc. Hamaoka NPS	Shizuoka	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.

Hokuriku Electric Power Co., Inc. Shika NPS	Ishikawa	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
The Kansai Electric Power Co., Inc. Mihama Power Station	Fukui	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
The Kansai Electric Power Co., Inc. Takahama Power Station	Fukui	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
The Kansai Electric Power Co., Inc. Ohi Power Station	Fukui	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
The Chugoku Electric Power Co., Inc. Shimane NPS	Shimane	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
Shikoku Electric Power Co., Inc. Ikata Power Station	Ehime	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
Kyushu Electric Power Co., Inc. Genkai NPS	Saga	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
Kyushu Electric Power Co., Inc. Sendai NPS	Kagoshima	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
JAEA , Fugen Decommissioning Engineering Center(Fugen)	Fukui	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, incineration, etc.
JAEA Fast Breeder Reactor Research and Development Center (Monju)	Fukui	Processing and storage of waste from the power plant	Stored at a storage facility after volume reduction by compaction, etc.

(As of the end of March 2011)

Table D3-2 List of Radioactive Waste Management Facilities (Other Than Power Reactors)

Nuclear facilities where radioactive waste management facilities are located		Location	Purpose	Features
Global Nuclear Fuel Japan Co., Ltd.	Fuel fabrication facility	Kanagawa	Processing and storage of uranium waste	Stored at a storage facility, etc. after volume reduction by compaction, etc.
Mitsubishi Nuclear Fuel Co., Ltd.	Fuel fabrication facility	Ibaraki	Processing and storage of uranium waste	Stored at a storage facility, etc. after volume reduction by compaction, etc.
Nuclear Fuel Industries, Ltd. Tokai Works	Fuel fabrication facility	Ibaraki	Processing and storage of uranium waste	Stored at a storage facility, etc. after volume reduction by compaction, etc.
	Fuel material use facility		Processing and storage of waste from fuel material use facility	Stored at a storage facility, etc. after volume reduction by compaction, etc.
Nuclear Fuel Industries, Ltd. Kumatori Works	Fuel fabrication facility	Osaka	Processing and storage of uranium waste	Stored at a storage facility, etc. after volume reduction by compaction, etc.
	Fuel material use facility		Storage of waste from fuel material use facility	Stored at a storage facility, etc. after volume reduction by compaction, etc.
JAEA Ningyo-toge Environmental Engineering Center	Enrichment facility	Okayama	Processing and storage of uranium waste	Stored at a storage facility, etc. after volume reduction by compaction, etc.
	Fuel material use facility		Processing and storage of waste from fuel material use facility	Stored at a storage facility, etc. after volume reduction by compaction, etc.
JAEA Tokai Research and Development Center Nuclear Science Research Institute	Waste disposal facility	Ibaraki	Disposal of low level radioactive waste	Trench disposal of concrete waste
	Research reactor facility; Fuel material use facility; Radioisotope		Processing and storage of radioactive waste from research reactor facility , fuel material use facility,	Stored at a storage facility, etc. after volume reduction by compaction, incineration, etc.

	Waste Management facility*[1]		radioisotope use facilities, etc.	
JAEA Tokai Research and Development Center Nuclear Fuel Cycle Engineering Laboratories	Reprocessing facility	Ibaraki	Processing and storage of HLW and Trans uranium waste	HLW stored after vitrification, waste containing Trans uranic nuclides stored after volume reduction by incineration etc
	Fuel material use facility		Processing and storage of waste from fuel material use facility	Stored at a storage facility, etc. after volume reduction by compaction, incineration, etc.
JAEA Oarai Research and Development Center	Waste management facility; Research reactor facility , Fuel material use facility; Radioisotope Waste Management facility*[1]	Ibaraki	Processing and storage of radioactive waste from research reactor facility , fuel material use facility, radioisotope use facilities, etc.	Stored at a storage facility, etc. after volume reduction by compaction, incineration, etc.
JAEA Aomori Research and Development Center Mutsu Office	Research reactor facility	Aomori	Processing and storage of waste from research reactor facility	Stored at a storage facility, etc. after volume reduction by compaction, etc.
JNFL Reprocessing Business division	Reprocessing facility	Aomori	Processing and storage of HLW and Trans uranium waste	Storage facility of waste generated from spent fuel receipt and storage facility (Reprocessing Facility is now under construction)
	Waste storage facility		Storage of vitrified waste	A storage facility for returned vitrified waste
JNFL Enrichment and Disposal Office	Waste disposal facility	Aomori	Disposal of low level radioactive waste	No.1 Disposal facility, No.2 Disposal facility
	Enrichment facility		Processing and storage of uranium waste	Stored at a storage facility
The University of Tokyo, Nuclear Professional School, School of Engineering	Research reactor facility; Fuel material use facility	Ibaraki	Temporary storage of waste from research reactor facility and fuel material use facility	Treated in Japan Atomic Energy Agency Tokai Research and Development Center Nuclear Science Research Institute
The University of Tokyo, Radioisotope Center	Radioisotope Waste Management facility*[1]	Tokyo	Processing and storage of waste from radioisotope use facility, etc	Stored at a storage facility, etc. after volume reduction by incineration, etc.
Kyoto University Research Reactor Institute	Research reactor facility Fuel material use facility	Osaka	Processing and storage of waste from research reactor facility and fuel material use facility	Stored at a storage facility, etc
Rikkyo University Institute for Atomic Energy	Research reactor facility	Kanagawa	Processing and storage of waste from research reactor	Stored at a storage facility, etc
Tokyo City University (former Musashi Institute of Technology) Atomic Energy Research Institute	Research reactor facility	Kanagawa	Storage of waste from research reactor facility	Stored at a storage facility, etc.
Kinki University Atomic Energy	Research reactor facility	Osaka	Storage of waste from research reactor facility	Stored at a storage facility, etc

Research Institute				
National Institute of Radiological Sciences Radiotoxicology Building Operations Section	Fuel material use facility	Chiba	Storage of waste from fuel material use facility	Stored at a storage facility, etc.
AIST Tsukuba Central 2	Fuel material use facility	Ibaraki	Storage of waste from fuel material use facility	Stored at a storage facility, etc.
Nuclear Material Control Center Rokkasho Safeguards Analytical Laboratory	Fuel material use facility	Aomori	Processing and storage of waste from fuel material use facility	Stored at a storage facility, etc.
Nuclear Material Control Center Tokai Safeguards Center	Fuel material use facility	Ibaraki	Storage of waste from fuel material use facility	Stored at a storage facility, etc
Japan Radioisotope Association The Kaya Memorial Takizawa Laboratory	Radioisotope Waste Management facility*2	Iwate	Processing and storage of waste from radioisotope use facility, etc.	Stored at a storage facility, etc. after volume reduction by compaction, incineration, etc
Japan Radioisotope Association Ichihara Office	Radioisotope Waste Management facility*2	Chiba	Storage of waste from radioisotope use facility, etc.	Stored at a storage facility, etc.
Japan Radioisotope Association Kanto Waste Relay Station II	Radioisotope Waste Management facility*2	Chiba	Storage of waste from radioisotope use facility, etc.	Stored at a storage facility, etc.
Japan Radioisotope Association Kansai Waste Relay Station	Radioisotope Waste Management facility*2	Osaka	Storage of waste from radioisotope use facility, etc	Stored at a storage facility, etc.
Toshiba Corporation Research Reactor Center	Research reactor facility	Kanagawa	Storage of waste from research reactor facility	Stored at a storage facility, etc
Toshiba Corporation Nuclear Engineering Lab	Fuel material use facility, Research reactor facility	Kanagawa	Storage of waste from research reactor facility and fuel material use facility	Stored at a storage facility, etc.
Hitachi, Ltd. Power & Industrial Systems Nuclear System Division Ozenji Hitachi Training Reactor Center	Research reactor facility	Kanagawa	Storage of waste from research reactor facility	Stored at a storage facility, etc
Nippon Nuclear Fuel Development Co., Ltd. NFD Hot Laboratory	Fuel material use facility	Ibaraki	Processing and storage of waste from fuel material use facility	Disposition on treatment to JAEA Oarai
Nuclear Development Corporation Fuel Hot Laboratory	Fuel material use facility	Ibaraki	Processing and storage of waste from fuel material use facility	Stored at a storage facility, etc. after volume reduction by compaction, etc.
T.N. Technos Co. Ltd. Tsukuba Laboratory	Radioisotope Waste Management facility*1	Ibaraki	Processing and storage of waste from radioisotope use facility, etc.	Stored at a storage facility, etc. after volume reduction by incineration, etc.
VESTA Co., Ltd.	Radioisotope Waste Management facility*1	Chiba	Processing and storage of waste from radioisotope use facilities, etc.	Stored at a storage facility, etc. after volume reduction by incineration, etc.

(As of the end of March 2011)

*: One facility is in operation for each center, laboratory or works unless any description is made. If more than one facilities for each center, laboratory or works is in operation or one facility or more is

under decommissioning, then said effect is specified.

*1: facility with Radioisotope Waste Management Business licensed on the basis of the Radiation Disease Prevention Act

*2: facility with Radioisotope Waste Management Business licensed on the basis of the Radiation Disease Prevention Act, the Medical Care Act, etc.

D4 Inventories of radioactive waste

D4.1 Inventory of Radioactive Waste Being Held in Storage

The wastes stored in the above-mentioned radioactive waste management facilities of nuclear power reactor facilities include ca. 500,000 drums (converted to number of 200 liter drums) (excluding the inventory of Fukushima Daiichi Nuclear Power Station due to the Tohoku District – off the Pacific Ocean Earthquake) in solid waste storage facilities, 32 used steam generators in steam generator storage facilities, used control rods, disused channel boxes, spent resin in spent fuel pools and other facilities at the end of March 2011.

At facilities other than nuclear power reactor facilities, HLW of ca. 1,700 vitrified packages and ca. 380m^3 high level liquid waste are stored in fuel reprocessing facilities, and LLW of ca. 660,000 drums (counted as the equivalent number of 200 liter drums) in total are stored in fuel reprocessing facilities, fuel fabrication facilities, laboratories, research reactor facilities of universities, and storage facilities of Japan Radioisotopes Association, and ca. 4,120m^3 low level liquid waste in total is stored in fuel reprocessing facilities, fuel fabrication facilities, laboratories, research reactor facilities of universities, concurrently at the end of March 2011. Details of these inventories are indicated in Section L.

D4.2 Inventory of Radioactive Waste That Has Been Disposed of

A portion of LLW stored at radioactive waste management facilities of commercial power reactor facilities, which has comparatively low concentration of radionuclides, has been transported to a radioactive waste disposal facility of JNFL and disposed of at near surface disposal facility since 1992.
The amount of the waste emplaced at the disposal facility is listed in Table D4-1. Presently, the disposal facility of JNFL is in operation and has disposed of ca. 230,000 drums (counted as the equivalent number of 200 liter drums) of waste, as of the end of March 2011. At the disposal facility of Tokai Research and Development Center, Nuclear Science Research Institute of JAEA, about 1,670 tons of very low level wastes (concrete) resulting from dismantling of JPDR were disposed of. The facility has started operation in 1995, and the disposal facility has been at the preservation stage since October 1997.

Table D4-1 The Amount of Waste to be Disposed of

Name of facility		Representative nuclides	Amount disposed
JNFL Enrichment and Disposal Office, Radioactive waste disposal facility*[1]	No. 1 disposal facility	Co-60, Ni-63, Cs-137, Sr- 90, C-14	145,275 drums*[3]
	No. 2 disposal facility	Co-60, Ni-63, Cs-137, Sr- 90, C-14	83,872 drums*[3]
	Total		229,417 drums*[3]
JAEA Tokai Research and Development Center Nuclear Science Research Institute*[2]	Waste disposal facility	Co-60, Ni-63, Cs-137, Sr- 90, Ca-41, C-14, Eu-152, H-3	1,670 tons

(As of the end of March 2011)

*1: Disposed of very low level concrete waste resulting from the dismantling of JPDR, and shifted to the preservation stage of the disposal facility since October 1997.

*2: 200-liter drums

D4.3 Inventory of Radioactive Waste that Has Resulted from Past Practices

None.

D5 List and status of nuclear facilities in the process of being decommissioned

Power Reactors in the process of being decommissioned include Tokai Power Station of JAPCO, the Advanced Thermal Reactor “Fugen” of JAEA and the unit 1 and 2 at Hamaoka NPS of Chubu Electric Power Co., Inc.

A reactor at the Tokai Power Station of JAPCO ceased the operation in 1998 and has been in decommissioning stage since December 2001. Turbine, feed water pumps, etc. started to be dismantled first. Dismantling heat exchangers started in 2006. In 2016 the dismantling reactor vessel will be started and it will last for 6 years. The decommissioning will be completed by 2021.

Fugen Decommissioning Engineering Center of JAEA ceased the operation of the advanced thermal reactor “Fugen” at the end of March 2003, and the application of decommissioning program was filed in November 2006 and permitted in February 2008. Spent fuel has being transferred to Tokai Reprocessing Plant of Tokai Research and Development Center Nuclear Fuel Cycle Engineering Laboratories of JAEA, and the decommissioning is planned to be completed by fiscal year 2028.

The unit 1 and 2 at Hamaoka NPS of Chubu Electric Power Co., Inc. terminated the operation in January 2009 and the decommissioning plan that describes the basic policy of decommissioning unit 1 and 2 for the entire decommissioning period and the activities in the first stage for “Period of preparation for dismantling” was approved in November 2009. In the first stage for “Period of preparation for dismantling”, shipping of spent fuel, survey and investigation of contamination, decontamination of systems and dismantling of systems and equipments outside control area will be commenced and the completion of decommissioning aims at the 2030s.

Moreover, a total of 8 Research Reactors in the process of being decommissioned or planned to be decommissioned include JRR-2 of JAEA, the Reactor Facilities of The First Nuclear Ship (Mutsu) and Deuterium Criticality Assembly (DCA) of JAEA, and Hitachi Training Reactor (HTR) of Hitachi Ltd., Training Reactor-1 (TTR-1) of Toshiba Corporation, Rikkyo University Institute for Atomic Energy (RUR), Tokyo City University (former Musashi Institute of Technology) Research Reactor (MITRR), The University of Tokyo Research Reactor (Yayoi).

The status of decommissioning activities, etc. is listed in Tables D5-1 and D5-2.

Table D5-1 List of Nuclear Facilities in the Process of Being Decommissioned and Planned to Be Decommissioned. Status of Decommissioning Activities at These Facilities (With Respect to Power Reactors)

Name of facility	Location	Reactor type	Electrical output (MW)	Commercial operation	Status of decommissioning
JAPCO Tokai Power Plant	Ibaraki	GCR	166	Jul 1966 - Mar 1998	Decommissioning started in 2001
JAEA Fugen Decommissioning Engineering Center (Fugen)	Fukui	ATR	165	Mar 1979 - Mar 2003	Termination of operation in March 2003. Continue taking out of spent fuels and preparation for decommissioning. The decommissioning is planned to start from February 2008 and be completed by fiscal year 2028.
Chubu Electric Power Co. Hamaoka NPS unit 1 and 2	Shizuoka	BWR	Unit 1 54.0 Unit2 84.0	Mar 1976 - Jan 2009 Nov 1978 - Jan 2009	Termination of operation in January 2009 and the decommissioning plan was approved in November 2009. In the first stage for “Period of preparation for dismantling” shipping out fuel, survey and investigation of contamination status, system decontamination, and dismantling and removal of equipment/components located outside the radiation controlled areas will be commenced and the completion of decommissioning aims at the 2030s.

(As of the end of March 2011)

Table D5-2 List of Nuclear Facilities in the Process of Being Decommissioned and Planned to Be Decommissioned. Status of Decommissioning Activities at These Facilities (With Respect to Research Reactors)

Name of facility	Location	Reactor type	Thermal output (kW)	Service period*	Status of decommissioning
JAEA, Tokai Research and Development Center, Nuclear Science Research Institute , JRR-2	Ibaraki	Heavy water moderated cooling tank reactor	10000	Oct 1960 - Dec 1996	The following activities for decommissioning have been completed. Shipment of spent fuel and heavy water, isolation of reactor cooling system and reactor body, removal of secondary cooling system and experimental equipment.
JAEA Aomori Research and Development Center Mutsu Office The Reactor Facilities Of The First Nuclear Ship (Mutsu)	Aomori	Pressurized light water moderated and cooled reactor, PWR	36000	Aug 1974 - Feb 1992	Dismantling has been completed. Accessory land facilities are currently being maintained for the purpose of storing solid waste and processing liquid waste
JAEA, Oarai Research and Development Center, Deuterium Criticality Assembly (DCA)	Ibaraki	Heavy water moderated reactor	1	Dec 1969 - Sep 2001	Deactivation of reactor and removal of heavy-water and cooling system has been completed.
Hitachi Ltd. Power & Industrial Systems Nuclear System Division Ozenji Center Hitachi Training Reactor (HTR)	Kanagawa	Light water moderated and cooled reactor	100	Dec 1961 - Feb 1975	Dismantling has been completed. Currently being proceeding are the maintenance of the pool storing spent fuel and the storage and maintenance of radioactive waste.
Toshiba Corporation Research Reactor Center, Toshiba Training Reactor-1 (TTR-1)	Kanagawa	Light water moderated inhomogeneous reactor	100	Mar 1962 - Jan 2001	Permanent suspension of operational functions and removal of reactor cooling system facilities and spent fuel.
Rikkyo University Institute for Atomic Energy (RUR)	Kanagawa	Zirconium hydride moderated light water cooled reactor	100	Dec 1961 - Dec 2001	Deactivation of reactor and removal of spent fuel has been completed.
Tokyo City University (former Musashi Institute of Technology) Research Reactor (MITRR)	Kanagawa	Zirconium hydride moderated light water cooled reactor	100	Jan 1963 - Jan 2004	Deactivation of reactor and removal of spent fuel has been completed.
The University of Tokyo, Research Reactor (Yayoi)	Ibaraki	Air cooling fast reactor with Uranium Fuel	2	Apr 1971 - Mar 2011	Termination of operation at the end of March 2011. Application of decommissioning plan will be implemented later.

*: A period from the first criticality to the termination of operation (As of the end of March 2011)

Section E Legislative and Regulatory System

In Japan, legal systems are provided for promoting proper management of spent fuel and radioactive wastes, and also for safety regulation on them.
This section describes such legal systems.

E1 Implementing measures

> Article 18
> Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

In Japan, the steps necessary for implementing the obligations under this Convention are taken in accordance with relevant laws and regulations. The “Atomic Energy Basic Act” provides the fundamental objectives of promoting nuclear energy research and utilization, securing of future energy resources, promotion of the progress of science and technology and industrial development and eventual contribution to the welfare of human society and improvement of the level of people’s living. The Law also provides for the basic principle that the research, development and utilization of nuclear energy shall be made only for peaceful purposes with ensuring safety, operating democratically and autonomously, publicizing the results, and actively contributing to international cooperation. In accordance with the objectives and basic principles provided by the “Atomic Energy Basic Act”, the government of Japan has established legal systems for safety regulation on spent fuel management and radioactive waste management. The relevant laws and regulations are outlined in E2.

To implement obligations under the Convention, the following organizations have been established to enforce legal systems described in this section. The roles of those organizations are summarized below.

1. The Japan Atomic Energy Commission (JAEC)

JAEC was established within Prime Minister’s office on January 1st 1956, in order to implement national policy on the research, development and utilization of nuclear energy in planned and democratic manner. (JAEC was transferred to the Cabinet Office in January 2001.)
JAEC has responsibility to plan, review and decide the following items;

1) prepare the basic policy on the research, development and utilization of nuclear energy,
2) prepare allocation of the budget for the nuclear energy development,
3) express opinions on the application of license standards based on the Reactor Regulation Act,
4) make planning, deliberation and decisions on coordinating the related administrative organizations in the matters that are related to the research, development, and utilization of nuclear energy.

Based on the Act for Establishment of the Atomic Energy Commission and the Nuclear Safety Commission (JAEC and NSC Establishment Act), when JAEC deems it necessary as a part of its assigned duties, JAEC may recommend the heads of relevant administrative organizations by way of the Prime Minister, may request reports and cooperation including submission of materials, statements of viewpoint, and explanation to the heads of relevant administrative organizations. Under the Reactor Regulation Act, the Minister of METI or Minister of MEXT shall, before granting a license to establish nuclear facility, receive views of JAEC with regard to the following items:

1) the nuclear facility 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

facility.

In 1956, JAEC established the Long-term Program for Development and Utilization of Nuclear Energy (hereinafter referred to as “Long-term Program”) that showed the basic policy and implementation plan for the nuclear research and development in Japan. Since then JAEC revised the Long-term Program, approximately every five years. The latest version of the Long-term Program decided by Cabinet council was issued in October 2005 with a new title of “Framework for Nuclear Energy Policy”.

JAEC is composed of a chairman and four other commissioners appointed by the Prime Minister with the consent of the Diet. General affairs of JAEC are performed by the office of nuclear energy policy under the Cabinet Office. It coordinates the matters with related administrative organizations in order to implement JAEC decisions.
Under JAEC, specialists are assigned to investigate and deliberate the specific matters, and special committees, councils or other bodies may be established when necessary. There are 6 special committees (committee for policy evaluation, special committee for nuclear protection, special committee for research and development, special committee for nuclear fusion, special committee for international issues and special committee for the new “Framework for Nuclear Energy Policy”). These committees and councils are deliberating assigned matters. Specialists are appointed by the Prime Minister from persons of knowledge and experience based on JAEC and NSC Establishment Act.
The discussions of meetings of JAEC including the committees and councils are open to the public in principle and public people can observe the meetings. The contents of the deliberations are provided for the public on a website of JAEC (http://aec.go.jp/) and at the Nuclear Energy Library.

2. The Nuclear Safety Commission (NSC)
The Atomic Energy Basic Act was partially revised on October 4, 1978 to establish the NSC under the Prime Minister’s Office. The function of safety regulation, which had been belonged to JAEC, was transferred to the NSC, in order to strengthen the system of ensuring 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 of the results of NISA’s examination on the application from the view points of the licensee’s technical capability and prevention of nuclear hazards. The NSC supervises and audits the appropriateness of NISA’s regulatory activity in construction and operation stages after Safety Review, from the viewpoint of adequacy, effectiveness and transparency. Thus, the framework that confirms the quality, effectiveness and transparency of the safety regulation is maintained. (See Fig E1-1)

When the NSC deems it necessary as a part of its assigned duties, The NSC may advice the heads of relevant administrative organizations by way of the Prime Minister, may request reports and cooperation including submission of materials, statements of viewpoint, and explanation to the heads of relevant administrative organizations.
From April 2003 (partially, from October 2003), The NSC receives from NISA quarterly reports on the regulatory activities after licensing such as Approval of the Construction Plan, Pre-Service Inspection, Periodic Inspection, Audit of Licensee's Periodic Check System, Audit of Licensee's Welding Check System, Approval of Operational Safety Program, the Operational Safety Inspection and accidents and failures of nuclear installations. The NSC also has the authority to inquire directly of the licensees, and maintenance and inspection contractors in order to audit the safety regulation implemented by regulatory body.
In the case of a violation of safety regulations in any of nuclear facilities, the employee can directly allege the fact to the NSC, and the NSC has the authority to investigate the allegation.
The Minister of METI, before granting license to establish nuclear installations, must receive

the opinion of NSC on the following matters: (i) that the applicant for the license of a nuclear installation has adequate technical capability to establish and reliably operate a nuclear reactor, and (ii) that the site, structures and equipment of the nuclear installation would 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 NSC are performed by the Secretariat of the NSC. The NSC Secretariat is composed of the Secretary-General, the Management and Coordination Division, the Regulatory Guides and Review Division, the Radiation Protection and Accident Management Division and the Subsequent Regulation Review Division and has about 100 personnel. (See Fig E1-2)
Under the NSC, two safety examination committees and seventeen other special committees are organized as shown in Table E1-1. The Special Committees may organize working groups under them, if necessary.
The members of the Committee on Examination of Reactor Safety and the Committee on Examination of Nuclear Fuel Safety are appointed from persons of knowledge and experience by the Prime Minister in accordance with the Act for Establishment of the Japan Atomic Energy Commission and the Nuclear Safety Commission. The Emergency Technical Advisory Body is composed of the commissioners of the NSC and the Emergency Measure Examination Member who are also appointed by the Prime Minister from persons of knowledge and experience. Other special committees are composed of the member of the NSC and the experts on the nuclear emergency and the experts are appointed by the Prime Minister.
Results of the safety examination committees and special committees are reported to the NSC and are decided after deliberation by the NSC. At nuclear emergency, the NSC determines advice for nuclear emergency after the discussion of the Emergency Technical Advisory Body.
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 on a website (http://www.nsc.go.jp/) and at the Nuclear Energy Library.

3. Ministry of Foreign Affairs (MOFA)

MOFA formulates foreign policy of on peaceful uses of nuclear energy and nuclear non-proliferation. MOFA has the responsibility for ratification, interpretation and implementation of international conventions concerned.

4. Organizations to promote the implementation of spent fuel management and radioactive waste management

(1) ANRE of METI

ANRE was established as an external agency of METI, to be responsible for ensuring stable and efficient sharing of mineral resources and energy and for promoting their appropriate utilization. ANRE plans, develops and promotes comprehensive policies for mineral resources and energy, policies for energy saving and new energy, nuclear energy policies and basic policies for electric power resources development. It promotes utilization of nuclear energy, ensuring energy resources and developing industry.

On the other hand, ANRE is responsible for the geological disposal of high level radioactive wastes (HLW) and for the disposal of TRU waste to be geologically disposed. Specifically, as for the geological disposal of HLW, ANRE has been holding explanatory meetings at every prefecture as part of public relation to the whole members of the community, and workshops for local community in cooperation with NPO. Also, in order to promote research and development to increase the public understanding, ANRE has been developing a part of the verification test facility of the ground/underground facilities for geological disposal as “geological disposal concept verification test facilities” by which geological disposal concept and its engineering possibility and long-term behavior could be felt real and understood, has been demonstrating the technologies for fixing, construction, monitoring, and recovery of radioactive waste, and has been investigating to promote understanding of the whole members of the community. Furthermore, for the purpose of promoting entire research and development effectively and efficiently in this country, research and development organizations deliberate the overall program of research and development and make report on the Overall Research Program on Basic Research and Development of Geological Disposal of HLW at the “Coordination Meeting for the Research and Development of Geological Disposal Infrastructure” under the guidance of ANRE.

For the geological disposal of TRU waste, ANRE amended “Designated Radioactive Waste Final Disposal Act”, to add both the TRU waste which was generated from fuel reprocessing and needed geological disposal and HLW which was to be exchanged with the TRU waste generated during overseas reprocessing, to the target for final disposal by NUMO. The generator of the radioactive waste is responsible for burden of expense needed for final disposal.

(2) The Research and Development Bureau and the Research Promotion Bureau of the MEXT

MEXT promotes nuclear energy research and development for science and technology. In MEXT, the Research and Development Bureau is promoting the research and development for fast breeder reactor (FBR) cycle technology, and for nuclear fusion including International Thermonuclear Experimental Reactor (ITER) project. In addition, the Bureau supervises JAEA and deals with nuclear liability insurance matters.
The Research promotion Bureau promotes application of radiations, radioactive isotopes and quantum beams. Specifically, the Bureau is promoting the Japan Proton Accelerator Research Complex (J-PARC) project and research on heavy particle cancer therapy.

5. Regulatory bodies

The following organizations have been established for the regulation in Japan. The roles of those organizations are summarized in E3.

(1) NISA of METI
Safety regulation for nuclear energy use as energy source

(2) Science and Technology Policy Bureau of MEXT
Safety regulation for nuclear energy use for science and technology and radiation utilization

(3) Ministry of Land, Infrastructure, Transport and Tourism (MLIT)
Safety regulation for transportation of nuclear fuel materials for nuclear energy use

(4) MHLW
Safety regulation for radioactive materials etc. for medical use

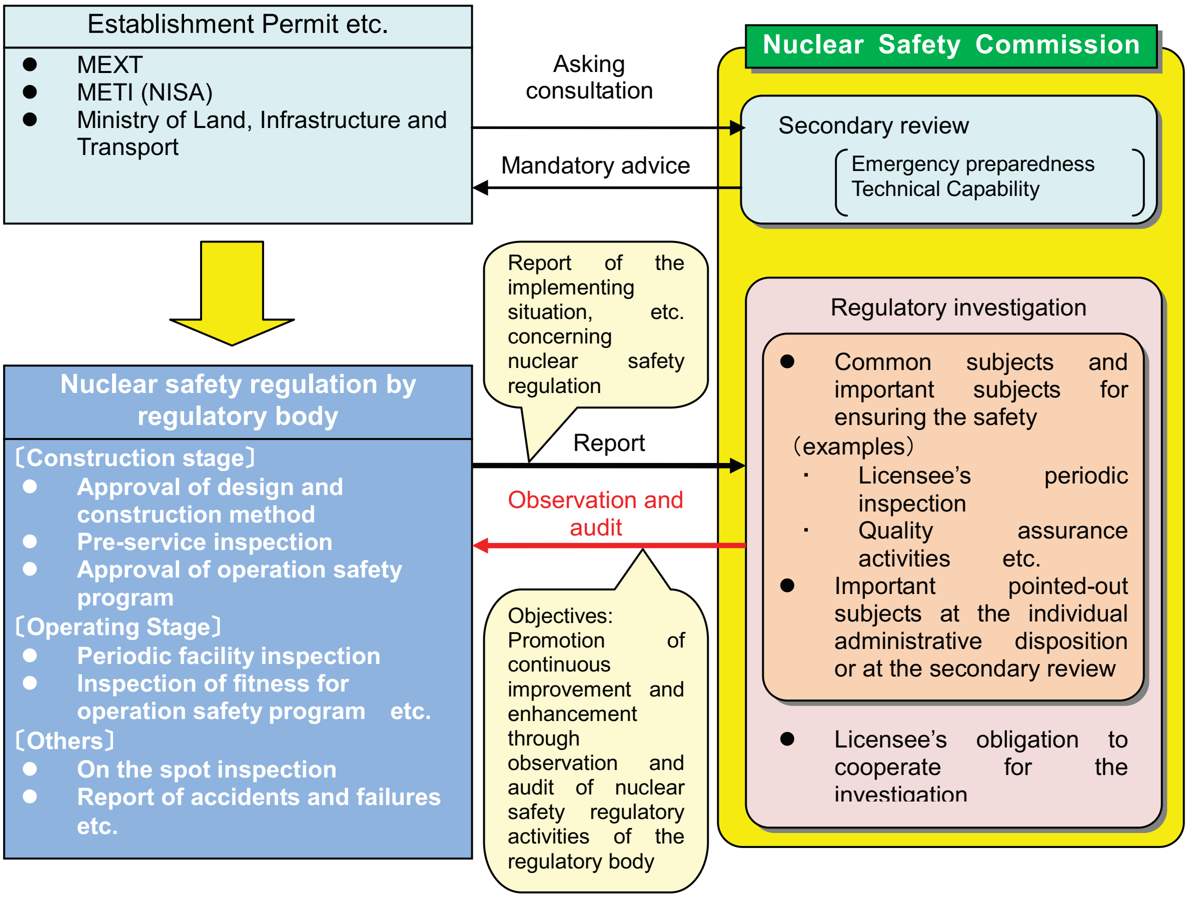
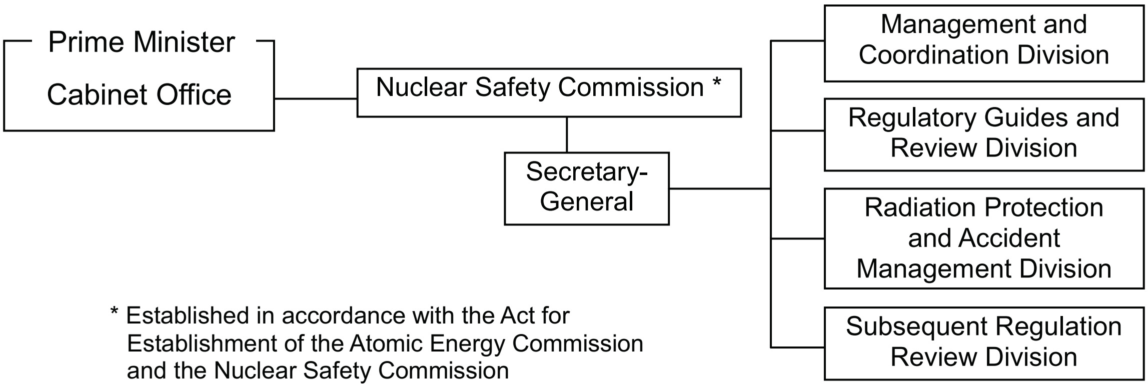


Fig. E1-1 Observation, Audit, Inspection, etc. of the Safety Regulatory Administration by NSC



* Established in accordance with the Act for Establishment of the Atomic Energy Commission and the Nuclear Safety Commission

Fig. E1-2 NSC Organizational Chart

Table E1-1 List of Special Committees within 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 Measure Examination Member	− Technical advices, etc. for emergency response in case of accident and failure exceeding certain criteria at nuclear facilities
Emergency Technical Advisory Body	− Appropriate technical advices of the NSC to Nuclear Emergency Response Headquarters in an nuclear emergency
Emergency Technical Advisory Body for Disaster Prevention of Nuclear Carriers and Submarines	− Technical advices in emergencies/disasters of nuclear carriers and submarines
Emergency Technical Advisory Body for Nuclear Disaster Prevention due to Armed Attacks	− Technical advices in nuclear emergencies/disasters due to armed attacks
Special Committee for Nuclear Safety Standards and Guides	− Matters concerning safety standards and guides of nuclear reactors, nuclear fuel facilities, and other nuclear installations
Special Committee on Radioactive Waste and Decommissioning	−Matters concerning the safety assurance in radioactive waste disposal −Matters concerning the safety assurance in decommissioning nuclear installations
Special Committee on Radiation Protection	− Matters concerning the radiation protection considering domestic and international trends
Special Committee on Safe Transport of Radioactive Materials	− Matters concerning the safety assurance in transportation of radioactive materials considering domestic and international trends.
Special Committee on Analysis and Evaluation of Nuclear Accidents and Failures	− Analysis and evaluation of domestic and international nuclear accidents and failures
Special Committee on Nuclear Safety Research	− Planning of nuclear safety research programs − Monitoring of the nuclear safety research programs −Evaluation of the nuclear safety research programs
Special Committee on Nuclear Disaster	− Technical and professional matters concerning nuclear emergency preparedness of emergency first aid response, protective measure to nuclear emergency, etc. − Technical and professional matters concerning medical care of radiation exposure
Project Team on Safety Survey of Reprocessing Facilities	− Survey and analyses of matters relevant to the safety regulation activities during the test operation of the Rokkasho reprocessing facility
Advisory Board on High-level Waste Repository Safety Technical and professional matters	− Technical matters concerning the safety assurance in the final disposal of high-level radioactive wastes
Investigatory Advisory Board on Assessment of Seismic Safety	− Investigation and evaluation concerning the ensuring of seismic safety of existing nuclear facilities
Investigatory Committee on the Seismic Safety of Research and Test Reactors	− Seismic safety checks of research and test reactors

(As of the end of March 2011)

E2 Legislative and regulatory framework

Article 19

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.
2. This legislative and regulatory framework shall provide for:
   (i) the establishment of applicable national safety requirements and regulations for radiation safety;
   (ii) system of licensing for spent fuel and radioactive waste management activities;
   (iii) a system of prohibition for the operation of a spent fuel or radioactive waste management facility without a license;
   (iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting;
   (v) the enforcement of applicable regulations and of the terms of the licenses;
   (vi) clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and radioactive waste management.
3. When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.

E2.1 Legislative and regulatory framework

1. Legal system for promoting spent fuel management and radioactive waste management

In Japan, spent fuel management is carried out on the site of facilities such as nuclear power stations and reprocessing facility. In addition, Japan has an option to alternately store spent fuel in intermediate storage facility outside of reactor facility. The law currently working for the promotion of spent fuel management is the “Act for Deposit and Administration of Reserve Funds for Reprocessing of Spent Fuel from Nuclear Power Generation” for securing the future costs for reprocessing in a safe, reliable and transparent means.

As for radioactive waste management, a part of LLW have been already being disposed of in a near surface disposal facility. Meanwhile, the Final Disposal Act is applicable to taking necessary steps to systematically and securely carry out the final disposal of the radioactive wastes to be geologically disposed, such as vitrified waste of HLW generated from reprocessing of spent fuel.
Main regulatory system to promote spent fuel management and radioactive waste management is shown in Fig. E2-1.

(1) Final Disposal Act

Final Disposal Act enacted in May 2000 provides for the following basic framework for systematically and securely carrying out the final disposal of the high level radioactive wastes generated from spent fuel reprocessing (hereinafter referred to as “Designated Radioactive Wastes”);

(i) development and public announcement of a basic policy and a plan (final disposal plan) for the final disposal of designated radioactive wastes by the Minister of METI
(ii) process for site selecting for a final disposal of designated radioactive wastes
(iii) securing of the expenses required for the final disposal of designated radioactive wastes
(iv) responsible licensee for the final disposal of designated radioactive wastes.

The amendment of the Act in June 2007 newly added TRU wastes to be the subjects of geological disposal.

The Minister of METI establishes the basic policy and based on this, provides for the final disposal plan. NUMO, which was established as an implementing organization based on the final disposal plan, carries out the activities of final disposal. Utilities shall pay deposits to the fund reserved for disposal, which is managed by RWMC designated by the Minister of METI. NUMO promotes site selection by three steps procedure, that is, selection of the preliminary investigation area, detailed investigation area and the construction site for final disposal facility, (hereinafter referred to as “Preliminary Investigation Areas, etc.”) and NUMO obtains approval of the Minister of METI at each step of procedure.

The three step procedure for site selection is as follows, and items for investigation and evaluation are clearly defined.

- Preliminary investigation area
  Definition: The area to investigate by boring etc. whether the geological formation concerned is stable for long term.
  Requirements for selection: There shall be no record of noticeable change of the geological formations by natural phenomena, such as earthquakes.
- Detailed investigation area
  Definition: The area to investigate, by constructing underground facility with testing and measuring equipment, whether the characteristics of the geological formation concerned is suitable for construction of disposal facility.
  Requirements for selection: Noticeable change of the geological formations by natural phenomena, such as earthquakes, has not occurred for long term.
- Construction site for final disposal facility
  Definition: The site where the final disposal facility is to be built.
  Requirements for selection: It is expected that underground facility to be built within the geological formation will not be exposed to an extraordinary pressure, and that physical property of the geological formation is suitable for the final disposal facility.

When the Minister of METI is to advance a step further of the three-step procedure of site selection and to put it in the final disposal plan upon receiving NUMO's selection of an area or a site, the minister shall ask for opinion of JAEC and NSC on the matters of regulation to secure the safety and shall consult relevant prefectural governors and mayors of municipalities and fully respect their opinions.

(2) "Act for Deposit and Administration of Reserve Funds for Reprocessing of Spent Fuel from Nuclear Power Generation" (May 2005)

This law provides for the frame work of deposit etc. to reserve funds for reprocessing of spent fuel etc. from the nuclear power generation. The fund is managed by an organization designated by the Minister of METI (Fund Management Organization). The Minister of METI, every fiscal year, notifies utilities of the amount of deposit based on the amount of electricity generated by the nuclear fuel, and utilities deposit the amount in the Fund Management Organization. This law was enacted in October 2005.

2. Legislative and regulatory framework on the safety of nuclear utilization

Major laws established for the purpose of providing safety regulations on the utilization of nuclear energy and related laws include "Reactor Regulation Act", "Electricity Business Act", "Radiation Disease Prevention Act", "the Act for Technical Standards of Radiation Hazards Prevention etc." "Special Act for Nuclear Emergency Preparedness", "the Medical Care Act", "the Clinical Laboratory Technician etc Act" and "the Pharmaceutical Affairs Act" (These 3 Acts are called "Medical Care Act, etc." hereafter).
Overviews of these laws are provided in the following paragraphs.

(1) Reactor Regulation Act

In accordance with the objectives of "the Atomic Energy Basic Act", the Reactor Regulation Act is enacted to ensure that the uses of nuclear source material, nuclear fuel material, and reactors are only for the peaceful purposes, and carried out in a planned manner, to ensure public safety by preventing hazards and providing physical protection of nuclear fuel material and to ensure that use of internationally controlled material is regulated to comply with conventions on nuclear utilization or other international commitments.
The Act covers following activities and provides regulation for each of them:

- Refining
- Nuclear fuel enrichment and fabrication

- Establishment and operation of reactor facilities
- Spent fuel storage
- Spent fuel reprocessing
- Radioactive waste storage and disposal
- Use of nuclear fuel material

The safety of spent fuel management is ensured through the each regulation for “establishment and operation of reactors”, “storage” and “reprocessing”, and the safety of radioactive waste management is ensured through the each regulation for “enrichment and fabrication”, “establishment and operation of reactors”, “storage”, “reprocessing”, “disposal” and “use of nuclear fuel materials”.

A business entity must have an approval for business of refining etc. from competent minister prior to starting business stipulated in the Reactor Regulation Act. The license for refining, fabrication, reactor establishment, storage, reprocessing, disposal and for use of nuclear fuel materials are granted on the basis that the location, structures and systems of the facility does not impair the prevention of hazards due to nuclear fuel materials, etc. and that the applicant has sufficient technological capability. The competent minister shall ask for opinions of JAEC and NSC before granting license (except for license for use of nuclear fuel material).

The regulation after granting license includes regulation for ensuring facility safety (facility regulation) and regulation for ensuring operational safety and safety activities of the operator (operation regulation). The facility regulation includes “approval of design and construction methods”, “pre-service inspection”, “approval of welding method and welding inspection”, “periodical facility inspection” and “confirmation for waste disposal”. The “approval of design and construction methods” is to confirm that the facility has been designed in accordance with the “permitted” conditions and the “technical standard”, and the approval must be obtained before starting construction. The “pre-service inspection” is to confirm that the construction has been carried out in accordance with the approved "design and construction methods” and that the facility has the prescribed capability. The licensee cannot operate the facility without passing the pre-service inspection. Then, the “periodical facility inspection” is conducted periodically during operation to confirm that the facility and systems maintain the prescribed capability. The “confirmation for waste disposal” is to confirm that the waste disposal facility and related safety measures as well as the waste packages and related safety measures are in compliance with the technical standards.

Operational safety regulation for spent fuel management and radioactive waste management includes the “approval of the Operational Safety Program and observance inspection of the Operational Safety Inspection”, “assignment of Chief Engineer of Nuclear Fuel or the Chief Engineer of Radioactive Waste”, “approval of the Physical Protection Program and observance inspection” and “assignment of the physical protection administrator”. The “Operational Safety Program” prescribes the measures for ensuring safety and facility maintenance including “operation and management of facility”, “walkdown”, “radiation control”, “radioactive waste management” and “Operational Safety Training”, and must be prepared by licensee and approved by the regulatory body. Licensee must have the “Operational Safety Program” approved before starting operation and must undergo periodically the “Operational Safety Inspection” after the commissioning.

In addition, the Reactor Regulation Act provides for restriction of ocean dumping of radioactive wastes, reporting of facility accident and other event, measures in emergency and penalties. Penalties are the steps to ensure the compliance with applicable regulation and license condition. If an licensee has built a nuclear facility without obtaining license, has violated a cease-operation order, or has not take necessary measures for emergencies, imprisonment with hard labor or fine or both is imposed on the licensee. It is also provided for that if an operator does not observe the Operational Safety Program or does not follow an order to amend the Operational Safety Program, the licensee is subject to penalties such as revocation of license.

NSC establishes the Regulatory Guides for design, safety review, etc. which specify technical requirements for safety regulation of activities under the Reactor Regulation Act. The guides are used in the safety review of license application as the criteria for judging adequacy of the application. Ministerial orders for each of activities under the Reactor Regulation Act provide for regulations for each activity. Safety regulation on spent fuel management is described in Section G and radioactive waste management is in Section H, respectively.
System of main legislations on the safety of spent fuel management and on the safety of radioactive waste management is shown in Fig. E2-2.
The legal system for safety management of radioactive waste related to nuclear power generation is also shown in Fig. E2-3.

The Reactor Regulation Act has recently been amended as follows:

a. Establishment of the safety regulation system for the final disposal of HLW in June 2007

This amendment was to establish the safety regulation system for the geological disposal of HLW and introduced a licensing system for HLW disposal. This licensing system requires the Minister of METI to approve the design and construction methods before the start of construction and to conducts pre-service inspection for the construction and capability of the facility, inspection on welding method, periodical facility inspection during operation, to approve the Operational Safety Program with the Operational Safety Inspection to inspect observance and to approve the Physical Protection Program with the Operational Safety Inspection to inspect observance”.

To establish an adaptable safety regulation system for radioactive waste disposal, making two classifications in the regulatory system. The conventional radioactive waste disposal of LLW was categorized as "Category 2 waste disposal" and disposal of HLW was categorized as "Category 1 waste disposal".
Following this amendment of the Act, ministerial ordinances prescribing detailed procedures for the Category 1 and 2 waste disposals were established and enacted in April 2008. The details of the safety regulation for the Category 1 and 2 waste disposals are described in Section H.

b. Improvement of fire protection system in June 2008

Kashiwazaki-Kariwa Nuclear Power Station of Tokyo Electric Power Co. Inc. was extensively affected by the Niigataken Chuetsu-Oki earthquake in July 2007, including the damages to the fire-fighting system such as main fire-fighting water pipe. The damage made it difficult to promptly extinguish the transformer fire that broke out immediately after the earthquake, and caused flooding of fire-fighting water into the reactor building of the unit 1.

In response to this event, NSC revised the “Regulatory Guide for Reviewing Fire Protection of Light Water Nuclear Power Reactor Facilities” to add fire detection, mobile fire-fighting equipment and in-house fire-fighting squad, recognizing importance of fire preparedness in operation in addition to design consideration against fire caused by big earthquake.

NISA, also, called a council of the experts from Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy to obtain advice for fire protection in nuclear facilities. On the basis of the advice of the council, NISA decided to add the requirement of fire protection provisions, such as in-house fire-fighting activities by operators and notification to the local fire station (initial fire-fighting activities), to the Operational Safety Programs as a measures to maintain safety. Specifically, NISA required the licensees to add provisions to the Operational Safety Programs on the preparation of fire-fighting vehicle equipped with chemical fire extinguisher, preparation of equipment to send alarm to local fire station and first response stuff for firefighting on regular basis. NISA confirms the implementation of such provisions by the Operational Safety Inspection.

MEXT required the operators that operate large-scale research reactors to confirm the compliance with the "Regulatory Guide for Reviewing Fire Protection of Light Water Nuclear Power Reactor Facilities" issued by the Nuclear Safety Commission and also requested to report on the programs for enhancing fire protection measures. The Ministry confirms the implementation of such programs within the scope of the Operational Safety Inspection.

c. Improvement of the system to perform maintenance activity of reactor facilities during the loss of power supply in March 2011

On March 30, 2011, responding to the impact from Fukushima Dai-Ichi NPS from the tsunami caused by the Tohoku District – off the Pacific Ocean Earthquake, the rules for commercial nuclear power reactors concerning the installation, operation, etc., and the rules for nuclear reactor at a stage of research and development concerning the installation, operation, etc., were both revised in order to improve the system to perform maintenance activity for reactor facilities.

These revisions also request licensee to arrange systems and equipments in his factory or facility where licensee constructed nuclear installations, in order to secure safety of the reactor facilities, and at the same time, request to add descriptions into the Operational Safety Program in order to maintain nuclear installations even when functions of all equipment to supply AC power, for cooling nuclear installations with sea water, and for cooling spent fuel storage tank are lost during tsunami.

(2) The Radiation Disease Prevention Act

It is the purpose of the Radiation Disease Prevention Act, based on the Atomic Energy Basic Act, to prevent from possible radiation hazards and to secure public safety, by regulating the use, sale, lease, disposal and other handlings of radioisotopes, regulating the use of radiation generating apparatus and regulating the disposal and other handlings of the contaminated materials caused by using radioisotopes or the activation products caused by using radiation generating apparatus.

Under the Law, the Enforcement Ordinance for the Radiation Disease Prevention Act is established.

A license holder for use, sale, lease and waste management of radioisotopes, who has a storage facility with a capacity equal to or more than a specified amount or has radiation generating apparatuses, shall undergo the Facility Inspection before starting operation and the Periodic Inspection after starting operation.

Those who use the facility licensed under the Radiation Disease Prevention Act must compile a set of the Internal Rules for Prevention of Radiation Hazards, assign the Supervisor of Radiation Protection, who is to supervise the prevention of radiation hazards, and notify these matters to the regulatory body before use of radioisotopes, etc. Furthermore, those who use the facility have an obligation to conform to the criteria for facilities to be used, which have been established by legislation. Other obligations include: measuring the radiation doses within the premises or on the boundary of the establishment; measuring the exposure doses of the occupational personnel; providing education and training; and conducting medical surveillance, etc.

The management of radioisotopes or materials contaminated by radioisotopes generated within radioisotopes use facility shall be carried out in conformity with the criteria established by Law and regulations. They shall be stored within the premises of licensed facility or the premises of the licensed facility of radioisotope waste management.

The basic framework for radioactive waste disposal by disposal business operators is

provided by the Radiation Disease Prevention Act amended in June 2004 and by subsequent amendments of the enforcement ordinances and regulations. Currently, MEXT is developing the technical details such as dose criteria for the disposal site for progress of waste disposal.
Those who intend to cease the use of radioisotopes or radiation generating devices shall notify the Minister of MEXT of it, and report on the measures taken to cease operation.
If it is necessary, MEXT instructs the Radiation Inspectors to conduct an on-site inspection in order to confirm the compliance with the standards established by laws and regulations.

Main items in the revision of the Radiation Disease Prevention Act in May 2010 are; introduction of clearance system into the Act, establishment of regulations for activation products into the Act and strengthening of regulations for decommission measures.

(3) The Act for Technical Standards of Radiation Hazards Prevention

The objectives of the Act for Technical Standards of Radiation Hazards Prevention is to maintain consistency with technical standards on radiation hazards prevention among the related regulations, by the clarification of the basic policy for defining technical standards for radiation hazards prevention and the establishment of the Radiation Council in MEXT.

(4) The Act on Special Measures Concerning Nuclear Emergency Preparedness and the Basic Act on Disaster Control Measures

The measures to be taken at a nuclear emergency are addressed by the Act on Special Measures Concerning Nuclear Emergency Preparedness (hereinafter referred to as “Nuclear Emergency Preparedness Act”) which was enacted in December 1999. The Special Act stipulates specific measures for nuclear emergency, including obligation of operators on the preparedness for nuclear emergency, the Declaration of Nuclear Emergency and establishment of headquarters for the nuclear emergency, and enforcement of emergency measures. The Senior Officer for Nuclear Emergency is stationed in the vicinity of each nuclear facility, to direct and advise the operator in preparing its Plan for Nuclear Emergency Preparedness, as well as to conduct its duty to prevent occurrence of nuclear emergency and mitigate consequences should it occur.
Moreover, in the part of the nuclear emergency measures of the Basic Plan for Emergency Preparedness on the basis of the Basic Act on Disaster Control Measures, measures necessary to the stages of abnormal event, nuclear emergency and recovery from the emergency are clearly described.

(5) Medical Care Act, etc.

The management of radioisotope waste generated from medical use is conducted only by waste management facility operators designated by the Minister of MHLW on the basis of the Medical Care Act etc. Location, structure, and equipment of the waste management facility shall be complied with related technical criteria (standards) in order to be designated by the Minister of MHLW. In addition, Periodical Inspection, Radiation Hazard Prevention Rules, notification of closure of waste management facility, etc, are provided by these laws equivalent to the Radiation Disease Prevention Act.

E2.2 Clear allocation of responsibilities in the different steps

The Special Committee on the Safety Standards of the Radioactive Waste of JAEC showed the basic concept in the “Policy on Radioactive Waste Processing and Disposal” (October 1985) that “since radioactive waste is generated according to the activities of operator of nuclear energy, the operator who is also generator of waste is essentially thought to be responsible for processing and disposal”, “on the other hand, it may be more effective and reasonable for operator to process and dispose those radioactive wastes, when the professional operator who has sufficient economic and technical abilities (hereinafter referred to as “disposal operator”) to process and dispose them in a concentrated manner. In such a case, it is more reasonable for the operator of radioactive waste to bear legal responsibility from the viewpoint of concentration of the responsibility of security and implementation of effective processing and disposal. In this regard, it is important that the generator bears the cost necessary for processing and disposal and give the disposal operator appropriate support in order to promote processing and disposal in a smooth and efficient manner.”

According to the basic concept mentioned above, in Japan, licensees of reactor facilities or other facilities are responsible for the safety of in-house management of the radioactive wastes generated in their facilities, while a disposal operator is responsible for the safety of waste management once the wastes are carried into the waste disposal facility. The Reactor Regulation Act regulates in-house management of spent fuel and radioactive wastes and provides for the measures to be taken by nuclear operators in transporting spent fuel of radioactive wastes outside the facilities. Thus the Reactor Regulation Act, while defining the competent minister responsible for safety regulation, provides for a system to consistently ensure the safety in each step of generation of spent fuel and radioactive wastes, on-site treatment and storage, transportation to disposal facility and disposal by disposal operators.

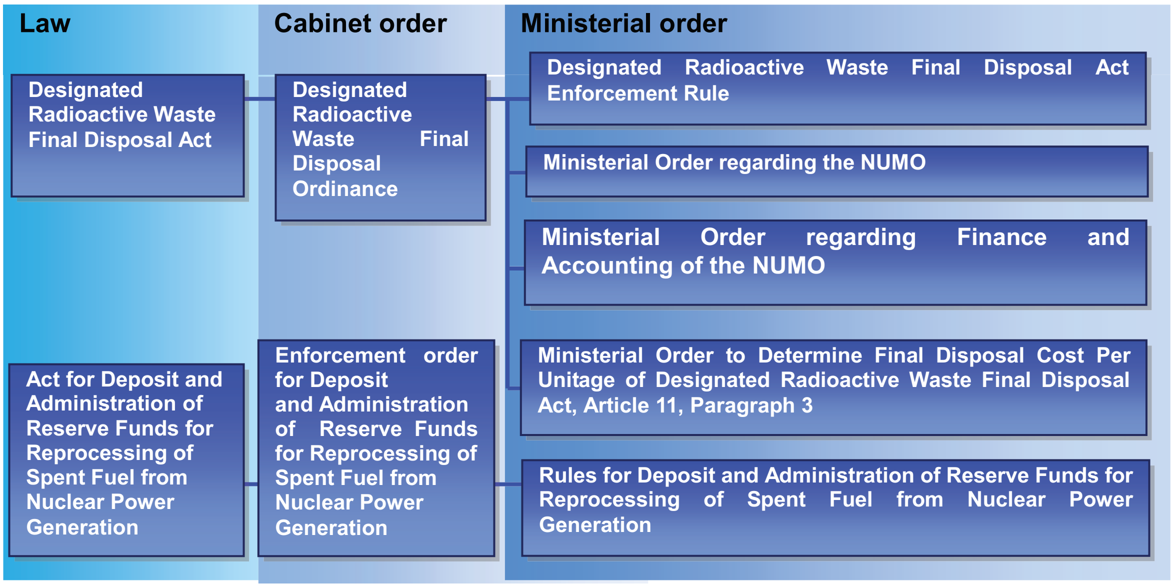


Fig. E2-1 Main regulatory system to promote spent fuel management and radioactive waste management

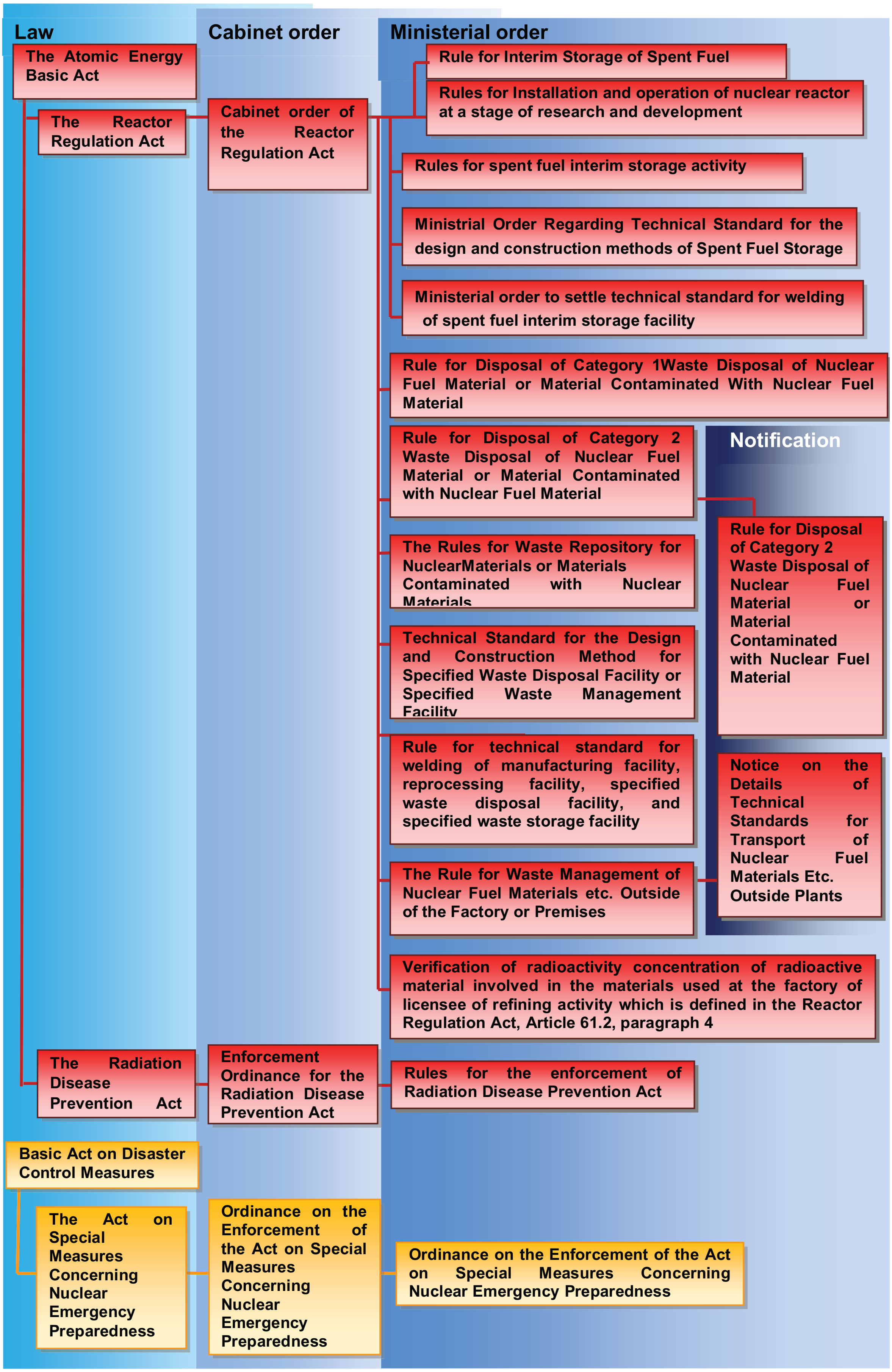


Fig. E2-2 System of Main Legislations on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

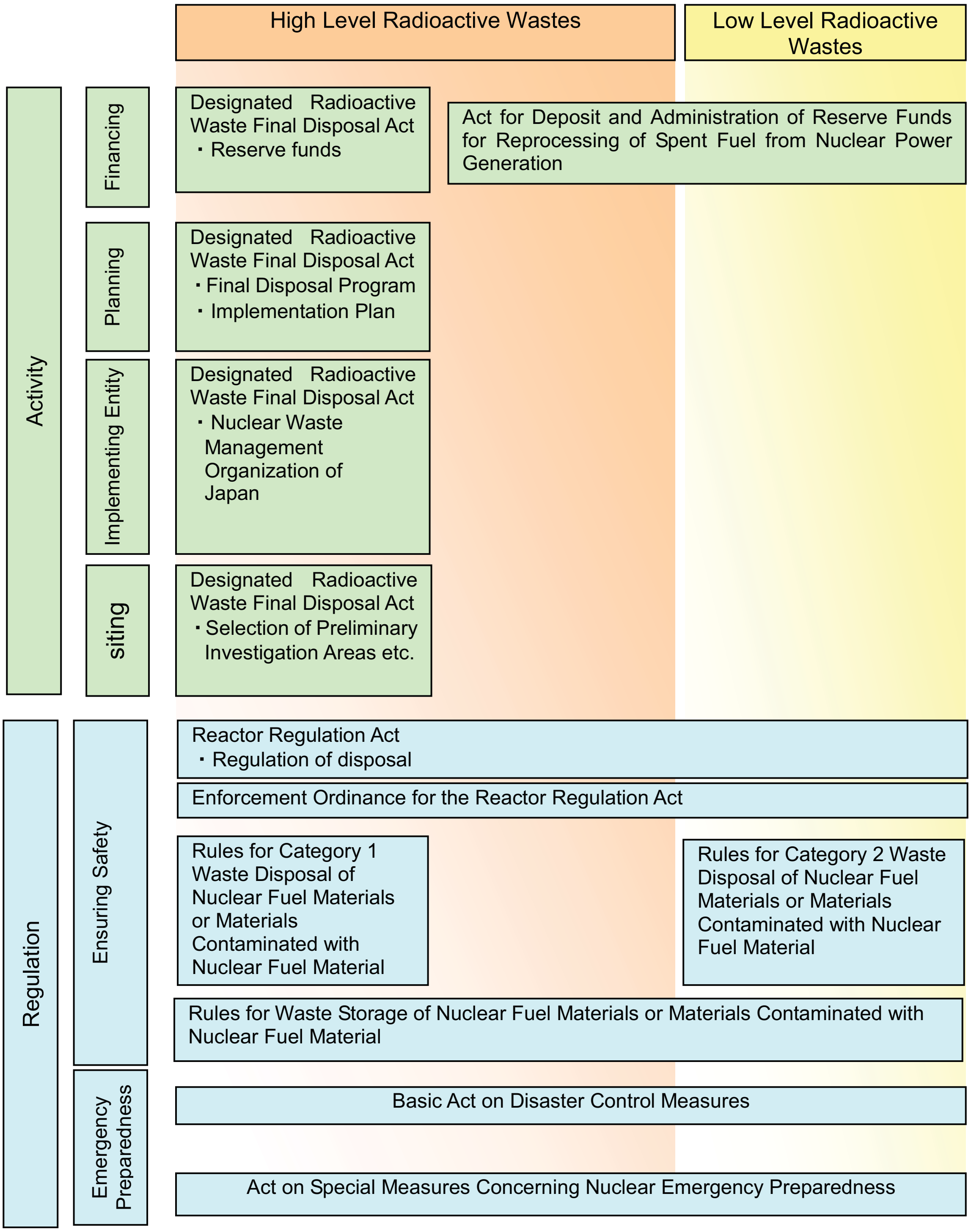


Fig. E2-3 Legal System for Safety Management of Radioactive Waste Related to Nuclear Power Generation

E3 Regulatory body

Article 20

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 19, and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities.
2. Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation.

The regulatory bodies in Japan are responsible for reliable implementation of regulation provided by the Reactor Regulation Act, the Radiation Disease Prevention Act and other relevant laws. The structures and duties of the regulatory bodies are clearly specified in each Establishment Acts and financed by the government budget.

The regulatory bodies share the responsibilities for nuclear safety regulation according to the types of nuclear energy utilization. The Minister of METI regulates the safety in the utilization of nuclear energy as an energy source, the Minister of MEXT regulates the safety in the utilization of nuclear energy for science and technology and the utilization of radioisotopes excluding medicines, etc., and the Minister of MHLW regulates the safety of the activities in radioactive medicines and medical facilities.
The subordinate agency or bureau of each ministry takes charge of the practical implementation of safety regulation: NISA of METI, the Science and Technology Policy Bureau of MEXT, the Pharmaceutical and Food Safety Bureau and the Health Policy Bureau of MHLW.

NSC, whose members are appointed by the Prime Minister with the consent of the Diet, audits the activities of regulatory bodies, and establishes fundamental policy on the safety regulation, coordinating activities among regulatory bodies.

E3.1 Regulatory bodies

1. Nuclear and Industrial Safety Agency (NISA), METI

NISA administrates the safety regulations for nuclear installations related to the utilization of nuclear energy. Specifically, NISA, entrusted by the Minister of METI, administers following duties under the competence of the Minister of METI.

The Minister of METI is responsible for implementing necessary regulation for safe utilization of nuclear source material, nuclear fuel material and nuclear reactors. The Minister has the authority to grant the license for establishing such nuclear facilities and, for that purpose, examines that the location, structures and systems of the proposed facility do not impair the prevention of hazards. The Minister has also the authority to revoke the license, when a licensee violates the Reactor Regulation Act.
The Minister of METI establishes the ordinances that provide for the operational safety, measures to be taken for protection of specific nuclear fuel materials, the Operational Safety Program, measures in emergency, etc. for the safety regulation of refining of nuclear source material, nuclear fuel material processing and fabrication, establishment and operation of nuclear reactors, storage of spent fuel, reprocessing of spent fuel, storage of radioactive wastes and disposal of radioactive wastes. The Minister approves the design and construction methods of facility, conducts inspection, approves the Operational Safety Program, approves decommissioning program of nuclear facility, collects reports from licensees and carries out on-the-spot inspection when necessary.
The Minister of METI has the competence to revoke or suspend a license, to order measures for operational safety, to dismiss a Chief Engineer of Reactors, to order measures for

decommissioning or emergency preparedness, etc.
The Minister of METI conducts examinations for Chief Engineers of Nuclear Reactors and issues the certificates. The Minister of METI has the authority also to order to return such certificates in a case of violation of the law by the Chief Engineers.

NISA has 11 divisions dedicated to the administration of the safety regulation of nuclear installations. They are Policy Planning and Coordination Division, Nuclear Safety Public Relations and Training Division, Nuclear Safety Regulatory Standard Division, Nuclear Safety Special Investigation Division, Nuclear Power Licensing Division, Nuclear Power Inspection Division, Nuclear Fuel Transport and Storage Regulation Division, Nuclear Fuel Cycle Regulation Division, Radioactive Waste Regulation Division, Nuclear Emergency Preparedness Division and Electric Power Safety Division. The assigned duties of those divisions are provided in Fig. E3-1.
Nuclear Safety Inspectors are assigned to each site of the nuclear installations. Fig. E3-2 shows the locations of the Nuclear Safety Inspectors Offices.
NISA has a total of ca. 350 staff engaged in the nuclear safety regulation as of March 2011, out of which 100 staff members are Nuclear Safety Inspectors and Senior Specialists for Nuclear Emergency stationed at nuclear installations.
The Nuclear and Industrial Safety Subcommittee under the Advisory Committee for Natural Resources and Energy was established as an advisory council to NISA, that proposed policies on nuclear safety and safety of electric power. 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, ground foundation etc.
"What challenges exist in the future in order to assure safety in nuclear power generation and safety in the electric power system operation, while under rapid social and economical change" were entrusted to the subcommittee to be discussed. The subcommittee and other subcommittees have deliberated on what nuclear safety regulation systems should be, and the results were reported to NISA.
NISA, when necessary, asks for opinion from experts of the subcommittee, etc. The Nuclear Fuel Cycle Safety Subcommittee and the Radioactive Waste Safety Subcommittee under the Advisory Committee for Natural Resources and Energy are advisory councils to NISA in the area of spent fuel management and radioactive waste management. (See Table E3-1)

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 divisions of NISA in discharging their duties, and take timely remedial actions after consulting with the senior managements. In order to improve the quality of regulatory activities, the development of the NISA Work Management System started in fiscal year 2006 and implemented from fiscal year 2007. NISA conducted study on investigation framework and implementation policy of the regulation issue, and reflected the implementation policy of regulation issues on “Mission and Action Plan of NISA” (mission paper) issued every year, on the basis of “Arrangement of Issues Concerning Nuclear Safety Regulation” which was developed as “Future Issues on Safety Regulation” in February 2010, developed by Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy Fundamental Policy Subcommittee.

In addition, NISA makes a continuous effort to maintain the high quality of regulation through education and training of the personnel, international activities and the hearing of advice from experts e.g. members of the Nuclear and Industrial Safety Subcommittee.
September 2001, NISA started information disclosure activity systematically integrating it with the regulatory work process, and introduced public relationship management (RM) program as a new effort, which makes feedback from outside into quality enhancement of the regulatory activities. The objectives of the RM are to improve stakeholders’ recognition and

understanding of NISA’s daily activities, to make appropriate response to the stakeholders’ concerns, to activate discussion of a better regulatory system, to improve emergency preparedness and to activate internal communication.

The main items of NISA information disclosure activity are as follows;

(i) NISA executive’s visit to the local government,
(ii) publication of newsletters and mail magazines,
(iii) explanation of policies and activities of the nuclear safety regulation to the public, (public meeting on the clearance system and on amendment of the Reactor Regulation Act, Pu-thermal symposium, public meeting on seismic safety, "one-day seminars to introduce NISA" were held in major cities and site municipalities),
(iv) making dialogue with local residents,
(v) activities to hear from the public at the Nuclear Safety Inspector's Offices,
(vi) implementation of risk-communication training course for local-government personnel etc.,
(vii) utilization of local cable television (CATV), website, etc. to communicate with the local residents, where NISA’s executives introduce its main policies such as the new inspection system or the locally stationed Nuclear Safety Inspectors Offices.

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

2. Japan Nuclear Energy Safety Organization (JNES)

In October 2003, JNES was established as a technical support organization for NISA in ensuring safety in utilization of nuclear energy, and has 432 officers and staffs as of April 2011.

The missions of JNES who conducts the fundamental duties of nuclear safety regulation, are followings;

- to effectively implement their duties scientifically and rationally
- to contribute to the enhancement of nuclear safety regulation by utilizing competence as a specialized agency
- to proactively deliver and provide with information for ensuring nuclear safety to the public
- to foster public confidence in the safety of nuclear energy

JNES implements the following activities to accomplish the above missions:

- Inspection of nuclear facilities, reactor facilities, etc.
- Safety analysis and evaluation of design of nuclear facilities and reactor facilities
- Activities to prevent occurrence of nuclear emergencies, to prevent progression of a nuclear emergency, and to recover from the nuclear disaster
- Investigation, testing, research, and training concerning ensuring safety in utilization of nuclear power as energy
- Collection, analysis and transmission of information relating to ensure nuclear safety

The framework for JNES to implement activities and the relation with NISA are as follows:

- NISA develops a plan on each activity based on the regulatory needs, and defines the medium-term objective in accordance with the Act of the General Rules for Incorporated Administrative Agency, and the Minister of METI assign it to JNES.
- JNES prepares a medium-term program to accomplish the medium-term objective, submits the program to the Minister of METI, obtains approval, prepares annual plan (fiscal year) in accordance with the medium-term program, notifies the plan to the minister of METI and implements it.

The budget for JNES consists of government budget and commission of inspections.

3. Science and Technology Policy Bureau (STPB), MEXT

The safety regulation concerning the activities on the nuclear utilization from a scientific and technological aspect and utilization of radioisotopes and radiation generating apparatus (excluding medicines, etc.) is regulated by the Minister of MEXT as the competent minister, and the Science and Technology Policy Bureau (STPB) of MEXT conducts the actual duties to be implemented by the authority of MEXT.

With regard to the licensing of establishment of test and research reactor facilities and use of nuclear fuel materials under the Reactor Regulation Act and approval for use of radioisotope etc. and for waste management carried out as business under the Radiation Disease Prevention Act, the Minister of MEXT has the authority to permit the respective licenses, after conducting an examination of the site, structure and equipment from the standpoint of nuclear disaster prevention. The Minister also has the authority to revoke the licenses under certain circumstances, such as the violation of applicable laws and regulations by the license holder.

STPB contains the Nuclear Safety Division, which has a further three offices. The assigned role of the divisions and offices are listed in Table E3-2. In addition, MEXT deploys a resident inspector for the safety management of nuclear facility to each site where the research reactor facility or the major fuel material use facility. Their missions are to conduct examinations and inspections stipulated in the Reactor Regulation Act to confirm the compliance with the Operational Safety Program and surveillance of reactor operation management, investigation of implementation of education and training, periodic licensee's inspection and to respond to an emergency situation. The locations of offices of Nuclear Safety Inspectors are illustrated in Fig E.3-2. As to the education and training programs for the staff members in charge of nuclear safety regulations are conducted in order to enhance competency of regulatory personnel.

The Radiation Council is established within MEXT under "the Act for Technical Standards of Radiation Hazards Prevention". The mandate of the Radiation Council is to clarify basic policy on establishing technical standards for prevention of radiation hazards and to maintain consistency among related technical standards. The basic policy is that the doses of radiation workers and the general public shall be less than the dose that may cause radiation hazards. The council reports to the consultation from the heads of the administrative organization concerning technical standards for prevention of radiation hazards, and states its opinion to the heads of administrative organization to keep consistency among technical standards. The Radiation Council consists of a maximum of 20 members, and the Basic Committee composed of experts from different fields is established under the council.

The STPB holds Advisory Committee on Nuclear Safety Regulation, etc. with an objective to contribute to the transparent and efficient administration of nuclear safety by MEXT. Under this committee, sub-committees are held, as listed in Table E3-3, in order to study safety regulations for research reactor and for utilization of radiation supervised by MEXT.

4. Ministry of Health, Labour and Welfare (MHLW)

MHLW administer the safety regulations for radioactive medicines, the regulations for the protection against clinical radiation, and the regulations for the structure and equipment of clinical laboratory equipped with radioisotope for specimen inspection. The mandate of MHLW is shown in Table 3-2.

The Pharmaceutical and Food Safety Bureau (PFSB) regulates the production of radioactive medicines based on the Regulations for Structures and Equipments for Pharmacies, etc. and the Regulations for Manufacturing and Handling of Radio Pharmaceuticals under the Pharmaceutical Affairs Act. The Independent Administrative Agency, Pharmaceuticals and Medical Devices Agency, conducts periodic inspections of manufacturing plants that produce radioactive medicines. And, PFSB also regulates disposal of radioactive pharmaceuticals.
The Health Policy Bureau regulates structures and equipments of X-ray clinical room and use room of radioisotope for clinical, etc., based on the Ordinance for Enforcement of the Medical

Care Act. This ordinance also provides standards for the facilities of storage, and disposal, etc. of clinical radioisotopes, etc.

Also, structures and equipments of the radioactive isotope laboratory test rooms were regulated by the Ordinance for Enforcement of the Clinical Laboratory Technicians, etc.Act, “Standards for Structures and Equipments of Clinical Laboratory equipped with Radioisotope for Specimen Inspection, Provided by Clinical Laboratory Technicians, etc.Act Enforcement Regulations Article 12, Paragraph 1. 5” (MHLW, Notification No.16, March 2, 1981). The ordinance, etc. shows the standard for the storage or disposal of radioactive isotopes for laboratory test.

E3.2 Ensuring of effective independence of regulatory functions from other functions

Regulatory bodies have clearly defined authorities and competences on safety regulation based on the Reactor Regulation Act. Although each of the regulatory bodies is established within a ministry which has departments promoting utilization of nuclear energy or radioisotopes, etc., the competence of each regulatory body is clearly separated from that of promotional department by its establishment law and order. Each regulatory body administers safety regulation independently, and NSC audits activity of each regulatory body. (See Fig. E3-3)

NISA is established as “special organization” of ANRE by the METI Establishment Act. The responsibility is clearly defined as “Agency to ensure the safety and industrial operational safety regarding nuclear and other energy” by the law.
NISA have clearly defined authorities and competences on safety regulation based on the Reactor Regulation Act. Regulatory activities based on the Law such as licensing, approval of construction plan, inspection for facilities or operation safety, are conducted by the name of Minister of METI. NISA independently makes decision or proposes of decision to the Minister without any interference of ANRE.
The regulatory activities of NISA are supervised and audited by NSC that is the Commission established by “JAEC and NSC Establishment Act”. The commissioners of NSC are designated by the Prime Minister with the consent of Diet.
NISA have to consult with NSC before granting the license of nuclear business facility and activities based on the Reactor Regulation Act. And NISA have to report to NSC of the regulatory activities such as approval of construction plan and the inspections of operational safety activities afterwards. NSC has the authority to make recommendation through Prime Minister if it deems necessary.
With these arrangements, the effective independence of NISA as a regulatory body has been ensured.

Nuclear Safety Division, STPB of MEXT has clearly defined authorities and competences on safety regulation based on the Reactor Regulation Act and the Radiation Disease Prevention Act. Regulatory activities based on these Laws such as licensing, approval of construction plan, inspection for facilities or operation safety, are conducted by the name of Minister of MEXT. STPB, which is assigned to conduct these regulatory activities by the order for organization of MEXT, independently makes decision or proposes of decision to the Minister without any interference of promotion body.
Based on the JAEC and NSC establishment Acts, NSC may require the head of each administrative organization to report matters necessary to accomplish the assigned mission and make recommendation through Prime Minister if it deems necessary.
With these arrangements, the effective independence of Nuclear Safety Division, STPB of MEXT as a regulatory body has been ensured.

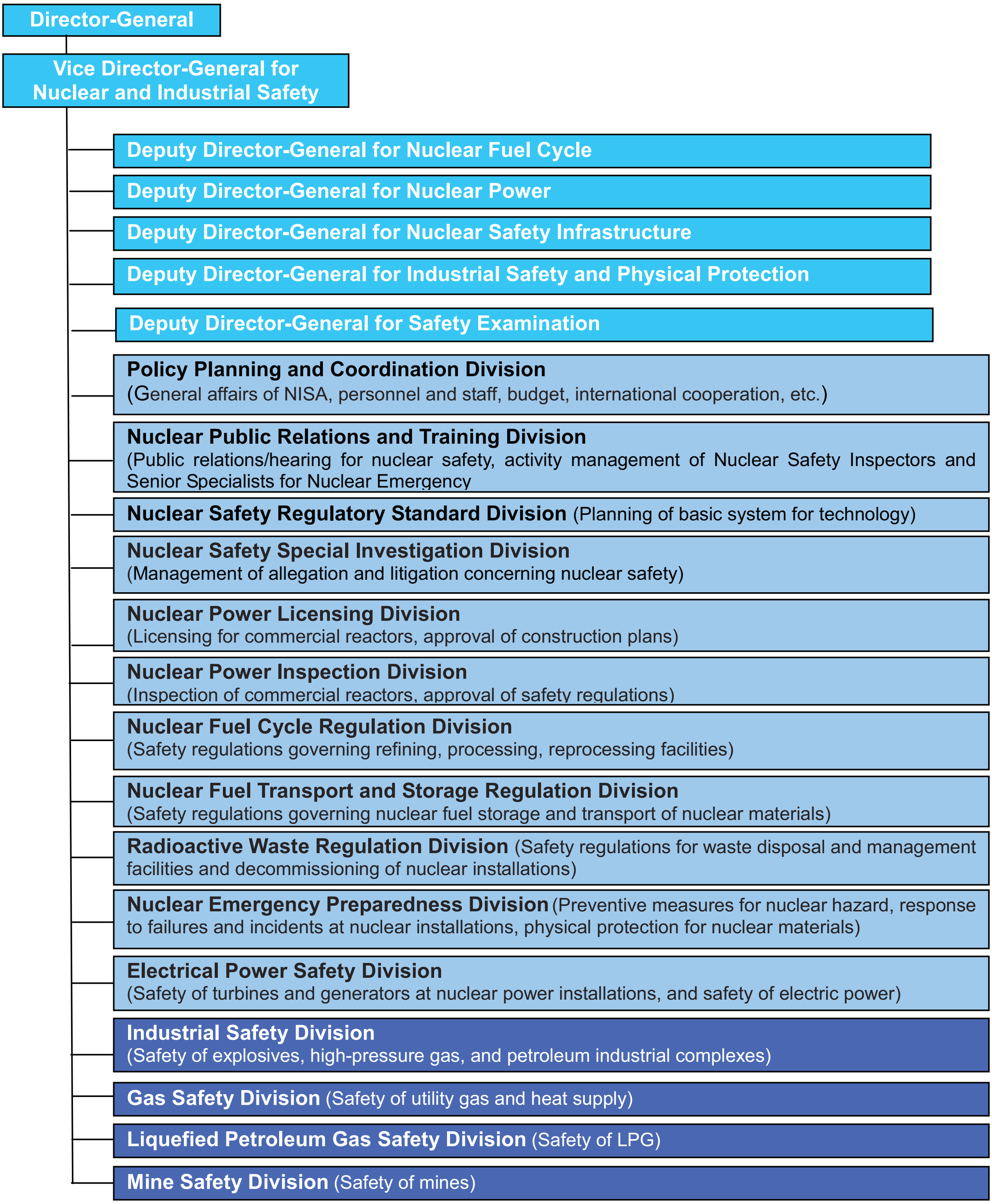
Based on the accident of TEPCO’s Fukushima NPSs, in August 15, 2011, the Minister for the Restoration from and Prevention of Nuclear Accident, announced his tentative plan to review an organization in charge of nuclear safety regulation.

He announced that (1) the government should firstly conduct an immediate review, mainly on the separation of NISA from METI so that an new regulatory body can be created in April 2012. He also pointed out that (2) the government should further conduct broader study on a future nuclear and energy policy review as well as the outcome of the investigation into the accident, it should then present the result of its review by around the end of 2012 on areas covered by the new organization and on the way to upgrade a more effective and robust organization.

Taking into consideration five principles below, a tentative plan for a review on a new regulatory organization was presented.

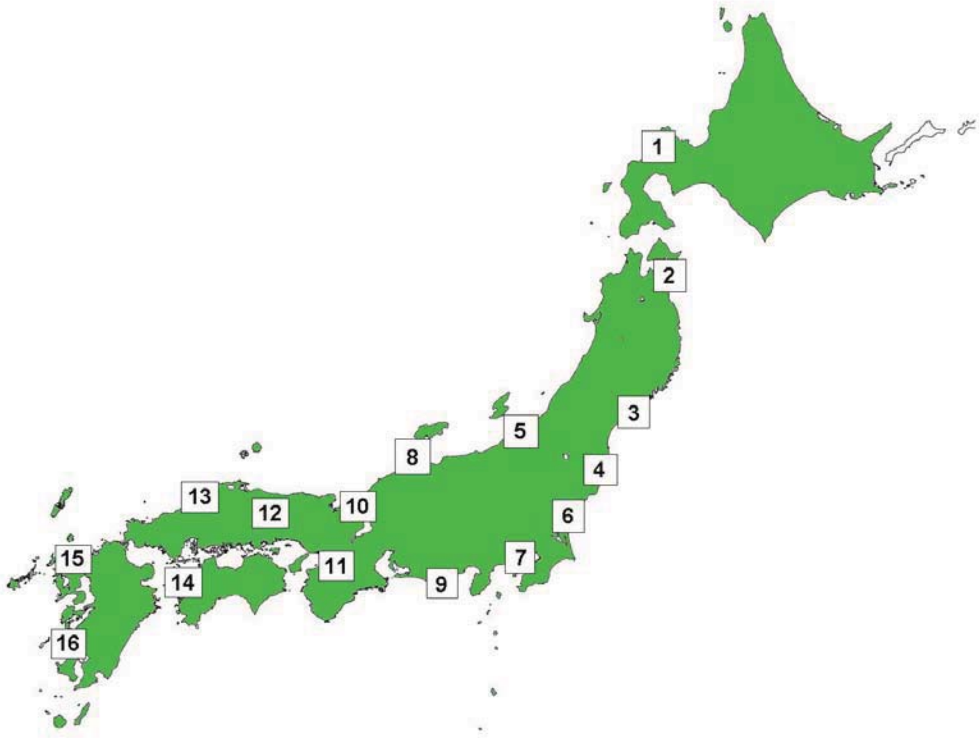
- Separation of regulation and promotion functions.
- Unification of relevant functions regarding nuclear safety regulations.
- Strengthening of the crisis management functions.
- Reform of organizational culture, and securing/training talented experts
- Strengthening of new nuclear safety regulations

The Japanese Government decided on the "Basic Concept of Structural Reform of Nuclear Safety Regulations" at the Cabinet Meeting of August 15 this year and decided on the launch of a new safety regulatory body. Specifically, considering international discussions in the past, and on the basis of the principle of "separating regulation from utilization," the nuclear safety regulatory divisions of NISA will be separated from the Ministry of Economy, Trade and Industry, with "Nuclear Safety and Security Agency (tentative name)" aimed to be established by April 2012 as an external agency of the Ministry of Environment by integrating into it the functions of the NSC. For this purpose, the capabilities of this regulatory body will be enhanced by centralizing nuclear safety regulatory activities, a dedicated risk management division will be established to enable this Nuclear Safety and Security Agency to take quick initial responses, and efforts will be made to recruit highly qualified personnel from both the public and private sectors to adequately execute the regulatory activities. In addition, a "Task Force for the Reform of Nuclear Safety Regulations and Organizations" was established on August 26 for the preparation of the bill necessary to establish the new organization.



- **Director-General**
  - **Vice Director-General for Nuclear and Industrial Safety**
    - **Deputy Director-General for Nuclear Fuel Cycle**
    - **Deputy Director-General for Nuclear Power**
    - **Deputy Director-General for Nuclear Safety Infrastructure**
    - **Deputy Director-General for Industrial Safety and Physical Protection**
    - **Deputy Director-General for Safety Examination**
    - **Policy Planning and Coordination Division** (General affairs of NISA, personnel and staff, budget, international cooperation, etc.)
    - **Nuclear Public Relations and Training Division** (Public relations/hearing for nuclear safety, activity management of Nuclear Safety Inspectors and Senior Specialists for Nuclear Emergency
    - **Nuclear Safety Regulatory Standard Division** (Planning of basic system for technology)
    - **Nuclear Safety Special Investigation Division** (Management of allegation and litigation concerning nuclear safety)
    - **Nuclear Power Licensing Division** (Licensing for commercial reactors, approval of construction plans)
    - **Nuclear Power Inspection Division** (Inspection of commercial reactors, approval of safety regulations)
    - **Nuclear Fuel Cycle Regulation Division** (Safety regulations governing refining, processing, reprocessing facilities)
    - **Nuclear Fuel Transport and Storage Regulation Division** (Safety regulations governing nuclear fuel storage and transport of nuclear materials)
    - **Radioactive Waste Regulation Division** (Safety regulations for waste disposal and management facilities and decommissioning of nuclear installations)
    - **Nuclear Emergency Preparedness Division** (Preventive measures for nuclear hazard, response to failures and incidents at nuclear installations, physical protection for nuclear materials)
    - **Electrical Power Safety Division** (Safety of turbines and generators at nuclear power installations, and safety of electric power)
    - **Industrial Safety Division** (Safety of explosives, high-pressure gas, and petroleum industrial complexes)
    - **Gas Safety Division** (Safety of utility gas and heat supply)
    - **Liquefied Petroleum Gas Safety Division** (Safety of LPG)
    - **Mine Safety Division** (Safety of mines)

Fig. E3-1 Organization of Nuclear and Industrial Safety Agency



	Name of Office	Competent ministry
1	Tomari Nuclear Safety Inspectors Office	METI
2	Higashidori Nuclear Safety Inspectors Office	METI
	Rokkasho Nuclear Safety Inspectors Office	METI
	Rokkasho Nuclear Safety Administration Office	MEXT
3	Onagawa Nuclear Safety Inspectors Office	METI
4	Fukushima-Daiichi Nuclear Safety Inspectors Office	METI
	Fukushima-Daini Nuclear Safety Inspectors Office	METI
5	Kashiwazaki-Kariwa Nuclear Safety Inspectors Office	METI
6	Tokai & Ooarai Nuclear Safety Inspectors Office	METI
	Ibaraki Nuclear Safety Administration Office	MEXT
7	Kanagawakita Nuclear Safety Administration Office	MEXT
	Yokosuka Nuclear Safety Inspectors Office	METI
8	Shika Nuclear Safety Inspectors Office	METI
9	Hamaoka Nuclear Safety Inspectors Office	METI
10	Tsuruga Nuclear Safety Inspectors Office	METI
	Mihama Nuclear Safety Inspectors Office	METI
	Ohi Nuclear Safety Inspectors Office	METI
	Takahama Nuclear Safety Inspectors Office	METI
11	Osaka Nuclear Safety Administration Office	MEXT
	Kumatori Nuclear Safety Inspectors Office	METI
12	Kamisaibara Nuclear Safety Inspectors Office	METI
	Kamisaibara Nuclear Safety Administration Office	MEXT
13	Shimane Nuclear Safety Inspectors Office	METI
14	Ikata Nuclear Safety Inspectors Office	METI
15	Genkai Nuclear Safety Inspectors Office	METI
16	Sendai Nuclear Safety Inspectors Office	METI

Fig. E3-2 Nuclear Safety Inspectors Offices and Nuclear Safety Administration Offices

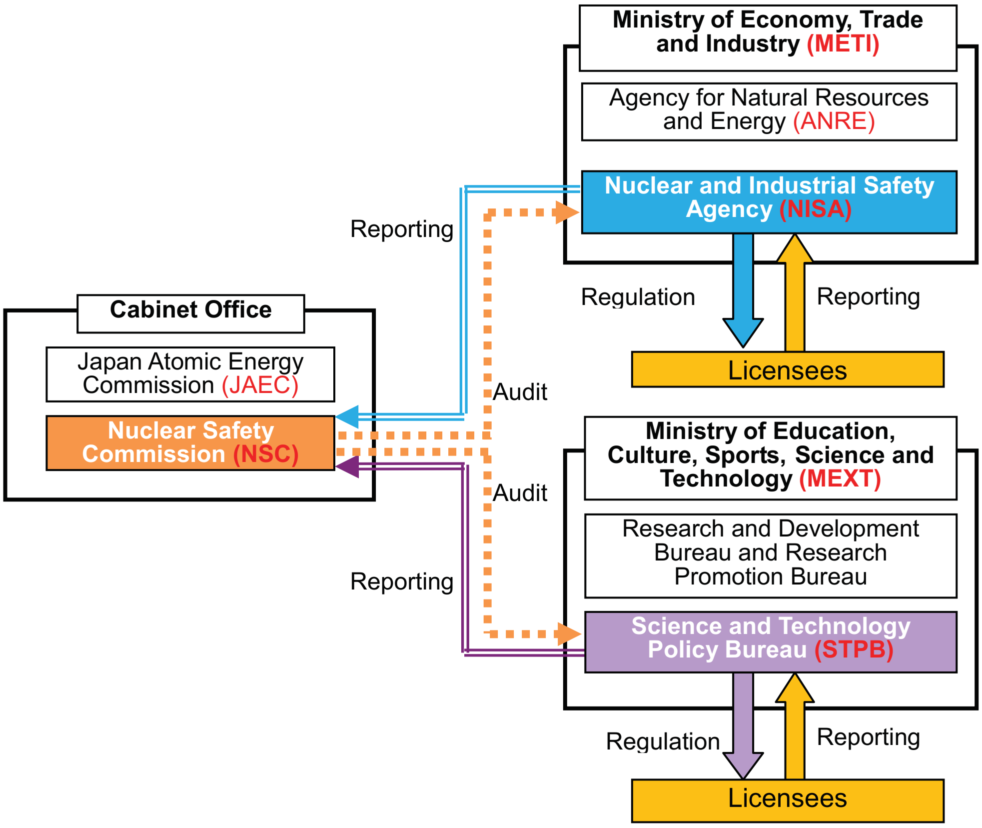


Fig. E3-3 Relation among nuclear safety regulatory bodies in subsequent stage regulation

Table E3-1 Organization of the Nuclear and Industrial Safety Subcommittee

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
Electrical Power Safety Subcommittee.	- Securing safety of electrical power
Study Group on the Way of Inspection (Acton is now intermitted)	- Matters concerning inspection system of nuclear power generation facilities and nuclear fuel cycle facilities
Subcommittee. for the Institution of Nuclear Safety Regulation (Acton is now intermitted)	- Study of the legal system for the Institution of Nuclear Safety Regulation
Subcommittee. for fitness-for-service assessment etc. of nuclear power system (Acton is now intermitted)	- Study of the Verification of validity in the check methods for nuclear power plant
Study Group on Countermeasures for Aging	- Clarification of basic standards, guides etc. for aging
Radiation Control Subcommittee.	- Deliberation on radiation control in nuclear facility
Study Group on Use of Risk Information	- Study of Risk-Information usage to Nuclear Safety Regulations
Nuclear Safety Infrastructure Subcommittee	- Study of safety infrastructure, - Study of safety infrastructure on codes and standards
Chuetsu-oki Earthquake Nuclear Installations Investigation and Study Subcommittee	- Investigation and future challenges due to the effects by Chuetsu-oki Earthquake at the Kashiwazaki-Kariwa nuclear power station

Table E3-2 Organizations of MEXT and MHLW regarding nuclear and radioisotope regulation

1. Ministry of Education, Culture, Sports, Science and Technology; Science and Technology

Nuclear Safety Division	
Nuclear Safety Division Office of Nuclear Regulation	Regulations for research reactor facility, fuel material use facility, etc.
Nuclear Safety Division Office of Radiation Regulation	Regulations for radioisotopes, etc.
Nuclear Safety Division Office of Emergency Planning and Environmental Radioactivity	Nuclear emergency measures Environmental radiation measures

2. Ministry of Health, Labor and Welfare

Pharmaceutical and Food Safety Bureau, General Affairs Division	Regulations concerning the entrustment of disposal of radioactive medicines, etc.
Pharmaceutical and Food Safety Bureau, Compliance and Narcotics Division	Regulations for Manufacturing, etc. of Radioactive Medicines
Health Policy Bureau, Guidance of Medical Service Division	Regulation for structure and equipment of X-ray clinical room and use room of radioisotope for clinical
	Regulation for structure and equipment of clinical laboratory equipped with radioisotope for specimen inspection

Table E3-3 Subordinate Organization of Advisory Committee on Nuclear Safety Regulation, etc.

Subcommittee on Safety Regulation for Research Reactors, etc.	Directions for safety regulation of research reactors, nuclear fuel materials, etc.
Subcommittee on Safety Regulation for Radiation Protection.	Directions for safety regulation of radiation protection.
Subcommittee on Nuclear Emergency Preparedness	Comprehensive assessment of institutional and business-operational aspects of the Act on Special Measures Concerning Nuclear Emergency Preparedness
Subcommittee on Evaluation of Radioactivity in Environment	Assessment of the Results of Survey on Radioactivity in Environment and of the Contents of the Survey

Section F Other General Safety Provisions

F1 Responsibility of the license holder

Article 21

1. Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant license and shall take the appropriate steps to ensure that each such license holder meets its responsibility.
2. If there is no such license holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste

F1.1 Steps to ensure that each license holder meets its responsibility

The prime responsibility for the safety of nuclear facility and activities of spent fuel or radioactive waste management rests with the license holder of the nuclear facility. That is, the license holder is responsible for adopting necessary measures to fully meet the regulatory requirements stipulated in the Reactor Regulation Act, etc. at all of the stages of planning, establishment, operation, maintenance and decommissioning of the nuclear facility. In addition to meeting with regulatory requirements, the license holder is required to make efforts for improving safety and reliability of the nuclear facility, through implementing education and training programs of personnel, and preparing operation manuals.

In accordance with the Reactor Regulation Act, the regulatory body conducts inspections to confirm the compliance of the performance of facilities and systems of reactors, reprocessing, storage, disposal, operation, etc. with the legal technical standards and to confirm the observance of Operational Safety Program and Regulations by an operator. The regulatory body also can conduct on-the-spot inspection when necessary, and can impose administrative penalties including revocation of license if an operator violates laws and regulations.
For the radioisotope waste management facilities subject to the Radiation Disease Prevention Act, the regulatory body conducts the Periodic Inspection to confirm radiation facility's compliance with the technical standards, and the Radiation Inspector conducts the On-the-spot Inspection of radiation facilities as necessary. In case the operator does not observe provisions of relevant laws and regulations, the regulatory body has authority to revoke the license or order shutdown of the operation.

On the basis of the Reactor Regulation Act, the license holder shall cooperate inquiry by NSC when NSC conducts the on-the-spot investigation after the report by regulatory body on the status of safety regulation.

F1.2 Steps to ensure that if there is no license holder or other responsible party exists

In Japan, in the case of revocation of the license, if the status of the operator is not succeeded through merger or inheritance stipulated by the Act, the license holder whose license is revoked shall continue to be deemed as a license holder and responsible for “record keeping,” “protective measures,” “Operational Safety Program,” and “physical protection” provided by the Reactor Regulation Act, and shall be subject to regulations. In the case of dissolution, etc. of the business of the license holder, if the status of the operator is not succeeded through merger or inheritance stipulated by the Reactor Regulation Act, a liquidator or a bankruptcy administrator shall be deemed as a license holder and responsible for “record keeping,” “protective measures,” “Operational Safety Program,” and “physical protection” provided by the Reactor Regulation Act, and shall be subject to regulations. In addition, the above-mentioned persons shall develop a decommissioning program, have it approved by the competent minister, carry out decommissioning and obtain confirmation of the competent minister for the completion of decommissioning.

Under the Radiation Disease Prevention Act, in the case of no succession of the business following dissolution, a liquidating partner shall take appropriate measures, such as removal of contamination by radioisotopes, etc, on cessation of the business.

As described above, it is ensured in Japan to avoid a case where no license holder exists due to succession of business, and the business is closed if nobody succeeds the business.

A license holder of radioisotope waste management facility issued under the Medical Care Act etc. is allowed to close its operation only after it completes necessary measures for the closure of facility and activities stipulated by the law.

F2 Human and financial resources

Article 22
Each Contracting Party shall take the appropriate steps to ensure that:
(i) Qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;
(ii) Adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning;
(iii) Financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

F2.1 Measures for maintain human resources

1. Human resources

The regulatory body confirms in the review for the license etc. on the basis of the Reactor Regulation Act application that the applicant has technical competence including human resources sufficient for installing the facility and appropriate operation. The applicant has to verify that its technical competence is sufficient for its activity. For confirming the technical competence, objective and reasonable examination is carried out by applying the "Examination Guide for Technical Capability of License Holders of Nuclear Power" issued by NSC in May, 2004. This Regulatory Guide defines the technical competence as organizational management capability to appropriately operate the activity with ensuring safety including knowledge, technology and expertise, and provides fundamental requirements to be met by the license applicant.

As a prerequisite to operate the activities, the Reactor Regulation Act requires licensees to appoint the following chief engineers from qualified employees for safety supervision of operation; Chief Reactor Engineer for reactor operation, Chief Engineer for Nuclear Fuel Material Handling in fabrication or reprocessing activity, Chief Engineer for Spent Fuel Handling in spent fuel storage facility, and Chief Engineer for Radioactive Waste Handling for handling nuclear fuel materials and other radioactive wastes in disposal facility.
Furthermore, regarding education and training, the Reactor Regulation Act requires operators to provide, in the Operational Safety Program, for the policy, the implementing program and contents of operational safety education. The regulatory body confirms the compliance with these requirements through the Operational Safety Inspection.

Also, operator of a business licensed under the Radiation Disease Prevention Act is required to select and appoint a Chief Engineer for Radiation Protection, who supervises safety management of handling of radioisotopes, etc., from qualified persons before commencing the business. The operator is also required to specify the matters related to duties and organizations of the persons engaged in safety management and handling of radioisotopes and the matters related to education and training required to prevent radiation hazards in the "Rules for Preventing Radiation Hazards".

2. Activities to ensure human resource infrastructure in Japan

In Japan, both regulatory body and nuclear industry are striving to ensure human resources as a part of activities for ensuring future nuclear safety infrastructure.

NISA is preparing a strategy to develop and secure human resources in the area of nuclear energy at the Nuclear Safety Infrastructure Subcommittee established in 2006 under the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy. Regarding the concept of human resource infrastructure in the future, in October 2007 this Subcommittee made the report concluding that:

"The matter of human resource depends upon a balance between demand and

> supply. In order to secure human resource it is important for industry and government side to show the actual needs from each point of view to educational institutes and research institutes those make decision to foster human resource in own institutes. And it is necessary to consider the measures from the both view points of fostering and securing human resource."

Based on the concept, the skill management system was introduced into education and training programs and operated.

In parallel with the above activities, MEXT and METI have been implementing "Nuclear Energy Human Resources Development Program" since 2007 to foster stuff effectively in universities, etc. who are prospected to be engaged in safety regulation administration, research institutes like university etc., nuclear industry etc. Also, from 2010, MEXT has been carrying on International Nuclear Human Resource Development Initiative to support cross-sectional HRD activities among the nuclear-related organizations in academy, industry and government. The "Japan Nuclear Human Resource Development Network" was established in November 2010, with the aim of enhancing this mutual cooperation among academy, industry and government, and to create an all-Japan nuclear HRD system.

(1) Training of Experts in MEXT and NISA

Staff members, who are in charge of nuclear regulation in MEXT and NISA, are the Senior Specialist for Nuclear Emergency, the Operational Safety Inspector, the Nuclear Facility Inspector, the Electric Facilities Inspector, the Safety Examiner and the Senior Specialist for Fire Protection. A Senior Specialist for Nuclear Emergency is stationed at each nuclear installation, guides and advises the licensees in preparing its Plan for Emergency Preparedness, and conducts duties necessary to prevent progression of nuclear emergency should it occur. An Operational Safety Inspector is stationed at each nuclear installation, conducts the Operational Safety Inspection to confirm licensee's compliance with the Operational Safety Program, conduct investigation, communicate with the staff of nuclear installation at incident if they occur, and supervises operation management of a nuclear installation. A Nuclear Facility Inspector conducts inspection activities, such as the Pre-Service Inspection and the Periodic Inspection of a nuclear installation. An Electric Facilities Inspector is dispatched from NISA head office, and conducts inspection activities, such as the Pre-Service Inspection of Electric Facilities, the Fuel Assembly Inspection, and the Periodic Inspection of Electric Facilities. Safety Examiners conduct the Safety Examination of a nuclear installation. A Senior Specialist for Fire Protection of NISA is stationed at each nuclear installation, guides and advises the licensees in fire protection measures in collaboration with local fire protection agency.

As stated above, each staff of Nuclear Regulatory 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. In order to increase effectiveness of the training, the contents of the training being implemented are also reviewed and improved suitably. The capability of the personnel engaged in securing safety of nuclear installations is improved through these training. Besides developing professional human resources as mentioned above, NISA recruits professional human resources for nuclear safety from industries or other ministries.

NISA has appointed six Special Inspection Instructors in December 2003. They advise inspectors for the Operational Safety Inspection, the Periodic Inspection, etc. in each power station, instruct them to equalize the levels of inspections, and they collect opinions and proposals from inspectors and licensees for the purpose of opinion exchanges at the site.

NISA also introduced a skill management system into its education and training program in 2009. This system provides personnel with opportunities to participate in instruction and OJT courses to learn necessary knowledge required for accomplishing their tasks. The system also develops an education and training program under the involvement of the administrator so that personnel can take part and gain experience in these courses. This skill management system aims at promoting voluntary participation of personnel in training courses, and also at improving conditions for personnel to take part in training courses due to their busy work schedule, which has traditionally been regarded as a challenge. The conventional education and training programs, other than the above competence management system, have also been continued. Thus, there is no change in recognition that it is important for fostering regulatory body staff that they acquire necessary skills and knowledge while performing their own tasks. The required skills and the relevant major training provided for the personnel of the nuclear safety division in Fig. F2-1.

(2) Training of Experts in JNES

The Electricity Utilities Industry Law or the Reactor Regulation Act stipulates that activities such as Electric Facilities Inspection, the Nuclear Facility Inspection, the Welding Inspection, the Audit of Licensee's Periodic Check System, the Audit of Licensee’s Welding Check System, the Safety Confirmation of Disposal Facility, the Safety Confirmation of Radioactive Waste Package, the Confirmation of Transportation Packaging, the Confirmation of Transportation Method and the Confirmation of Clearance Measurement shall be conducted by JNES’s qualified personnel under the instruction of NISA. JNES prepares various training courses for its staff members to get appropriate qualification in their respective activities. President of JNES assigns inspectors from those qualified persons. JNES develops training courses for its personnel, putting emphasis on inspection activities. JNES also is recommending its staff to obtain relevant official qualification, and to participate outside lectures and academic seminars in order to brush up the capability for inspection and safety review and knowledge in his specialty.

(3) Efforts by Nuclear Industry

The nuclear industry has concerns in the succession of expertise and experiences, and the maintaining sufficient number of skilled workers. In Japan, 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 proposals for training and career development of experts in June 2003; establishment of an industry’s qualification system of nuclear maintenance and repair technicians, simplification of organizations, establishment of an engineering center to share training facilities and resources of maintenance and repair technicians, establishment of a nuclear educational network system to share common educational infrastructure to ensure resources for future.

Main activities currently performed for human resource training and succession of expertise in the nuclear industry are shown in the following;

a. Training of on-site technicians and succession of skills

In the area where the nuclear installation is established, the training for qualification, training of practical skills for maintenance and repair, OJT training at the power station, etc. are implemented beyond the frame of an individual operator.

b. Study on qualification and certification system for private sectors

For the purposes of improved skills of maintenance-and-repair workers, appropriate staffing, and ensuring future human-resources, the common standards and qualification / certification procedures for objective evaluation of skill level are being studied. These standards etc. will be made to harmonize with the licensee's in-house qualification system.

c. Acquisition of advanced expertise

Licensees’ engineers are sent to the graduate school in nuclear engineering to acquire advanced expertise.

Moreover, the Japan Atomic Industrial Forum, Inc., consisting of enterprises related to the nuclear power and developing industry-wide policies, has investigated and studied the current status of universities, graduate schools and research institutes in 2006, in order to improve the effectiveness of “Nuclear Energy Human Resources Development Program”. “The Nuclear Human Resource Development Committee” investigated the issues related to human resource development in the field of nuclear energy since 2007, by sharing visions and discussing about the roadmap, based on the challenges faced by the nuclear industry in Japan, and on future perspectives. Since 2010, these activities have been taken over by the “Japan Nuclear Human Resource Development Network”.

(4) Efforts by University and Research Institutes

The Tokyo University established a graduate school, in April 2005, consisting of three courses of the “Nuclear Reactor Specialist Course”, the “Nuclear Fuel Specialist Course”, and the “Administrator Course”.

Since 1958, JAERI, now JAEA has been operating training courses for engineers and technicians in radioisotope, radiation and nuclear technologies. Recently, JAEA 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 Professional Engineers System is the qualification system in order to intend to foster competent engineers who have special knowledge on science and technology, high capability of application, abundant experience in actual business, and high morality as engineers for ensuring public benefit.

The MEXT who has jurisdiction over the Professional Engineers System established a nuclear and radiation field of specialization for professional engineers in 2004 fiscal year. The qualification examination has been implemented every year, and a total of 381 people were qualified as the Professional Engineer by the end of FY 2010. The purposes of the Professional Engineers System are such to enhance nuclear engineering capabilities, to utilize the capability in the nuclear safety regulation, to strengthen the safety management system in each corporation.

F2.2 Financial Resources and Financial Rules

In permission of establishment license of a nuclear facility, except for nuclear fuel material use facility, the regulatory body, in accordance with the Reactor Regulation Act, confirms that the applicant for the license possesses necessary financial basis. The applicant should submit business plan that explains about the financial base of the business.

For the financial base of the decommissioning of nuclear installations, METI stipulated the Ministerial Order established under the Electricity Utilities Industry Law on the reserves for decommissioning of nuclear power generation facilities. Based on the Ministerial Order, Electric Utilities internally reserved the money for the decommissioning as the expense of dismantling and removal of commercial power reactor facilities, and as the expense of the processing and disposal of the waste from decommissioning. The amount of reserve by the end of March 2011 is about 1,700 billion yen by 10 electric utilities.

In addition, the electric utilities are depositing money to be used for spent fuel reprocessing from electricity sales, in a fund administered by an administrative organization, designated by the Minister of METI in accordance with the “Act for Deposit and Administration of Funds for Reprocessing of Spent Fuel from Nuclear Power Generation” enacted in May 2005. The total funds deposited by 10 electric utilities amount to about 2,400 billion yen at the end of March 2011.

In accordance with the Final Disposal Act enacted in May 2000, operators of power reactor facilities deposit funds for disposal of high level radioactive waste to NUMO, the implementing body for disposal, who entrusts management of the fund to RWMC. The Minister of METI, every year, notifies utilities of the amount of money to be deposited to the fund. The amount of deposit per vitrified package was 39,543,000 yen in the year of 2010. The amount of money for construction of depository and disposal of about 40,000 vitrified packages of high level waste is estimated about 3 trillion yen. The amount of the money deposited to RWMC at the end of March 2011 was about 840 billion yen.

As for disposal of waste from Research, Medical and Industrial Facilities, a generator of waste must pay for the disposal under the principle of the liability of generator, as set forth in the Framework for Nuclear Energy Policy. The largest generator of the above waste, JAEA started funding for disposal based on the amendment of the Law for the Incorporated Administrative Agency, JAEA in June 2008. The amount of budget plan for fiscal year 2008 is about 4.3 billion yen.

Financial basis of a license holder of nuclear fuel material use is to be confirmed through procedures to approve the Operational Safety Program and the steps to be taken at the time of decommissioning.

Financial basis of the operator of radioisotope waste management facility licensed under the Radiation Disease Prevention Act (except for disposal business) is to be confirmed through receiving the Periodical Inspection, obligation to maintain the facility in compliance with technical standards, implementation of education and training programs, notification of the Internal Rules for Prevention of Radiation Hazards and the steps to be taken at the time of decommissioning.

Financial basis of disposal business is an essential condition of licensee of waste management.

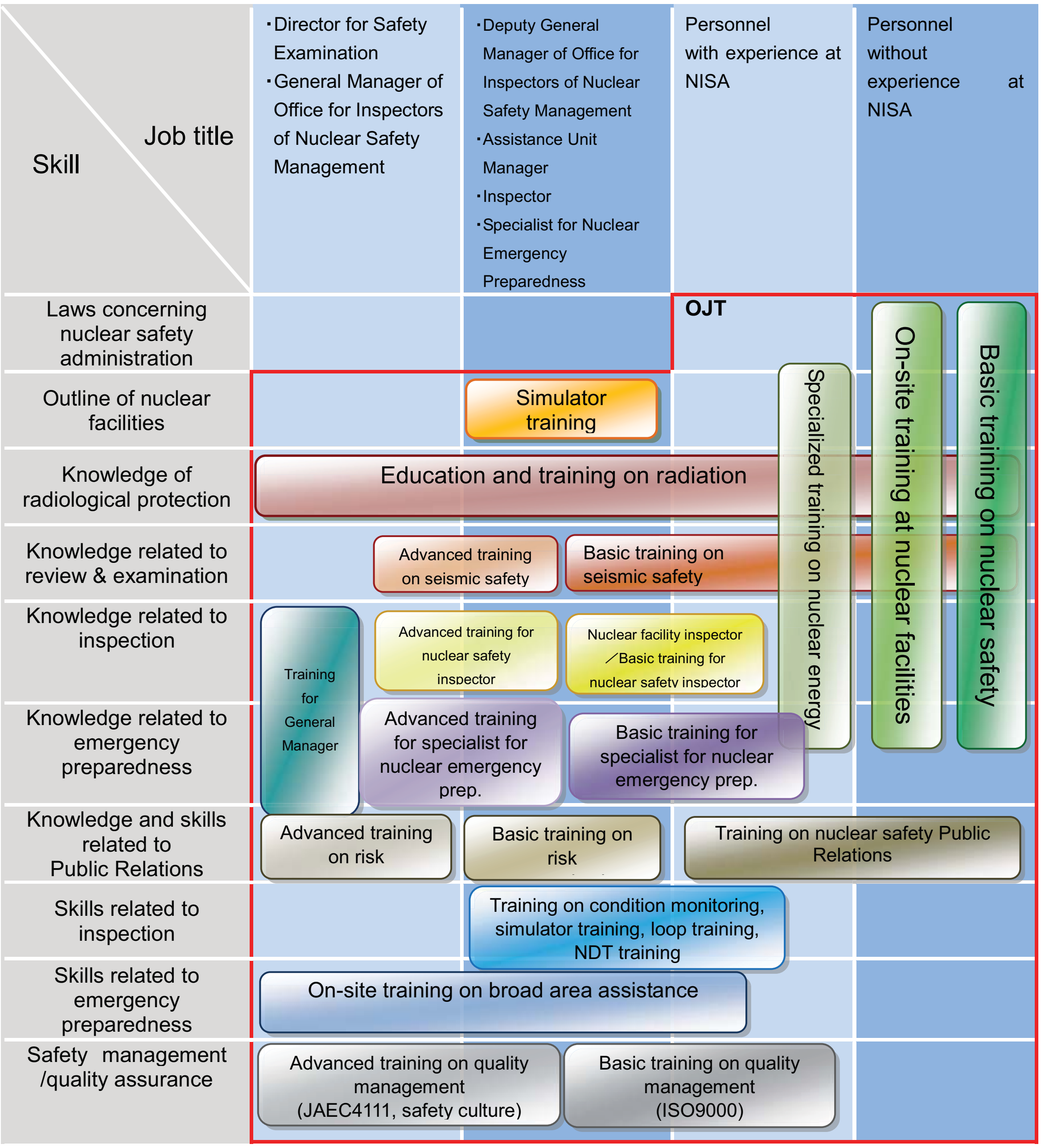


Fig. F2-1 Training System of Nuclear Safety Regulation at NISA

F3 Quality assurance

Article 23
Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmes concerning the safety of spent fuel and radioactive waste management are established and implemented.

By the amendment of the Reactor Regulation Act enacted in September 2003 and February 2004, it is provided that the licensee establishes quality assurance plan for the operational safety activities, and plan, do, check and improve the operational safety activities, and improve quality assurance plan continually. And it is provided that the quality assurance system should be included in the Operational Safety Program. NISA confirms operator's compliance with it through the Operational Safety Inspection. The quality assurance activities at the nuclear facilities except for research reactor facilities and fuel material use facilities are described in the followings.

F3.1 Regulatory Requirements on QA of Nuclear Installations

NISA's regulatory activities on major nuclear facilities, based on the Reactor Regulation Act and the Electricity Business Act, include licensing, approval of design and construction methods, pre-service inspection, periodical facility inspection, etc., are covering from planning stage to operation stage.

By the Reactor Regulation Act, a licensee is required to integrate its quality assurance program into the Operational Safety Program. NISA approves the Operational Safety Program and confirms the operator's compliance with it through the Operational Safety Inspection.

This establishment of the quality assurance system provides a mechanism for systematic implementation of the activities that influence the quality. By establishing the quality assurance system, a licensee can have confidence in its safety activities, and by achieving its accountability for the quality assurance, the licensee can obtain public understanding.

The key points of QA activities are; i) to involve top management, ii) to be based on international standards on QA (ISO9001:2000), iii) to improve them by Plan-Do-Check-Act cycle, iv) to establish an in-house independent audit organization.

The Reactor Regulation Act stipulates that licensee's QA program should include i) organization managing QA activities, ii) plan for operational safety activities, iii) implementation of operational safety activities, iv) evaluation of operational safety activities, and v) improvement of operational safety activities.

Note) The term, operational safety activities, means activities necessary for maintenance of major nuclear facilities, use of major nuclear facilities, and shipment, storage and disposal of nuclear fuel materials or materials contaminated by nuclear fuel materials.

Licensees prepare their QA program of the nuclear facilities and implement them, according to JEAC 4111-2009, "Rules of Quality Assurance for Safety of Nuclear Power Plants" (hereinafter referred to as "JEAC 4111-2009"), which was developed by the Japan Electric Association (JEA) in autumn of 2003 (last revised in 2009) based on the ISO9001:2000 to specify QA management, top management, management of resources, business plan, and evaluation/improvement in QA program for nuclear power plant. NISA evaluated the standard and endorsed that it meets the regulatory requirements for nuclear facilities other than test and research reactors and use facilities.

The major items of JEAC4111-2009 revised from the original 2003 version are as follows:

- Statement on technical information is added in the procurement process.
- Statement on root cause is added in the corrective action and preventive action.
- Statement on implementation of PSR is added in the special notes of data analysis.
- Statement on information sharing is added in the special notes of preventive action.
- Response to the IAEA's revision of GS-R-3 and ISO9001:2008, etc.

Moreover, NISA is studying to clarify requirements of quality assurance during not only operating stage but also construction stage in legislation.

As for research reactors and nuclear fuel material use facility, MEXT confirms the implementation of QA program described in Operational Safety Program based on the Reactor Regulation Act through Operational Safety Inspection.

F3.2 Confirmation of Quality Assurance by NISA

1. Examination of the Policy for QA at Licensing Stage

NISA confirms the applicant’s technical capability in the process of Safety Review. In addition, NISA requests the applicant to submit the “Policy for Quality Assurance” attached to the application format, and examines it.

2. Examination of QA Program in Construction Stage

At the construction stage of a commercial power reactor facility, NISA requests the license holder to submit the “Description on Quality Assurance Program” as specified in the Rules for the Electricity Utilities Industries Law, which describes license holder’s QA activities during detailed design, manufacturing, installation and functional tests, and examines it. Also, NISA confirms that license holder of nuclear power reactor oversees subcontractor's quality control, material control, etc. in appropriate procedures, in addition to its QA audit of primary contractor and primary contractor's own management of manufacturing process.

3. Confirmation of QA Activities throughout Operation Stage

NISA confirms QA activities of the license holder throughout service life of major nuclear facilities by the Operational Safety Inspection. Furthermore, at the commercial power reactor facility, NISA, at the Periodic Safety Management Review, examines adequacy of operator’s organization and methods for the Licensee's Periodic Inspection.

F4 Operational radiation protection

Article 24

1. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:
   - (i) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;
   - (ii) no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and
   - (iii) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.
2. Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:
   - (1) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and
   - (2) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.
3. Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

In Japan, necessary steps are taken as described in F4.1 and F4.2 for (i) and (ii) of Item 1 and (i) and (ii) of Item 2 of Article 24 of the Convention, in F4.3 for (iii) of Item 1, and in F4.4 for Item 3 of the Article.

F4.1 Laws, Regulations and Requirements on Radiation Protection

The national standards for radiation protection at nuclear facilities are prescribed by the Reactor Regulation Act, the Electricity Business Act, the Radiation Disease Prevention Act, etc. and related government ordinances, ministerial ordinances, orders and notifications, and guidelines based on these laws. The recommendations of the International Commission on Radiological Protection (ICRP) are given due consideration and are incorporated into national legislation and regulation. The Radiation Council coordinates these technical standards in the laws and regulations on prevention of radiation hazards.

In examining application of a license for a nuclear facility, it is confirmed that the application conforms to the Examination Guides established by NSC as well as the legislation and technical standards. In these guides, operators are required to reduce the radiation dose received by the public in the vicinity of the facility site as low as reasonably achievable.

Ministerial ordinances on the basis of the Reactor Regulation Act prescribe area control for radiation protection, radiation control of personnel engaged in radiation activities in controlled areas, measurement and surveillance of radiation levels, monitoring of discharged radioactive materials, and maintenance of radiation control equipment. The Notification for Dose Limits on the basis of each of these rules prescribes dose limits and concentration limits of radioactive materials in air and surface activity density of the material contaminated by radioactive materials inside controlled area and dose limits and concentration limits of radioactive materials 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. All these limits are shown quantitatively in the Notification for Dose Limit.

In order to ensure compliance with these regulations, in the Reactor Regulation Act for example, operators are required to prescribe in the Operational Safety Program, i) controlled areas, access controlled areas and peripheral monitoring area and access control to these areas, ii) monitoring equipment at air ventilation and water discharge, iii) monitoring of dose, dose equivalent, concentration of radioactive materials in the air and density of radioactive materials on the surface of contaminated objects, and the decontamination, and iv) maintenance of radiation monitoring equipment. And operators are also required to keep the records regarding occupational exposure.

F4.2 National Requirements on Radiation Protection and the Implementation

1. Allowable Dose Limits

(1) Definition of Controlled Areas

The abovementioned rules and dose limit notifications define a controlled area as an area where dose of external radiation may exceed 1.3mSv for a period of three months, the concentration of radioactive material in the air, excluding natural background, may exceed the limit specified in the notification, or the density of radioactive material on the surface of contaminated objects may exceed the limit specified in the notification, and request operators to take necessary measures in the area.

(2) Allowable Dose Limits for Occupational Exposure

The abovementioned rules and dose limit notifications provide for the allowable dose limits for occupational exposure listed in Table F4-1.

The government has changed the dose limit for radiation workers in emergency rescue work from 100mSv to 250mSv in light of the present situation of the accident at Fukushima Dai-ichi NPS of TEPCO in order to prevent escalation of the accident.* This was decided based on the information that a 2007 recommendation of the ICRP provided for 500mSv as the dose to avoid deterministic effects that has been set for radiation workers in emergency rescue work.

*: In the event of an unavoidable emergency, in the emergency response measures implementation area, from the day of the declaration of nuclear emergency situation to the day of the declaration of cancellation of the situation, according to the Nuclear Emergency Preparedness Act.

Table F4-1 Dose limits for personnel engaged in radiation work

Items	Limits
1. Effective dose limits	
(1) Personnel engaged in radiation work	100mSv/5 years (do not exceed 50mSv/year)
(2) Female personnel	In addition to the provision (1), 5mSv/3 months
(3) Pregnant female personnel	In addition to the provision (2), 1mSv for internal exposure during a period after her employer etc. knows her pregnancy until the childbirth
2.Equivalent dose limits	
(1) Eye lens	150mSv/1 year
(2) Skin	500mSv/1 year
(3) Pregnant female's abdominal region	2mSv during a period after her employer etc. knows her pregnancy until the childbirth
3.Dose limits for the personnel engaged in emergency radiation work	
(1) Effective dose limit	100mSv→250mSv (Changed in response to the accident at Fukushima Dai-ichi NPS of TEPCO)*
(2) Equivalent dose limit for eye lens	300mSv
(3) Equivalent dose limit for skin	1Sv

*: In the event of an unavoidable emergency, in the emergency response measures implementation area, provided in the Paragraph 8, Article 17 of the Nuclear Emergency Preparedness Act, from the day of the issuance of the declaration of nuclear emergency situation according to the provision of Paragraph 2, Article 15 of the Act (Law No. 156 of 1999) due to the occurrence of the Tohoku District – off the Pacific Ocean Earthquake in 2011, until the day of the issuance of the declaration of Cancellation of the situation, provided in Paragraph 4 of the same Article.

(3) Dose Limits for the Public

The abovementioned rules and dose limit notifications provide for the allowable dose limits for the public listed in Table F4-2.

Table F4-2 Dose limits for the public

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

2. Numerical Guide to Reduce Dose to the Public in Vicinity and Discharge Control

Regarding nuclear facilities licensed on the basis of the Reactor Regulation Act, operators are required to keep the radiation dose received by the public in the vicinity of the facility low taking the ALARA principle, in addition to comply with dose limits and concentration limits of radioactive materials outside peripheral monitoring area due to the discharge of radioactive materials.

For nuclear power reactors, the guidelines prepared by NSC, "the Guides for the Dose Target Value in the Vicinity of the Light Water Nuclear Power Reactors", defines the target value for radiation doses received by the public in the vicinity of the facilities as 50μSv per year due to the release of radioactive materials to the environment during normal operation. Operators establish the annual numerical discharge control guide that satisfies the above-mentioned target, put it in the Operational Safety Program, and obtain approval of the regulatory body.

For the reprocessing facility, fabrication facility, use facility, waste disposal facility, and waste management facility and spent fuel intermediate storage facility, the operators are required to reduce radiation doses based on the ALARA principle at the license examination. Operators define the control target value smaller than the dose limit of 1mSv / year, put it in the Operational Safety Program, and obtain approval of the regulatory body.

During the decommissioning, operators continue the radiation control, setting the control target value equivalent or lower than the value during operation.

The regulatory body approves the control target value, confirms compliance with the Operational Safety Program, and collects report from operators.

At radioisotope waste management facilities licensed on the basis of the Radiation Disease Prevention Act, an operator, in addition to comply with concentration limits of radioactive materials within gaseous and liquid discharge, makes efforts to keep dose at site boundary below 250μSv/3 months.

3. Measurement of Environmental Radiation

A licensee on the basis of the Reactor Regulation Act conducts radiation monitoring at the site vicinity during normal operation, assesses the impact upon the environment of the discharge of radioactive materials from the facility, and feedbacks the results in improving discharge control and facility management.

Local governments hosting nuclear facilities also monitor radiation level independently at the site vicinity to protect public health and safety.

Meanwhile, NSC indicates fundamentals of the monitoring plan and its implementation and the evaluation of radiation dose in the “Guideline for Environmental Radiation Monitoring” which was established in March 2008, integrating the existing “Guideline for Environmental Radiation Monitoring” and the “Guideline for Environmental Radiation Monitoring in Emergencies”, in order to improve and standardize monitoring technology. Local governments and licensees implement monitoring in accordance with the guide.

An operator of radioisotope waste management facility licensed on the basis of the Radiation Disease Prevention Act monitors radiation level and measures contamination by radioactive materials at controlled area boundary, site boundary and any appropriate points.

4. Environmental monitoring concerning the accident at Fukushima Dai-ichi NPS of TEPCO

The environmental monitoring has been implemented in response to occurrence of the accident at Fukushima Dai-ichi NPS of TEPCO.
In the Basic Plan for Emergency Preparedness, local governments are in charge of environmental monitoring when a nuclear emergency occurs. However, most of the monitoring posts became disfunctional at first when the accident occurred. From March 16, it was decided that MEXT would take charge of summarizing the environmental monitoring carried out by MEXT, local governments and cooperating U.S. organizations.
As for the land areas outside the premises of the NPS, MEXT measures the air dose rate, radioactivity concentrations in the soil, and concentrations of radioactive materials in the air and takes environmental samples in cooperation with JAEA, Fukushima Prefecture, the Ministry of Defense, and electric companies. MEXT also carries out monitoring by aircraft in cooperation with the Ministry of Defense, TEPCO, the U.S. Department of Energy, etc.
In terms of the sea areas near the NPS, MEXT, the Fisheries Agency, the Japan Agency for Marine-Earth Science and Technology, JAEA, TEPCO, and others cooperate with each other to carry out the monitoring of radioactivity concentrations, etc. in the seawater and in the seabed, while the Japan Agency for Marine-Earth Science and Technology simulates the distribution and spread of radioactivity concentrations.
Environmental monitoring of the air, sea and soil of the premises and the surrounding areas of the Fukushima NPSs is conducted by TEPCO.

F4.3 Measures taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment

The abovementioned rules provide that three-month-averaged concentration of radioactive materials in air outside peripheral monitoring area shall not exceed the concentration limits for discharge of gaseous radioactive waste, that three-month-averaged concentration of radioactive materials in water at the outside of the boundary of the peripheral monitoring area shall not exceed the concentration limits for discharge of liquid radioactive waste with a discharge facility, and that doses due to liquid discharge of radioactive wastes from reprocessing facilities monitored at the outlet to the ocean shall not exceed the dose limit. The rules also provide that licensees shall immediately report to the competent minister when any of these limits are exceeded, and report within 10 days on details of the event and corrective measures taken.

F4.4 Provision for mitigate the effects by an unplanned or uncontrolled release of radioactive materials

Licensees of Nuclear Facilities, on the basis of abovementioned rules, shall stipulate the measures that should be taken in case of emergency in the Operational Safety Program and have them approved by the regulatory body, which provide that operators, in case of unplanned or uncontrolled release of radioactive materials, should take measures against the spread of contamination by nuclear fuel materials or radioisotopes to control the discharge and mitigate the infruence. And as an example, the Safety Examination Guide for Reprocessing Facility, which is used in safety examination of reprocessing facility with large inventory of radioactive materials, provides that fire and explosion due to fine metal particles from fuel cladding or organic solvent, criticality accident, leakage or loss of function due to damage or failure of equipment or piping, or spent fuel handling failure do not cause excessive exposure of radiation to the public.
When an unplanned or an uncontrolled release of radioactive materials initiates any specific events (Table F5-1) defined in the Nuclear Emergency Preparedness Act, emergency activities start according to the procedure, and the Prime Minister declares Nuclear Emergency if the initial event progresses and exceeds the predetermined level. Nuclear emergency will be described in detail in the ensuing section.

F4.5 Discharge of radioactive materials to the environment due to the accident at Fukushima NPSs of TEPCO

1. Discharge of radioactive materials to the atmosphere

On April 12, NISA and NSC each announced the total discharged amount of radioactive materials to the atmosphere so far.

NISA estimated the total discharged amount from reactors at the Fukushima Dai-ichi NPSs according to the results analyzing reactor status, etc. by JNES and presumed that approximately 1.3x 10^{17} Bq of iodine-131 and approximately 6.1x 10^{15} Bq of cesium-137 were discharged. Subsequently, JNES re-analyzed the status of the reactors based on the report which NISA collected on May 16 from TEPCO on the plant data immediately after the accident occurred. Based on this analysis of reactor status and others by JNES, NISA estimated that the total discharged amount of iodine-131 and cesium-137 were approximately 1.6 x 10^{17} Bq and 1.5 x 10^{16} Bq, respectively.

NSC estimated the amount of certain nuclides discharged into the atmosphere (discharged between March 11 to April 5) with assistance from JAEA through back calculations, based on the data of environmental monitoring and air diffusion calculation; the estimations are 1.5 x 10^{17} Bq for iodine-131 and 1.2 x 10^{16} Bq for cesium-137. The discharged amount since early April has been declining and is about 10^{11} Bq/h to 10^{12} Bq/h in iodine-131 equivalent.

On June 3, NSC issued “Near-term policy to ensure the safety for treating and disposing contaminated waste around the site of Fukushima Dai-ichi Nuclear Power Plants” as an approach for the immediate future that ensures safety related to the 1) reuse, 2) treatment, transportation and storage, and 3) disposal of wastes affected by this accident.

*: According to the current Reactor Regulation Act and the associated regulations in Japan, the matters which are to be disposed of among the matters contaminated by nuclear fuel materials, etc., generated in the course of operation and dismantling of nuclear facilities are regarded as “radioactive waste”, and the soil, etc. contaminated by radioactive materials discharged and flown in association of the accident is not subject to regulation.

The Japan Atomic Energy Agency (JAEA) reported on May 12 to the Nuclear Safety Commission (NSC) about its trial calculation of the amount of release to the atmosphere of iodine-131 and cesium after the accident occurred, and, as the result of emergency monitoring from March 12 to 15 was thus newly confirmed, the JAEA reevaluated and reported the result to the NSC on August 22.

For the current release amount of radioactive materials at the site, TEPCO, using a graph of the concentration distribution which had been made in advance by means of observed data of concentration measurements of radioactive materials in the atmosphere near the site and a diffusion model (a diffusion model based on the “Regulatory Guide for Meteorological Observation for Safety Analysis of Nuclear Power Reactor Facilities” of the NSC), estimated the current release amount of radioactive materials to the atmosphere. As a result, at a time in early August, the release amount including the total of both cesium-137 and cesium-134 per unit time was estimated to be approximately 2.0×10^{8} Becquerel/hour (Bq/h).

The government, to assess the impact of radioactive materials released from the Fukushima Dai-ichi NPS, has actively continued environmental monitoring. In July, the government established the “Monitoring Coordination Meeting” to promote precise implementation and evaluation of monitoring based on the overall results of wide-range environmental monitoring performed by related ministries and agencies, municipalities and the operators. The Coordination Meeting determined the “Comprehensive Monitoring Plan” on August 2 to perform careful monitoring without omissions regarding 1) general environmental monitoring, 2) harbors, airports, etc., 3) the water environment, etc., 4) agricultural soil, forests and fields, etc., 5) food, 6) the water supply, in cooperation with related organizations.

Although the RPV and PCV of Unit 1 have been pressurized to some extent, steam generated in some units such as Units 2 and 3 seems to have leaked from the RPV and PCV, and some steam seems to have been released into the atmosphere. To respond to this issue, the status has been checked by dust sampling in the upper part of the reactor buildings, and discussion and preparation for covering the reactor buildings has been underway. As for Unit 1, the construction of the structure to cover up the reactor building started in June 28. Cold shutdown of Units 5 and 6 has been maintained using residual heat removal systems with temporary seawater pumps.

２. Discharge of radioactive materials to the seawater

(1) Leakage of radioactive materials to the sea from the power station

In Fukushima Dai-ichi NPS, the water containing dissolved radioactive materials that were released from inside the RPV leaked into the PCV. In addition, as a result of injecting water from outside in order to cool the reactors and Spent Fuel Pools, some of the injected water leaked out of the PCV and accumulated inside the reactor buildings and the turbine buildings. The management of the contaminated water in the reactor and turbine buildings became an important issue from the viewpoint of workability inside the buildings, and the management of contaminated water outside the buildings became an important issue from the viewpoint of preventing the release of radioactive materials into the environment.

TEPCO found at around 09:30 on April 2, 2011 that water with a reading of over 1,000mSv/h had accumulated in a pit storing electric cables near the Intake Channel of Unit 2 and that there was a crack (about 20cm) on the lateral surface of the pit, from which water was flowing out into the sea. From this reason, TEPCO took some measures such as pouring concrete, etc. and injecting soluble glass to stop water discharge and confirmed that the water outflow stopped at 05:38 on April 6. TEPCO evaluated the amount of contaminated water that had flowed into the sea from Unit 2, including highly-concentrated radioactive materials (hereinafter referred to as “contaminated water”) and NISA also confirmed it.

On April 1, the day before the outflow was detected, the air dose rate near the sea surface around Unit 2 screen was confirmed as 1.5mSv/h, which was the same as the surrounding background level. Immediately after the outflow was confirmed, the air dose rate measured at almost the same place was 20mSv/h. This makes it reasonable to assume that contaminated water flowed out in a period from April 1 to 6. The outflow rate was calculated as about 4.3 m^3/h based on photos, etc. The total amount of radioactive materials contained in the outflow of the contaminated water can be estimated at 4.7×10^{15} Bq using measured values obtained via sampling.

TEPCO confirmed that the outflow from a pit near the Intake Channel of Unit 3 into the sea at 16:05 on May 11 and that it stopped around 18:45 on the same day. TEPCO evaluated the amount of contaminated water that flowed out to the sea from Unit 3 and the NISA also confirmed it. As a result of the evaluation, the amount of radioactive materials discharged from Unit 3 was calculated as 250m^3 in an outflow period of 41 hours (from 02:00 on May 10 till 19:00 on May 11). As for the concentration of contaminated water that flowed out into the sea, the total amount of radioactive materials contained in the outflow of contaminated water can be estimated at 2.0×10^{13}Bq using a measured value of water that flowed into the pit.

(2) Discharge of radioactive materials to the sea from the power station

Because of a possible leakage of highly-concentrated radioactive waste water accumulated in the basement floor of the turbine building of Unit 2, TEPCO decided to discharge the low-level radioactive water accumulated in the Radioactive Waste Treatment Facilities to transfer the highly-concentrated radioactive waste water as an emergency measure, pursuant to Article 64 paragraph 1 of the Nuclear Regulation Act. In addition, to protect important equipment from the subsurface water entered into the building, TEPCO also discharged such subsurface water, including low-level radioactive waste water accumulated in the sub-drains of Units 5 and 6. Therefore, NISA requested TEPCO to report on the facts, and draw up an impact assessment and TEPCO's view related to the discharge to the sea, pursuant to Article 67 paragraph 1 of the above Act. NISA confirmed the report details and obtained technical advice on the discharge to the sea from NSC Japan as an emergency measure.

TEPCO discharged about 10,393tons from the Radioactive Waste Treatment Facilities and sub-drains of Units 5 and 6 from April 4 to 10. The total amount of radioactive materials is estimated at about 1.5×10^{11}Bq based on the amount discharged during this period.
To check the environmental impact of the above (1) and (2), TEPCO carried out some measures including strengthening coastal sea area monitoring and installing silt screens (leakage protective fences).

Regarding the above, the Japanese government sincerely regrets that we had to discharge stagnant water, even though with low-level radioactivity, to the sea, and recognized that much needs to be improved regarding the communication with neighboring countries on this discharge. Therefore, we reviewed the communication channels in the governmental organizations and explained to individual countries and areas about the background of the discharge, the relevant data and other information. Also, we identified a contact point where the Japanese government can maintain around-the-clock communication with the neighboring countries and regions. Subsequently, prior notification on specific areas of interest for the neighboring countries and regions such as shift of INES level, establishment of restricted zone, evaluation of contaminated water and opening of the airlock (See F5.5).

(3) Processing of contaminated water with high concentration of radioactive materials and prevention against sea contamination

At the Fukushima Dai-ichi NPS, a great volume of water with high concentration of radioactive materials due to the water injection for cooling the reactor core is now being accumulated.

TEPCO installs processing facilities for the Contaminated Water and is controlling the occurrence of the Contaminated Water by injecting the processed water reused after removing the radioactive materials from the Contaminated Water newly added to the reactor core.

NISA requested TEPCO on June 1 to submit a report regarding the effect of reducing the Contaminated Water by the installation of the following processing facility, etc. and regarding the safety measures related to the installation, prior to the installation of water processing facility for high level radioactive water, storage facility of the Contaminated Water and storage facility for highly-concentrated, high level radioactive materials generated from the treatment of the Contaminated Water.

As the result, on June 8, TEPCO submitted the report to NISA. On June 8, NISA reviewed the report and judged necessary measures for preventing radiation hazards would be planned to be implemented as the emergency measures pursuant to Article 64, Paragraph 1 of the Reactor Regulation Act.

TEPCO has decreased the risk of unintended leakage by securing storage facilities for the Contaminated Water and by commissioning the processing facilities for contaminated water from June 17. For the outflow of radioactive materials to the sea from the Fukushima Dai-ichi NPS, TEPCO has implemented measures to prevent outflow and mitigate diffusion, including the closure of the seawater piping trench located in the upper part of outflow routes as well as blocking pits with the risk of outflow. The concentration of radioactive materials in seawater near the NPS's water intake and water discharge locations has now decreased to a level near the regulatory limits defined by law. However, in the future, there would be a possibility that the Contaminated Water might increase the level of contamination of the sea by way of the outflow of the groundwater.

In light of this situation, the installation of a water shielding wall (at the seaside) made of steel pipe sheet pile with an adequate water shielding function in front of the existing seawall of Units 1 to 4 is planned.

F5 Emergency preparedness

Article 25

1. Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested with appropriate frequency.
2. Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

F5.1 Laws, Regulations and Requirements for Nuclear Emergency Preparedness

The JCO Criticality Accident in September 1999 was a very serious accident when local residents were instructed for sheltering or evacuation for the first time in Japan, shattering basic premise of securing safety in promoting utilization of nuclear energy. Lessons learned from the accident clarified the special characteristics of nuclear emergency, which would demand quick initial response, coordinated cooperation among the national and local governments, strengthening of the national emergency preparedness and the clarification of operator's responsibilities. The Nuclear Emergency Preparedness Act was enacted in December 1999 and enforced in June 2000, addressing the special characteristics of nuclear emergency*[1] mentioned above.

The law was enacted within the legal framework already established by the Basic Act on Disaster Control Measures, which had defined roles of the national government, local governments, etc. expect operators in emergencies such as earthquakes, typhoons, conflagrations and nuclear emergency.

The part of "Nuclear Emergency Preparedness" in the Basic Plan for Emergency Preparedness based on the Basic Act on Disaster Control Measures, was extensively revised in accordance with the Nuclear Emergency Preparedness Act, clarifying roles and responsibilities of the national government, local governments, and nuclear operators*[2].

*1 The term "nuclear emergency" means unusual release of radioactive materials or unusual radiation streaming outside of a nuclear facility, by operation of a nuclear reactor, fabrication, reprocessing and use of nuclear fuel materials, storage of spent fuels, management of nuclear fuel materials or the materials contaminated with nuclear fuel materials, and the accompanying shipment, and the term "nuclear disaster" means the damage caused by a nuclear emergency to the life, health or property of the public, according to the Nuclear Emergency Preparedness Act.

*2 The term "an operator" means a license holder for fuel manufacturing operation of nuclear reactors, spent fuel storage , reprocessing , radioactive waste disposal , or use of nuclear fuel materials, according to the Nuclear Regulation Act.

NSC, taking into consideration the Nuclear Emergency Preparedness Act and the lessons learned from the JCO Criticality Accident, revised the "Guideline on Emergency Measures for Nuclear Facilities" on technical and specialized matters for nuclear emergency in May 2000,

- to correspond to the Nuclear Emergency Preparedness Act,
- to expand the scope for research reactors and nuclear fuel related facilities in addition to the nuclear power stations, reprocessing facilities, etc., and
- to include measures against the nuclear fuel material release and the nuclear criticality accident in addition to the noble gases and iodine release.

After that, the Guideline has been revised several times and developed by NSC. Recent main revisions are as follows:

- to correct the description concerning medical care for emergency exposure with revision of the "Principles of Medical Care for Emergency Exposure" in October 2008.
- to add spent fuel storage facility in nuclear facilities covered by this guideline in August 2010 in response to issuance of a license to spent fuel storage business in May 2010 and also to add the statement that the reference distance of the Emergency Planning Zone (EPZ) of the spent fuel storage facility should be about 50m, by applying the principle of the range of the area where minimum emergency preparedness should be particularly enhanced.

As the Nuclear Emergency Preparedness Act provides that its enforcement situation is subject to review five years after its enforcement, the enforcement situation was investigated by MEXT and METI. Results of the investigation were reported to the Special Committee on Nuclear Disaster, the NSC in March 2006.

NISA checked the enforcement situation concerning four issues that were presupposed to be noted when the Nuclear Emergency Preparedness Act was enacted, and reported the following:

- Concerning the speeding up of the initial response, non-scenario-based training should be carried out, and the effort should be continued;
- Concerning enhancing the cooperation between the national government and local governments, the "Integrated Nuclear Emergency Preparedness Network", which is a large-scale system and preparation of a fast unified network of communication among them, should be established;
- Concerning enhancing the emergency response system of the national government, necessary renewal of materials and equipment of the Emergency Preparedness Center should be promoted; and,
- In relation to clarification of the licensees' duties, effective functioning of nuclear emergency specialists in an emergency should be verified and improved.

In this section, emergency preparedness of main nuclear facilities in accordance with the Nuclear Emergency Preparedness Act is described.

F5.2 Nuclear Emergency Preparedness and the Emergency Measures

The responsibilities of related authorities for nuclear emergency preparedness and the emergency measures concerning operators and major nuclear facilities in accordance with the Nuclear Emergency Preparedness Act are as follows.

1. Outline of Nuclear Emergency Preparedness at Nuclear Facilities (See Fig. F5-1)

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

- The Nuclear Emergency Preparedness Act defines specific initial events in major nuclear facilities (See Table F5-1), the occurrence of which the operator shall immediately notify the competent minister and the heads of related local governments of.
- The competent minister, receiving the notification, starts 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 Officer for Nuclear Emergency collects information and coordinates activities preventing expansion of the events.
- When the competent minister 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 declares "Nuclear Emergency", and advises or directs related local governments on necessary measures such as sheltering, evacuation or preventive use of stable iodine tablets to be taken by them.
- The Prime Minister establishes the "Nuclear Emergency Response Headquarters" in Tokyo, which he will head, and the "Local Nuclear Emergency Response Headquarters".
- NSC, when a nuclear emergency occurs, calls the Emergency Technical Advisory Body that consists of members from the NSC and the Investigation Committee for Emergency Measures and makes technical advices to the Prime Minister.
- Local governments establish their own emergency response headquarters.
- The national government, local governments and related operators etc. establish the "Joint Council for Nuclear Emergency Response" at the emergency response key facility "Off-Site Center (See Fig. F5-2)" in order to share information and coordinate

their emergency measures.

2. On-site and Off-site Nuclear Emergency Preparedness at Nuclear Facilities

Organizations related to nuclear emergency preparedness keep themselves always ready to collect and send information and start quick response against an emergency, and conduct exercises, disseminate knowledge and promote research on emergency preparedness. Outline of roles and responsibilities of related organization are as follows.

(1) On-Site Emergency Preparedness at Nuclear Facilities

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

The operator develops Operator’s Plan for Nuclear Emergency Preparedness after consulting with related local governments, which provides for prevention of, emergency measures against, and post-emergency restoration from, 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 operator.

Moreover, the operator is required to take part in comprehensive exercise with related organizations, and keep close contact with them.

(2) Off-Site Emergency Preparedness of Nuclear Facilities

Roles and responsibilities of the national government and local governments in emergency preparedness are defined in the Nuclear Emergency Preparedness Act and the Basic Plan for General Emergency Preparedness. Each local government develops its own Local Plan for Emergency Preparedness. They conduct emergency environmental radiation monitoring, and recommend or instruct evacuation, sheltering or preventive use of stable iodine to the resident, receiving advice or direction from the Prime Minister.

3. Responsibility of the National Government, Local Governments and Operators concerning the 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.

- The competent minister stations a Senior Officer for Nuclear Emergency in the vicinity of each nuclear facility, who guides and advises the operator in preparing Operator’s Plan for Emergency Preparedness and, in emergency, takes necessary measures preventing progression of the emergency.
- NSC, when a nuclear emergency occurs, calls the Emergency Technical Advisory Body that consists of members from NSC and the Investigation Committee for Emergency Measures and makes technical advices on dissolution of nuclear emergency, change of area for emergency measures, and other technical matters to the Head of the Nuclear Emergency Preparedness Headquarter (the Prime Minister).
- The competent minister designates a facility in the vicinity of a nuclear facility as Off-Site Center to be used in an emergency. In case of an emergency, the national government, the local governments and the operator 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, located on the points shown in Fig.F5-2, have communication equipment with the Prime Minister’s Official Residence, the Cabinet Office, the Emergency Response Centers of NISA or MEXT and related local governments, and other necessary equipment.
- The Off-site Center is provided with equipment to monitor the environmental radiation level in the vicinity of the facility and display it on-line. Also, it is provided with equipment to display on-line information on accident condition in the nuclear facility

except for the temporary data, and information on accident progression predicted by ERSS (Emergency Response Support System). Also SPEEDI (System for Prediction of Environmental Emergency Dose Information) net work was developed that predict quickly the concentration of airborne radioactive materials and exposure around the surrounding area based on the radiation source information provided by ERSS, meteorological condition and topographical data.

- The national government establishes arrangements to initiate quick and coordinated activities in an emergency.
- The national government conducts comprehensive nuclear emergency exercise once a year according to the plan prepared by the competent minister.

(2) Responsibilities of Local Governments

The local governments are required to develop and revise Local Plan for Emergency Preparedness in accordance with Article 40 of the Basic Act on Disaster Control Measures, consulting with the Prime Minister beforehand.

(3) Licensee's Responsibility

- The licensee develops its own Operator's Plan for Nuclear Emergency Preparedness after consulting with related local governments, and submits it to the competent minister before operation of the nuclear facilities.
- The licensee establishes on-site organization for nuclear emergency preparedness, and designates 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.

F.5.3 Implementation of the Nuclear Emergency Exercises

Plans for Nuclear Emergency Preparedness are developed in the vicinity of each nuclear facility in accordance with the Nuclear Emergency Preparedness Act, and an Off-Site Center is located in the vicinity of each nuclear facility. Exercises of various levels are conducted to confirm the effectiveness of the emergency preparedness. The purpose of exercise includes 1) to enhance understanding of the nuclear emergency preparedness by responsible personnel of related organizations and local residents, and 2) to verify whether emergency measures function in predetermined way, and whether information sharing and cooperation among related organizations are adequate. Exercises cover communication, monitoring, decision making on emergency measures to be taken, sheltering or evacuation etc., ranging from large scale national exercise to operator's on-site exercise. Exercises in the past years are shown below.

1. Exercise Planned by the National Government (See Table F5-2)

The national government started nation-wide comprehensive exercises for nuclear emergency involving national and local governments, designated public organizations, operators of the nuclear facility and the local residents once a year, upon enforcement of the Nuclear Emergency Preparedness Act established after the JCO Criticality Accident, increasing its involvement in exercises planned and executed mainly by local governments in the past. The exercise for power reactor facilities includes a scenario assuming core damage and relevant accident management activities.
The following exercises were conducted since 2008.

- On October 21 and 22, 2008, the government, Fukushima Prefecture, concerned cities, TEPCO, and other emergency-preparedness-related organizations conducted a joint exercise for the Fukushima Dai-ichi NPS (in Fukushima Prefecture) with a participation of about 4,000 persons including local residents. Firefighting training assuming radioactive material release and evacuation of the persons who need help in time of emergency were conducted within this exercise and the PR activities from the viewpoint of local residents, including communication with the residents were also emphasized in this exercise.

- On December 21 and 22, 2009, the government, Ibaraki Prefecture, concerned cities/villages, JAPCO, and other emergency-preparedness-related organizations conducted a joint exercise for the Tokai Dai-ni Power Station (in Ibaraki Prefecture) with a participation of about 3,100 persons including local residents. This was the first exercise held in Ibaraki prefecture, commemorating the 10th year from the JCO Criticality Accident. Improvement of evacuation of residents in the heavily-populated areas was included in one of the emphases of the exercise. Car evacuation of the persons who need help was also attempted during this exercise for the first time in Japan.
- On October 20 and 21, 2010, the national government, Shizuoka Prefecture, concerned cities/towns/villages, Chubu Electric Power Co. and other emergency-preparedness-related organizations conducted a joint exercise for the Hamaoka Nuclear Power Station (in Shizuoka Prefecture) with a participation of about 2,400 persons including local residents. PR activities for residents including foreign residents in Japan and the persons who need help in time of emergency by taking advantages of CATV were among the emphases of the exercise.

Comprehensive evaluation of the exercises has been conducted since FY2009, based on the results of questionnaires to the participants including the exercises held by the local communities and the electric utilities, opinions provided by the third-party experts observing the exercises, and also assessment of the results of questionnaires to the residents by the third-party experts, in addition to the comprehensive assessment of the exercises conducted by the national government in Tokyo and at the local emergency response headquarters.

2. Exercise Planned by NSC

NSC implements exercise for improvement of the emergency communication system, and for activation of the Emergency Technical Advisory Body and improvement of its effectiveness.

3. Exercise Planned by Local Governments (See Table F5-2)

The Local Plan for Emergency Preparedness prescribes local exercise to be planned and conducted by local governments, which national government and NSC support by sending expert staffs, etc.

4. Exercise Planned by Licensees

The licensees have conducted on-site exercises including establishment and operation of emergency response headquarters, communication, emergency environmental radiation monitoring, etc. based on Operator’s Plan for Emergency Preparedness for each site about once per year. The operators conduct the exercise etc. involving accident management activities, to confirm its effectiveness.

The licensee participates in the exercise planned and executed by the local government.

5. Participation in international exercise

Japan is a contracting party to the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. Japan has been participating and will continue to actively participate in the international emergency response exercise (ConvEx) organized by IAEA.

F5.4 Response to the nuclear emergency at Fukushima NPSs of TEPCO

At Fukushima Dai-ichi NPS, all AC power was lost due to the disaster of the earthquake and tsunamis. In accordance with Paragraph 1, Article 10 of the Nuclear Emergency Preparedness Act, TEPCO notified the government at 15:42 on March 11, 2011, the day on which the earthquake occurred, that all AC power had been lost in Units 1 to 5. After that, TEPCO recognized that the injection of water via the emergency core cooling systems was impossible at Units 1 and 2 of the Fukushima Dai-ichi NPS and notified the government at 16:45 on the same day of a State of Nuclear Emergency in accordance with the Article 15 of the Nuclear Emergency Preparedness Act.

The Prime Minister declared a state of nuclear emergency at 19:03 on the same day and established the Nuclear Emergency Response Headquarters and the Local Nuclear Emergency Response Headquarters. On March 15, the Integrated Headquarters for the Response to the Incident at the Fukushima Nuclear Power Stations (later renamed the Government–TEPCO Integrated Response Office on May 9) was established so that the government and the operator could work together in a concerted manner, decide to take necessary measures and promptly respond while sharing information on the state of the disasters at the nuclear facilities and on necessary measures.

The Prime Minister, who serves as the Director-General of Nuclear Emergency Response Headquarters, determined the evacuation area and the in-house evacuation area according to the assessment of the possibility of discharging radioactive materials, and instructed Fukushima Prefecture and relevant cities, towns and villages to act in accordance with this determination. Responding to the status of accidents at Fukushima Dai-ichi NPS, at 21:23, March 11, the evacuation area was set at the area within a 3km radius and the in-house evacuation area was a 3 to 10km radius from Fukushima Dai-ichi NPS. Afterwards, according to the escalation of events, the evacuation area was expanded to a 20km radius at 18:25, March 12, and the in-house evacuation area was expanded to a 30km radius at around 11:00, March 15. Also, responding to the status of the accidents at Fukushima Dai-ni NPS, the evacuation area within a 3km radius and the in-house evacuation area of a 3 to 10km radius were set at the same time a nuclear emergency situation was declared at 7:45, March 12, with the evacuation area expanded to a 10km radius at 17:39 on the same day. Then, the evacuation area was changed to a 8 km radius on April 21. Evacuation and stay-in-house instructions immediately after the accident were promptly implemented through a concerted effort by residents in the vicinity, local governments, the police and other relevant authorities.

The Prime Minister determined that evacuation areas within a 20km radius of Fukushima Dai-ichi NPS would be a “restricted area,” in accordance with the Basic Act on Disaster Control Measures and instructed the mayors of cities and towns and the heads of villages and concerned local governments to prohibit access to the area on April 21. The Nuclear Emergency Response Headquarters announced the basic viewpoints of temporary access concurrently with establishment of the Restricted Area. Temporary access is allowed within 20km radius from Fukushima Dai-ichi NPS excluding 3km radius from the NPS and high risk area. The residents are allowed to enter the area temporarily for a few hours and carry the minimum necessary goods out from there while ensuring safety. Also, corporate bodies, etc., whose inability to access the area is expected to cause serious loss of public interest shall be permitted access by the heads of relevant local governments after consultations with the head of the Local Nuclear Emergency Response Headquarters. On April 23, the Director-General of the Headquarters announced the Permission Criteria for temporary access to Restricted Area (Eligibility, conditions, procedures, etc.). On May 9, NSC Japan provided technical advice on “Implementation of temporary access” upon request of the Nuclear Emergency Response Headquarters. The temporary access of residents has been sequentially implemented pursuant to the permission criteria from May 10 onward, after coordination of relevant local governments, Fukushima prefecture and others.

The Local Nuclear Emergency Response Headquarters started its activities at an Off-Site Center as designated by the Basic Plan for Emergency Preparedness. However, it was moved to the Fukushima Prefectural Office in Fukushima City due to high-level radiation as the nuclear accident escalated, in addition to a communication blackout and a lack of fuel, food and other necessities caused by logistic congestion around the site. The longer the accident lasted, the heavier the burden on residents in the vicinity of the NPS became. In particular, many of the residents who were instructed to stay within their houses were voluntarily evacuated and those who remained in the area found it increasingly difficult to sustain their livelihoods due to congestion in the distribution of goods and logistics problems. In response to this situation, the government launched support measures on March 25.

The environmental monitoring data have revealed that there were areas where radioactive materials were accumulated at high levels even outside of the 20km radius. Therefore, the Prime Minister as Director-General of Nuclear Emergency Response Headquarters instructed the heads of relevant local governments on April 22 that deliberate evacuation areas needed to be established for specific areas beyond the 20km radius, and area between the 20 km and 30km radius which had been set as in-house evacuation areas, excluding the areas within it qualifying as deliberate evacuation areas, was renamed an "evacuation-prepared area in case of emergency," since the residents there could possibly be instructed to stay in-house or evacuate in the case of future emergencies. In this way, residents inside the deliberate evacuation area were directed to evacuate in a planned manner, and residents inside of the area prepared for evacuation in case of emergency were directed to prepare for evacuation or for in-house evacuation in case of an emergency.

In addition, outside the Deliberate Evacuation Areas as well as the Restricted Area, there exists plural spots inside certain areas that are not wide spread in region to warrant the designation of a Deliberate Evacuation Area, at which air dose rates have been maintained at a level that is estimated to exceed an integral dose of 20mSv over a period of one year after the accident. The radiation dose decreases when going away from these spots, therefore, a risk of exceeding 20mSv per year through daily life in general is low. Considering that the level of 20mSv per year was adopted because it was the lowest figure within the range that ICRP and other organizations have indicated as a reference level, being different from the Deliberate Evacuation Areas where high dose areas expand in entire region, the spots are not in a situation that the Government should instruct across-the-board evacuation or restrict industrial activities from the standpoint of safety. On the other hand, it is natural for residents to feel anxious about the situation, and since the possibility of exceeding 20mSv per year depending on a person's lifestyle cannot be ruled out, it is important for the Government to take measures for the issue. For these reasons, the Nuclear Emergency Response Headquarters decided the response policy, "Regarding Response to the Specific Spots Estimated to Exceed an Integral Dose of 20mSv Over a Period of One Year After the Accident" on June 16, taking into consideration opinions of NSC. This led to the designation of these spots as "Specific Spots Recommended for Evacuation" and the government has decided to call attention of residents in these spots, and assisted and promoted their evacuation. To date, 227 spots have been established as Specific Spots Recommended for Evacuation, covering 245 households.

The NSC has indicated conditions, etc. for the lifting of each of the designations of Evacuation-Prepared Area in Case of Emergency, Evacuation Area, and Deliberate Evacuation Area, taking into account radiation protection and reactor stability under the "Basic Policy of the Nuclear Safety Commission of Japan on Radiation Protection for Termination of Evacuation and Reconstruction" (July 19) and "Standpoint of the Nuclear Safety Commission for the Termination of Urgent Protective Actions implemented for the Accident at Fukushima Dai-ichi Nuclear Power Plant" (August 4).

Based on the above initiatives, the Nuclear Emergency Response Headquarters indicated the "Concept of Review of Evacuation Area, etc." on August 9. The Japanese government intends to lift the designation of Evacuation-Prepared Area in Case of Emergency in block at the stage when all local municipalities have completed the development of a restoration plan based on their residents' intentions.

Therefore, related organizations are currently promoting environmental monitoring actively with a view to the lifting of the Evacuation-Prepared Area in Case of Emergency. Whole area environmental monitoring of the sites of schools and other public facilities, school zones and parks, etc. and environmental monitoring in response to individual requests of cities, towns and villages, etc. have been performed.

F5.5 Response to radiological emergencies in neighboring countries

Japan is a contracting party to the "Convention on Early Notification of a Nuclear Accident" and the "Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency". To implement the provisions of these conventions, MOFA is designated as "National Warning Point (NWP)" and "National Competent Authority for an Emergency Abroad, NCA (A)" in the case of a nuclear accident and a radiological emergency out side the Japanese territory
When a radiological emergency occurs outside Japanese territory including neighboring countries, MOFA through the established response system, receives notifications and forwards them to appropriate authorities to share the information and to take necessary steps. In relation to the Assistance Convention, the response system has been reviewed for its important by considering registration for Response Assistance Network (RANET) and other so that Japan as a contacting party could dispatch personal and provide material and equipment to the extent possible under the Convention.

Regarding the provision of information of the accident at Fukushima NPSs of TEPCO to the international community, the Japanese Government reported the accident status to IAEA promptly pursuant to the Convention on Early Notification of a Nuclear Accident, beginning with the first report on 16:45 on March 11, immediately after the accident occurred. The Japanese Government has also reported the provisional evaluations of the International Nuclear and Radiological Event Scale (INES) when the government made its announcement regarding each evaluation.
Notification to other countries including neighboring countries about the deliberate discharge of accumulated water of low-level radioactivity to the sea on April 4 was not satisfactory. This is a matter of sincere regret and every effort has been made to ensure sufficient communication with the international community and to reinforce the notification system (See F4.5).

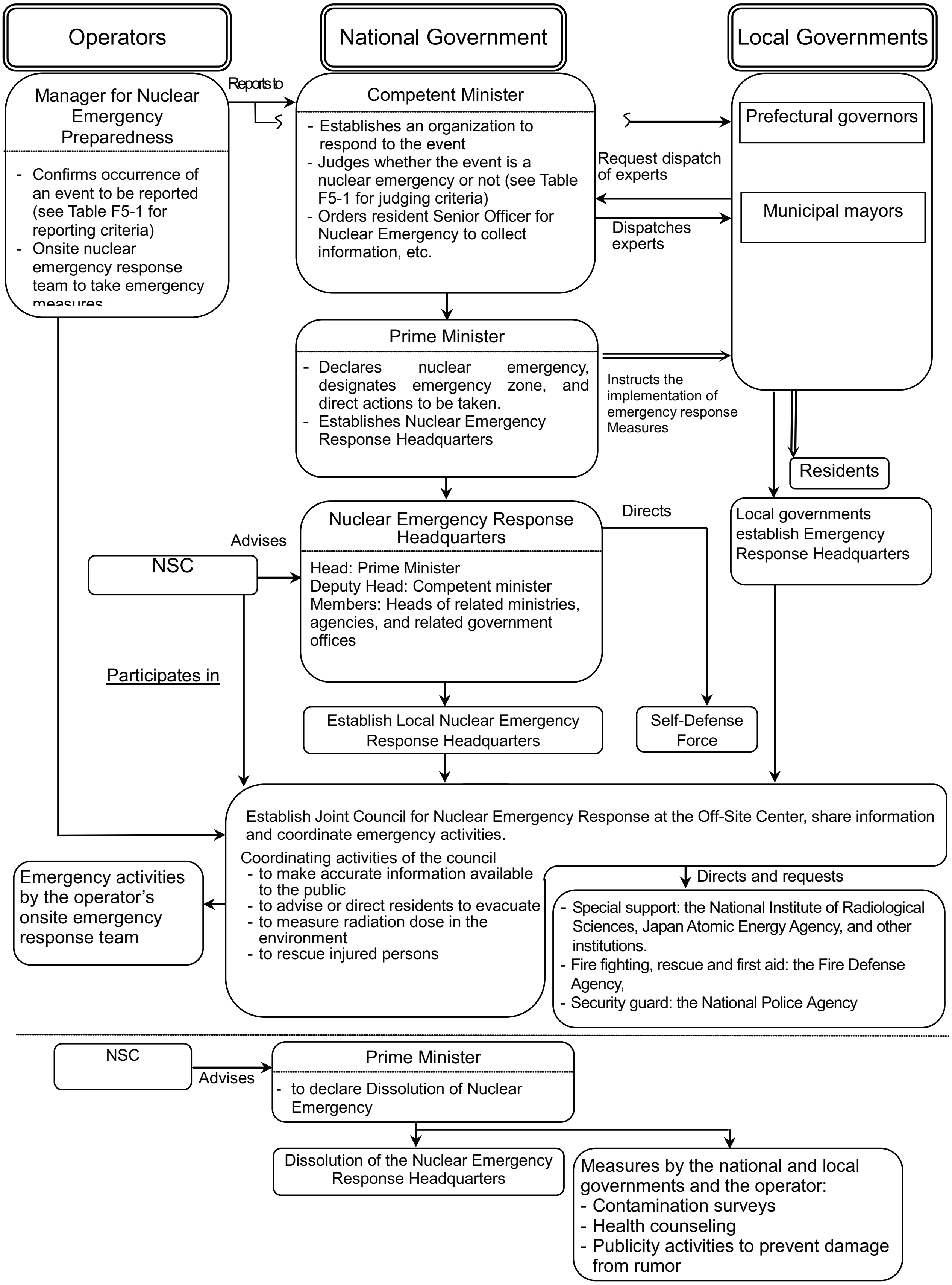


Fig. F5-1 Measures Based on the Nuclear Emergency Preparedness Act

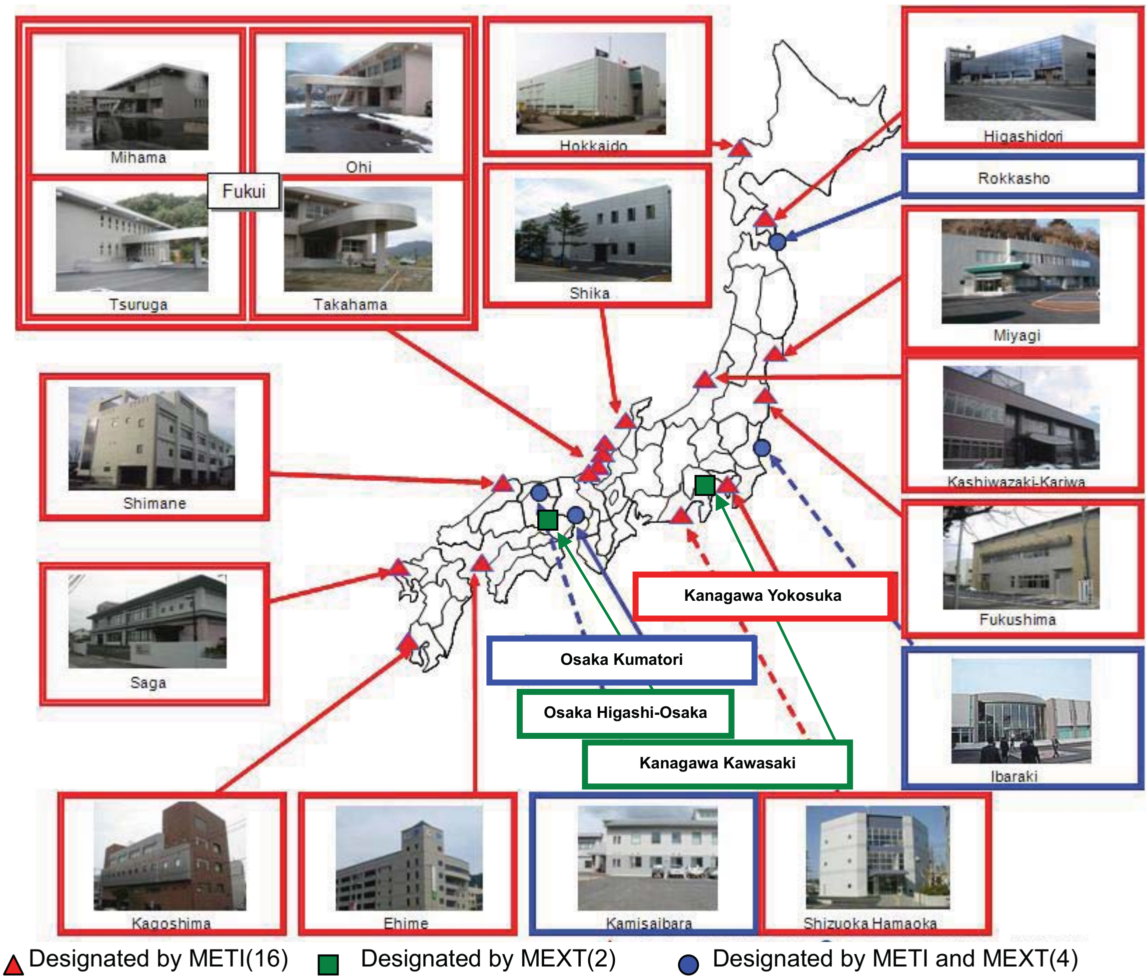


Fig. F5-2 Locations of Off-Site Centers

Table F5-1 Main Specific Events, Nuclear Emergencies and Responses Prescribed in the Nuclear Emergency Preparedness Act

Events		Criteria of Specific Event	Criteria of Emergency
a	Dose rate near the site boundary	Exceeding 5μSv/h at one point for more than 10 minutes	Exceeding 500μSv/h at one point for more than 10 minutes
		Exceeding 5μSv/h simultaneously at more than two points	Exceeding 500μSv/h simultaneously at more than two points
b	Detection of radioactive materials at exhaust stack or other normal release points	Release of radioactive materials that results in more than 50μSv of dose or more than 5μSv/h of dose rate for more than 10 minutes	Release of radioactive materials that results in more than 5mSv of dose or more than 500μSv/h of dose rate for more than 10 minutes
c	Detection of radiation or radioactive materials due to fire or explosion, outside controlled areas	More than 50μSv/h of radiation dose rate	More than 5mSv/ h of radiation dose rate
		Release of radioactive materials that results in more than 5μSv/h of dose rate	Release of radioactive materials that results in more than 500μSv/h of dose rate
d	Individual event in consideration of facility characteristics		
	Failure of scram	Reactor cannot be shut down with normal neutron absorbers	Emergency reactor shutdown is required, but all reactor shutdown functions are unavailable
	Loss of reactor coolant	Emergency core cooling system (ECCS) is actuated due to reactor coolant.	All ECCS injections are unavailable.
	Loss of all AC power supplies	All AC power supply is unavailable more than 5 minutes.	All AC power supply is lost and all core cooling functions are lost.
	A decrease of spent fuel pool water level at a reprocessing facility	Fuel assemblies are exposed due to drop of water level	

- The competent minister dispatched expert staff to local governments at their request. - Resident Senior Officer for Nuclear Emergency conducts prescribed response operations. - Officials from concerned ministries and agencies assemble for the accident response liaison conference (Tokyo). - Designated parties assemble in the Off-site Center for local accident response liaison conference.	The competent minister confirms the occurrence of nuclear emergency and reports it to Prime Minister. Prime Minister declares nuclear emergency and takes following measures - To advise or instruct the local governments on evacuating etc. - To establish Nuclear Emergency Response Headquarters in Tokyo and Local Nuclear Emergency Response Headquarters(Off-site Center) - To set up the Joint Council for Nuclear Emergency Response in order to exchange information among the national and local governments.

Table F5-2 Records of Nuclear Emergency Exercise

Planned by	Date of exercise	Nuclear facility
(1) Exercise planned by National Government (April 2008 - March 31, 2011)		
National Government	2008/10/21 (Tue) -22 (Wed)	Fukushima Dai-ichi NPS (TEPCO)
	2009/12/21 (Mon) -22 (Tue)	Tokai No2 NPS (JAPCO)
	2010/10/20(Wed) -21 (Thu)	Hamaoka NPS (Chubu Electric Power Co., Inc.)
(2) Exercise planned by Local Government (April 2008 - March 31, 2011)		
Ibaraki	2008/9/30 (Tue)	Tokai No2 NPS (JAPCO)
Okayama	2008/10/9 (Thu)	Ningyotoge Environmental Engineering Center (JAEA)
Fukui	2008/10/25 (Sat)	Takahama NPS (The Kansai Electric Power Co., Inc)
Aomori	2008/10/29 (Wed)	Higashidori NPS (Tohoku Electric Power Co., Inc.)
Ehime	2008/11/5 (Wed)	Ikata NPS (Shikoku Electric Power Co., Inc.)
Ishikawa	2008/11/14 (Fri)	Shika NPS (Hokuriku Electric Power Co., Inc.)
Saga	2008/11/19 (Wed)~20(Thu)	Genkai NPS (Kyushu Electric Power Co., Inc.)
Miyagi	2009/1/22 (Thu) ~23(Fri)	Onagawa NPS (Tohoku Electric Power Co., Inc.)
Kagoshima	2009/1/31 (Sat)	Sendai NPS (Kyushu Electric Power Co., Inc.)
Hokkaido	2009/2/10 (Tue)	Tomari NPS (Hokkaido Electric Power Co., Inc.)
Shizuoka	2009/2/12 (Thu)	Hamaoka NPS (Chubu Electric Power Co., Inc.)
Okayama	2009/10/9 (Fri)	Prototype Uranium Enrichment Plant, Ningyotoge Environmental Engineering Center (JAEA)
Aomori	2009/10/21 (Wed)	Rokkasho reprocessing facility (JNFL)
Ehime	2009/10/22 (Thu)	Ikata NPS (Shikoku Electric Power Co., Inc.)
Saga	2009/10/23 (Fri) -24 (Sat)	Genkai NPS (Kyushu Electric Power Co., Inc.)
Hokkaido	2009/10/29 (Thu)	Tomari NPS (Hokkaido Electric Power Co., Inc.)
Shimane	2009/11/13 (Fri)	Shimane NPS (The Chugoku Electric Power Co., Inc.)
Miyagi	2009/11/17 (Tue) – 18 (Wed)	Onagawa NPS (Tohoku Electric Power Co., Inc.)
Fukui	2009/11/22 (Sun)	Mihama NPS (The Kansai Electric Power Co., Inc.)
Fukushima (Public protection exercise)	2009/12/22(Tue)	Fukushima Dai-ni NPS (TEPCO)
Kagoshima	2010/1/19 (Tue)	Sendai NPS (Kyushu Electric Power Co., Inc.)
Shizuoka	2010/2/4/ (Thu)	Hamaoka NPS (Chubu Electric Power Co., Inc.)
Ishikawa	2010/3/17 (Wed)	Shika NPS (Hokuriku Electric Power Co., Inc.)
Ibaraki	2010/9/30 (Thu)	Experimental FBR “Joyo” (JAEA)
Okayama	2010/10/7 (Thu)	Ningyotoge Environmental Engineering Center (JAEA)
Ehime	2010/10/15 (Fri)	Ikata NPS (Shikoku Electric Power Co., Inc.)
Saga	2010/10/23 (Sat)	Genkai NPS (Kyushu Electric Power Co., Inc.)
Fukui	2010/10/26 (Tue)	Ohi NPS (The Kansai Electric Power Co., Inc.)
Miyagi	2010/11/4 (Thu) – 5 (Fri)	Onagawa NPS (Tohoku Electric Power Co., Inc.)
Niigata	2010/11/5 (Fri)	Kashiwazaki-Kariwa NPS (TEPCO)
Aomori	2010/11/5 (Fri)	Higashidori NPS (Tohoku Electric Power Co., Inc.)
Hokkaido	2010/11/17 (Wed)	Tomari NPS (Hokkaido Electric Power Co., Inc.)
Ishikawa	2010/11/18 (Thu)	Shika NPS (Hokuriku Electric Power Co., Inc.)
Fukushima	2010/11/25 (Thu) – 26 (Fri)	Fukushima Dai-ichi NPS (TEPCO)
Shimane	2011/1/19 (Wed)	Shimane NPS (The Chugoku Electric Power Co., Inc.)

F6 Decommissioning

Article 26
Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:
(i) qualified staff and adequate financial resources are available;
(ii) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;
(iii) the provisions of Article 25 with respect to emergency preparedness are applied; and
(iv) records of information important to decommissioning are kept

The Framework for Nuclear Energy Policy issued by JAEC states that “it is important to carry out decommissioning of a nuclear facility such as commercial power reactor, experimental research reactor and nuclear fuel cycle facility, ensuring safety, on the operator's own responsibility, in accordance with the revised Reactor Regulation Act, under the government's regulation and obtaining local communities' understanding and cooperation."

The regulatory policy for dismantling or decommissioning of reactor facilities has been investigated and discussed, resulting in following three reports;

- "Basic Philosophy to Assure Safety for the Dismantling Nuclear Reactor Facilities" (December 1985, Decision by NSC, revised in August 2001)
- "Aiming at Decommissioning of Commercial Nuclear Power Facilities " (January 1997, Nuclear Energy Subcommittee, ACNRE)
- "Philosophy for Safety Assurance and Safety Regulation on the Decommissioning of Commercial Power Reactor Facilities" (August 2001, Decommissioning Safety Subcommittee, NISS/ACNRE)

Based on these reports, in order to ensure the safety during the decommissioning of commercial nuclear power reactors, the regulation was implemented by applying existing provisions in the Reactor Regulation Act, such as “notification of dismantling” or “modification of Operational Safety Program, by the operators.

So far, the decommissioning of reactor facilities was implemented at the Japan Power Demonstration Reactor (JPDR) of JAEA and the Tokai Power Station of JAPCO, etc. and the development and application of dismantling technologies have been progressed, and the know-how for decommissioning has been accumulated through these processes.

Under such circumstances, NSC pointed out on October 14, 2004, that it is required to investigate the development of a graded approach in safety regulation system in accordance with the degree of importance in safety commitment and the progress of dismantling processes, considering that the main activities during the period after the termination of operation are safety management of spent fuels, dismantling works and the associated radiation control and handling of radioactive wastes, and that the regulatory experiences concerning dismantling and decommissioning of test and research reactors have been accumulated, as the conclusion of the regulatory activities investigation concerning the safety regulation system during the period after the termination of operation of reactor facilities.

The Decommissioning Safety Subcommittee has investigated appropriate regulatory system of decommissioning, based on the regulatory experiences on decommissioning of reactor facilities under the current system. The investigation is conducted on the graded regulatory approach to cope with the progress of the decommissioning process, the diversity of each facilities, reflecting the experiences of decommissioning, and development of technology in the near future, and reported in "The Way of the Decommissioning Regulation of the Nuclear Facilities" (December 9, 2004)).

In this investigation, the Subcommittee recognized that the decommissioning of nuclear reactors is becoming to a routine activity, and the amendment of legislation must cope with graded regulatory approach and clarification of the responsibilities of licensees. It is considered important (i) to clarify the requirement in decommissioning regulations, (ii) to keep

the transparency on procedures for the operators, and (iii) to obtain in the understanding and confidence of the national people and local residents on decommissioning regulations.
The Subcommittee proposed the way of decommissioning regulations, as;

- replacing "dismantling notification by licensee", to the "approval of the licensee's decommissioning plan of dismantling processes, methods etc. by regulatory body "
- implementation of the decommissioning as approved in the plan
- completion of decommissioning is confirmed by regulatory body and after the confirmation of the completion of decommissioning, the operation license loses its effect
- the regulatory activities during the decommissioning process (example: Periodical Inspections, Operational Safety Inspections etc.) should be changed in accordance with the changes of the functions of the facilities and safety operation activities as the decommissioning proceeds (graded regulatory approach)

On the basis of such recognition, the Reactor Regulation Act was amended in May, 2005 and the safety regulation for decommissioning of reactors and other facilities was updated. In response to this amendment of the Law, the Enforcement Ordinance for the Reactor Regulation Act and related ministerial ordinances (rules for Refinery, Commercial Power Reactors, Reactors at Development Stage, Research Reactors, Fuel Fabrication, Spent Fuel Storage, Reprocessing, Waste Disposal, Waste Storage and Use of Nuclear Material) were amended in November 2005 and put into force in December 2005.
The above amendment of laws and regulations clarified the legal process of decommissioning. A licensee applying for approval of decommissioning has to submit a decommissioning program that describes the facility to be dismantled and dismantling method, management and transfer of nuclear fuel materials, removal of contamination with nuclear fuel materials, management of nuclear fuel materials or materials contaminated with nuclear fuel materials, process of decommissioning work, radiation exposure control, safety assessment, systems with functions to be maintained and their performance, financial plan, implementation organization, etc. The regulatory body approves the decommissioning program after examining its conformity with the technical standards. At the final stage of decommissioning, the licensee submits a document that describes the implementation status of dismantling, transfer of nuclear fuel materials, removal of contamination with nuclear fuel materials, management of nuclear fuel materials or materials contaminated with nuclear fuel materials and the final distribution of contamination with nuclear fuel materials, and requests the regulatory body's confirmation. The decommissioning is completed after the regulatory body confirms that the measures for radiation hazard prevention is no more necessary and management of nuclear fuel materials or materials contaminated with nuclear fuel materials is completed.
In addition, a graded regulation system was introduced. For example, the annual periodic facility inspection by the government is no more conducted when nuclear fuel materials are cleared from the facility.

The Radiation Disease Prevention Act requires the license holders to take steps, such as transferring the radioisotopes to another user, eliminating contamination with radioisotopes and disposing radioisotopes or material contaminated by radioisotopes, etc, to remove radioisotope contamination when they intend to cease the waste management business or use of radioisotopes and/or radiation generating apparatus. The procedure of cessation of use, etc. of radioisotopes is conducted adequately in a law-abiding manner. Furthermore, with the amendment of the Radiation Disease Prevention Act in May 2010, regulations concerning decommissioning were reinforced by introduction of provisions including the prior submission of a decommissioning program when a license holder decides to discontinue the use, etc. of radioisotopes.

F6.1 Human resources and financial resources

1. Human Resources

Licensees clarify, in the Operational Safety Program, safety organizations, responsibility and roles in decommissioning processes, and planning and implementation of relevant safety education programs necessary for managers and workers including subcontractors.

The regulatory body confirms the observance of the above-mentioned Operational Safety Program by the inspection (Operational Safety Inspection).

2. Financial Resources

Electric utilities have deposited funds for decommissioning of commercial power reactor facilities using the Dismantling Reserve Funds. (See Section B)

F6.2 Operational radiation protection

The regulations on radiation protection applied to nuclear facilities in operation, which is described at Article 24 (F4), are also applicable to nuclear facilities in the process of being decommissioned.

F6.3 Emergency preparedness

The regulations on emergency preparedness applied to nuclear facilities in operation, which is described at Article 25 (F5), are also applicable to nuclear facilities in the process of being decommissioned.

F6.4 Records of information important to decommissioning are kept.

The Reactor Regulation Act requests to keep important records such as inspection records, radiation control records, etc. even at decommissioning stage.

And other records specific to decommissioning such as each equipment or system being dismantled, schedule and method for dismantling it, etc. are required to be recorded and kept at the end of each dismantling process.

Thus the regulatory body can confirm that the decommissioning has been appropriately completed ensuring safety and in compliance with the Decommissioning Plan of that facility by keeping records to show it.

Section G Safety of Spent Fuel Management

The Government of Japan regulates spent fuel management on the activity basis in accordance with the Reactor Regulation Act. Specifically, in the licensing process of a nuclear activity, the facility to be used for the proposed activity, i.e. a reactor facility that generates spent fuel, an independent spent fuel storage facility or a reprocessing facility, is required to demonstrate its adequateness in terms of nuclear disaster prevention. This requirement is applied to the whole facility including its spent fuel storage sub-facility.

The major safety functions required for the handling and storage of spent fuel within a facility are "confinement of radioactive materials", "shielding of radiations", "prevention of criticality" and "removal of residual heat" which are common requirements of the laws and regulations governing any kind of spent-fuel-related activity.

Spent fuel storage activity became practical when the Reactor Regulation Act was amended in 1999. The first licensing application in Japan was filed in March 2007 by Recyclable-Fuel Storage Company, for a spent fuel storage facility outside of nuclear power station to store spent fuel intermediately before reprocessing. This application was approved in May 2010, and, based on the approval, construction of the facility began in August 2010, aiming to commence operation in July 2012. The spent fuel storage facility, currently under construction, is the “Recyclable-Fuel Storage Center” (in Mutsu City of Aomori Prefecture. See Fig.L5-1, L5-2) which is planned to store spent fuel in metallic dry casks (See Fig. L5-3), which will also be used for transportation. The capacity of the Storage Center will be ca. 3,000 tons in total of ca. 2,600 tons and ca. 400 tons for BWR and PWR spent fuels, respectively.

Since the Reactor Regulation Act requires almost same safety regulatory procedures for all types of spent fuel management activities, the explanation on the procedures in this Section focuses on “spent fuel storage activity”.

The regulatory flow for spent fuel storage is shown in Fig.G-1.

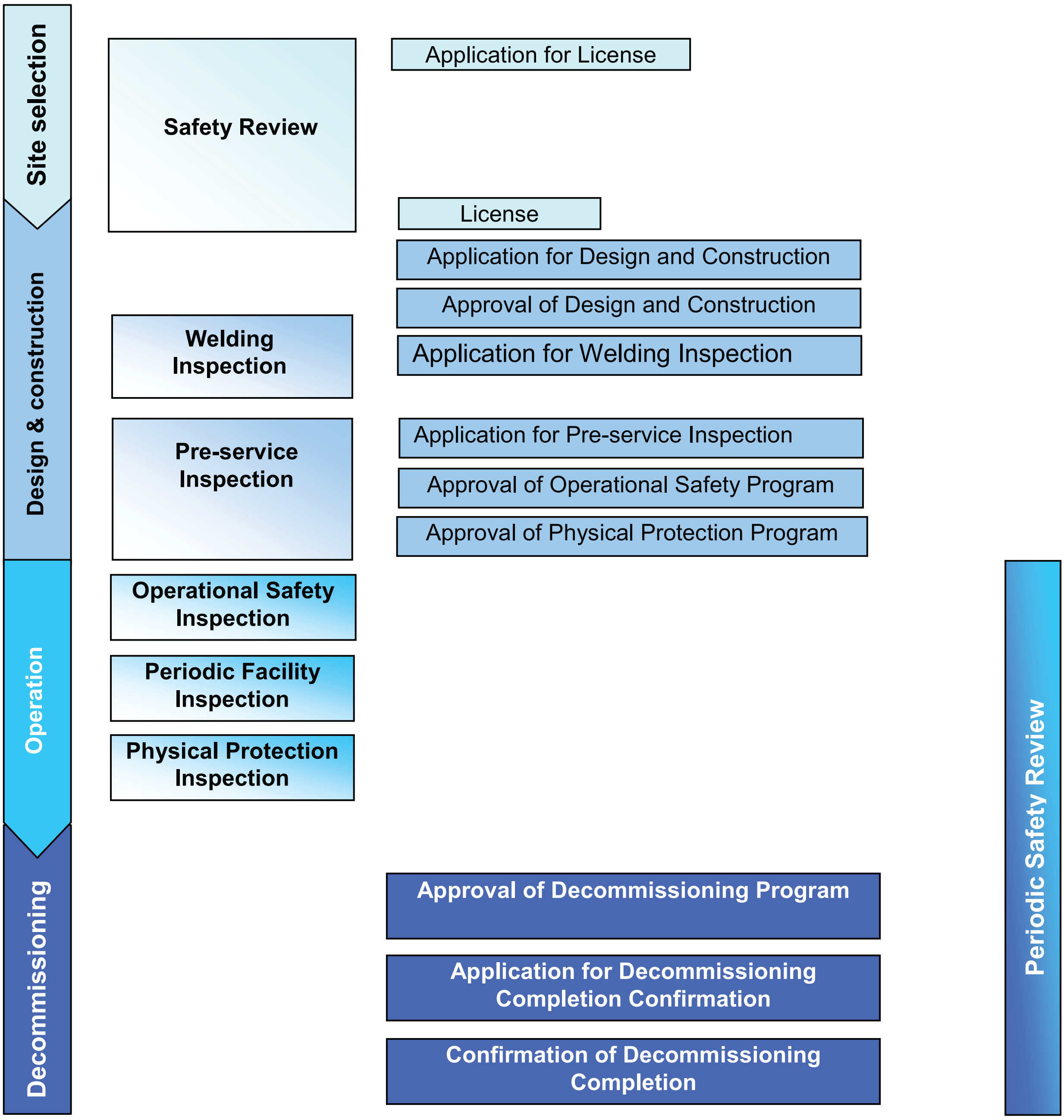


Fig. G-1 Regulatory Flow for Spent Fuel Storage

G1 General safety requirements

Article 4

Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management, individuals, society and the environment are adequately protected against radiological hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed;
(ii) ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted;
(iii) take into account interdependencies among the different steps in spent fuel management;
(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;
(v) take into account the biological, chemical and other hazards that may be associated with spent fuel management;
(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;
(vii) aim to avoid imposing undue burdens on future generations.

G1.1 Prevention of criticality and removal of residual heat

In Japan, spent fuel is handled and/or stored in commercial nuclear power plants, reprocessing facilities and spent fuel storage facilities. The Reactor Regulation Act requires an applicant for license for such activity to demonstrate that the location, structures and systems of the facility to be used for the activity are adequate for preventing a nuclear-material-related disaster. Spent fuel storage facilities are licensed as spent fuel storage business, while the spent fuel facilities associated with the commercial power reactor facilities and reprocessing facilities are licensed as the associated facilities of each facility.

When applying for permission for a spent fuel storage license, the applicant is required by the Reactor Regulation Act to demonstrate that the structures and systems of the proposed spent fuel storage facility, especially those for “prevention of spent fuel criticality” and “heat removal of spent fuel”, are safety-designed so as not to hinder disaster prevention.
In addition, prior to actually starting construction of the licensed spent fuel storage facility, the applicant has to obtain approval of the Minister of METI for design and construction plan.
The Minister gives approval after confirming that the design and construction plan is consistent with the licensed design and is in compliance with applicable technical standards. These standards provide safety requirements such as to take adequate measures to maintain sub-criticality of spent fuel, for instance, through geometrically safe configurations and to provide systems capable of safe removal of decay heat of spent fuel.
During construction, the facility must undergo the pre-service inspection conducted by the Minister of METI, pursuant to the Reactor Regulation Act. This inspection is conducted to make sure that the construction works are being carried out in accordance with the approved design and construction plan and the performance of the facility meets the requirements of the technical standard. The facility has to get through this inspection to be put into operation. The operator must also undergo the welding inspection of the facility. The operator cannot pass the welding inspection unless it is confirmed that the welding works are being carried out in accordance with the method approved by the Minister of METI and that the requirements of the technical standard are met.

Spent fuel is stored in the depositories that are associated with a reactor facility or reprocessing facility as well as in an independent spent fuel storage facility. Such associated storage facilities are regulated similarly by the laws and regulations governing the relevant activities.

As above, it is ensured in spent fuel management in Japan that criticality and removal of residual heat generated during spent fuel management are adequately addressed.

In the spent fuel pool in each unit of Fukushima Dai-ichi NPS of TEPCO, which were suffered of the Tohoku District – off the Pacific Ocean Earthquake, the water level continued to drop on account of the evaporation of water caused by the heat of the spent fuel in the absence of the pool water cooling system, due to the loss of power supply. Water injection to the spent fuel pool was carried out by the Self-Defense Forces, the Fire and Disaster Management Agency and the National Police Agency, using helicopters and water cannon trucks. Concrete pump trucks were ultimately secured, which led to stable water injection using freshwater from nearby reservoirs after the initial seawater injection.

Although the water in the spent fuel pool is usually cooled by releasing heat to the sea, which is the ultimate heat-sink, using FPC (spent fuel pool cooling and clean-up system), cooling failed due to the function loss of both the seawater pumps and the external power supply. In Units 1, 3 and 4, since the upper parts of their buildings were damaged, in order to tentatively secure the cooling function, efforts were made to maintain the proper water levels by water injection with external hosing, which was conducted using the Self-Defense Force‘s helicopters, water cannon trucks, and seawater supply system against fire and squirt fire engines of Emergency Fire Response Teams. Since Unit 4 had the greatest decay heat and the fastest decrease in water level due to evaporation, special attention was paid to it to maintain the proper water level. On the other hand, Unit 2‘s building remained undamaged, and this was thought to suppress the decrease in water level to some extent as evaporated steam condensed on the building‘s ceiling; efforts were made to recover the water supply line while maintaining the water level by hosing the opening of the building. On and after March 20, water injection began from the primary water supply line. In Units 5 and 6, the power supply was secured from Unit 6's emergency DG, and the cooling function was also secured using the temporary seawater pump, allowing the spent fuel pool and the reactor to be alternately cooled.

Subsequently, heat exchangers were installed in Units 2 and 3, after the normal lines were recovered aiming to achieve stable cooling of spent fuel. Finally, circulating cooling was established on May 31 and June 30, respectively in Unit 2 and Unit 3. Water injection via the normal line began on May 29 in Unit 1, and an external water injection system was installed in Unit 4 as an alternative to the normal line on June 17. Circulating cooling was also started in Unit 1 on August 10 and in Unit 4 on July 31, and thus the target of Step 1 for all the Units has been achieved. Currently the water temperature of Unit 1 through Unit 3 are stabilized at around 30 degrees Celsius and the water temperature of Unit 4 is also stabilized at around 40 degrees Celsius.

On April 13, in accordance with the laws and regulations, NISA requested TEPCO to report the results of the seismic safety evaluation of the current situation of the reactor buildings, etc. and also the results of investigation concerning seismic reinforcement works conducted as necessary, because the exterior walls of the reactor buildings of Fukushima Dai-ichi NPS were severely damaged due to hydrogen explosion and fires, etc.

In response to the report on Units 1 and 4 submitted by TEPCO on May 28, NISA set out the strict conservative conditions. For example, NISA requested to assume in the seismic evaluation that the damaged and collapsed part of the building does not exist, and thus the weight of such part is supported only by the floor of the lower level. In the meantime, NISA confirmed that the reactor buildings of Units 1 and 4, and the spent fuel storage pool of Unit 4 maintained their functions against the basic design ground motion which was established in pursuant to the Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities. Furthermore, reinforcement work has been carried out and completed on July 31 at the bottom of the spent fuel storage pool of Unit 4, aiming to increase the margin as the measures to reinforce bearing resistance against the load imposed from above.

Results of seismic safety evaluation conducted by TEPCO will also be strictly checked for the reactor building and the spent fuel storage pool of Unit 3, and the reactor buildings of Units 2, 5 and 6.

No significant damage has been assumed to exist concerning spent fuel stored in the pools, judging from the observation by underwater camera and pool water monitoring results. Sufficient amount of water is being injected steadily into the spent fuel storage pools so that cooling and shielding is secured.

G1.2 Minimization of the generation of radioactive waste

Japanese laws and regulations do not require to minimize the radioactive waste amount, however, the capacities of radioactive waste storage facilities such as those in reprocessing facility etc. as well as the capacities of radioactive waste disposal sites are limited and, which leads to a common understanding of the necessity to reduce the radioactive waste generation.

In Japan, spent fuel is reprocessed to recycle valuable nuclear materials and it is understood that reprocessing of spent fuel is more effective than direct disposal in reducing the amount of high level radioactive wastes.

Licensees are striving to minimize the amount of radioactive wastes generated from their activities by appropriate measures such as evaporating and concentrating liquid radioactive wastes and incinerating solid radioactive wastes.

By establishing the clearance system, materials of insignificant radiation level, which are part of concrete and metals generated from decommissioning of nuclear facilities, can be released from regulatory control of radioactive wastes as clearance materials, and recycle of such materials can result in reduction of radioactive waste amount.

G1.3 Interdependencies among the different steps in spent fuel management

Spent fuel is generated in a reactor facility, temporally stored there and then transported to spent fuel storage facility or reprocessing facility. Spent fuel that was stored in a spent fuel storage facilities is also transferred to reprocessing facility. In reprocessing facility, spent fuel is stored for a certain period and finally reprocessed.

The information such as specifications and irradiation record of spent fuel is shared among the licensees of the different steps in spent fuel management and the facilities for those steps are designed considering forms, burn-up, cooling term and other properties of spent fuel. For getting license, applicant is required by the relevant laws and regulations to clearly show the specifications of spent fuel that will be handled and thus it is ensured that safety is not impaired through the different steps in spent fuel management.

G1.4 Protection of individuals, society and the environment

Description on radiation protection for the safety of spent fuel management is provided in F4.

G1.5 Biological, chemical and other hazards that may be associated with spent fuel management

The Reactor Regulation Act requires that nuclear facilities are adequate for preventing a disaster that involves radioactive materials. For getting license, any spent fuel management facility, i.e. reactor facility, spent fuel storage facility or reprocessing facility, has to take into account the measures against the events that may affect the facility, such as leakage of radioactive materials, fire, explosion and earthquake, to prevent radiological effects on the public and employees. These measures have to be considered also in the detailed facility design to get approval for the design and construction plan. Such consideration as well as subsequent pre-service inspection ensures that the hazards that may affect spent fuel management are duly taken into account.

G1.6 To avoid imposing impacts on future generations

The Government of Japan, in the Framework for Nuclear Energy Policy in 2005, makes it a basis of its nuclear energy policy to establish a national nuclear fuel cycle in which spent fuel is reprocessed in order to make effective use of uranium resources. Spent fuel generated by nuclear power plant is considered as a useful recyclable fuel resource, so that all the spent fuel is reprocessed and recyclable fuel is re-used as nuclear fuel. There is no fuel stored in future generations thus no greater impacts than those permitted for the current generation will be considered.

G1.7 To avoid imposing undue burdens on future generations

The laws and regulations require to ensure the costs for spent fuel reprocessing, etc. not to impose undue burdens on future generations. (See Section B)

G2 Existing facilities

Article 5
Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility.

G2.1 Review the safety of existing spent fuel management facility

Periodic Assessment is implemented in Japan to maintain the safety of nuclear facilities. The Rule for Interim Storage of Spent Fuel requires to make assessments, at an interval of not exceeding 10 years, of the safety activities at the spent fuel storage facility and the introduction of the latest technological knowledge into the safety. It is also required to make a technical assessment of aging degradation and to develop a 10-year maintenance plan for the spent fuel storage facility based on the aging assessment, before the operation period reaches 20 years.
The regulatory body conducts the following inspections for the spent fuel management facilities attached to nuclear facilities. Up to now, no major modification of facility has been suggested by those inspections for continuous operation.

1. Periodic Inspection of Facility

The regulatory body conducts the Periodic Inspection of Facility once a year (once every 13 months in the case of commercial power plants) to confirm if the performance of the facilities and equipment complies with the technical standards prescribed by laws and ordinances.

2. Operational Safety Inspection

The regulatory body conducts the Operational Safety Inspection by a resident Nuclear Safety Inspector four times a year to confirm operators' compliance with the Operational Safety Program.

3. Responses to other nuclear power stations based on the accident at Fukushima Dai-ichi Nuclear Power Station of TEPCO

In the accident, the loss of power supplies led to failure of the cooling for the spent fuel pool. The operators, under instructions from NISA, in order to maintain cooling of the spent fuel pool even when power supplies had been lost, deployed alternative/external cooling water injection devices for the spent fuel pools (pump tucks, fire engines, hoses, coupling parts, etc.), ensured the capacity of freshwater tanks, and arranged feedwater lines that take water from the sea.Beyond this, they plan to undertake seismic reinforcement of the cooling piping system for the spent fuel pool, etc. as future efforts.

(1) Instructions on emergency safety measures

On March 30, 2011, NISA instructed all electric power companies and related organizations to implement emergency safety measures at all NPSs in order to prevent the occurrence of nuclear disasters and core damage, etc. caused by tsunami-triggered total AC power loss, on the basis of the latest knowledge gained from the accident at the Fukushima NPSs. On May 6, NISA carried out on-site inspections at all NPSs (except the Onagawa NPS, Fukushima Dai-ichi and Fukushima Dai-ni NPS), and confirmed that emergency safety measures were appropriately implemented at these NPSs. On June 1, NISA confirmed that work to prepare against tsunamis was appropriately implemented at Onagawa NPS, where such work was delayed after it was hit by the tsunamis. Regarding the Fukushima Dai-ni NPS, which achieved a stable condition after cold shutdown on April 21, NISA also instructed the NPS to implement emergency safety measures, and received an implementation status report from it on May 20.

Moreover, on May 1, NISA requested reprocessing operators to implement emergency safety measures in the event of loss of all systems that supply AC power, all systems that remove decay heat and all facility for preventing an accumulation of hydrogen, due to tsunamis and other events. As a result, NISA received each report on the status of implementation from JAEA on May 31 and JNFL on May 31. NISA confirmed, on June 15, that their emergency safety measures have been appropriately implemented through on-the-spot inspections, etc.

Hamaoka Nuclear Power Station of Chubu Electric Power Co., Inc. is considered to be an extremely imminent danger as evaluated the anticipated Tokai Earthquake by the Headquarters for Earthquake Research Promotion of the Ministry of MEXT, which anticipates an 87 percent probability of a magnitude 8-level earthquake occurring in the region within 30 years. Given the high possibility of Hamaoka Nuclear Power Station being hit by a major tsunami following this earthquake, on May 6, based on the decision that the public safety is the first priority NISA has requested Chubu Electric Power to shut down all the reactors of Hamaoka Nuclear Power Station until the enough protective measures against tsunami for middle and long term like a tide embankment, etc., are completed. Chubu Electric Power Co., Inc. accepted the request and stopped the operation of all plants by May 14.

(2) Instructions on severe accident measures

On June 7, 2011, NISA directed each Electric Utility, etc. to implement immediate actions to undertake the preparatory measures regarding the response to a severe accident at all the nuclear power stations in order to implement the measures that should be immediately taken in the event of a severe accident in addition to the preventive measures against a severe accident. On June 18, NISA confirmed that the measures against a severe accident have been appropriately implemented by conducting on-the-spot inspections, etc.

Moreover, on June 15, 2011, NISA directed reprocessing plant operators (JNFL and JAEA) to implement the necessary measures at the reprocessing plants, based on the measures against a severe accident at nuclear power stations, and received these report on the implementation status from the reprocessing plant operators. On July 8, NISA confirmed that the measures against a severe accident at the reprocessing plants, based on the measures against a severe accident at nuclear power stations have been appropriately implemented through on-the-spot inspections, etc.

(3) Implementation of comprehensive safety evaluation of existing commercial power reactor facilities

Regarding NPS's resuming operations after the regular inspections, many others questioned NISA's safety assessments, thus making it difficult to say that sufficient acceptance has been obtained from the public and local residents. In this context, aiming to further improve safety at NPSs and to reassure and regain public trust in terms of nuclear safety, the Japanese government announced on July 11 that the government will implement safety assessments based on new procedures and rules including the participation of NSC, basically by making use of the knowledge and experiences of the stress tests implemented in European countries. As a result NISA prepared comprehensive assessment procedures and implementation plan and reported to NSC. NSC approved them on July 21. On July 22 NISA requested each Electric Utility, etc. to perform comprehensive safety evaluation of commercial power reactor facilities based on them and to report the results to NISA.

In such evaluation, each Electric Utility, etc. is required to assess safety margin based on the scenario leading ultimately to core damage, assuming either the earthquake/tsunamis with the scale exceeding what is supposed in design, or station blackout, or loss of cooling functions, and also multiple failures of respective components in the scenario.

Concerning nuclear fuel cycle facilities, implementation of such evaluation will be separately considered.

G3 Siting of proposed facilities

Article 6

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:
   - (i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;
   - (ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment;
   - (iii) to make information on the safety of such a facility available to members of the public;
   - (iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.
2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

G3.1 Evaluation of site-related factors

In Japan, evaluation of relevant site-related factors and safety impact of the proposed facility is conducted during the licensing process of each activity. The criteria for the license are that “granting of the license does not impair the planned implementation of the nuclear development and utilization programs; the applicant has adequate technical capability and financial basis to appropriately carry out the proposed activity; and the location, structure and systems of the proposed facility does not impair the prevention of the hazards due to nuclear fuel materials or the materials contaminated with nuclear fuel materials”. The specific evaluation items for the technical capability and the prevention of hazards are specified in a guides developed by NSC and are used for the review of an application by the regulatory body.

One who plans to operate a spent fuel storage facility has to be licensed by the Minister of METI in accordance with the provisions of the Reactor Regulation Act.
The license application document must include the descriptions on “the type and storage capacity of spent fuel to be stored”, “the location, structure and systems of the spent fuel storage facility and the storage method”, and “the method for removing spent fuel after the termination of storage”. The document must be supplemented by explanatory materials on “the conditions of meteorology, ground structure, hydrology, seismology, social environment at the site of the proposed spent fuel storage facility” and “the safety design of spent fuel storage facility”. With these information, the applicant is required to make an evaluation of site conditions for the spent fuel storage facility.
METI examines the application form and confirms that “granting of the license does not impair the planned implementation of the nuclear development and utilization programs"; "the applicant has adequate technical capability and financial basis to appropriately carry out the proposed activity"; and "the location, structure and systems of the proposed facility does not impair the prevention of the hazards due to nuclear fuel materials or the materials contaminated with nuclear fuel materials” as provided by the Reactor Regulation Act. Based on this confirmation, the Minister grants the license after hearing the option of JAEC and NSC.

NSC established "Safety Review Guide for Spent Fuel Interim Storage Facility using Metallic Dry Casks" (See Section L Table G5-1), which is being applied to the safety evaluation of the spent fuel interim storage facility currently under safety review.
The above Guide provides that the following matters shall be taken into account as basic siting conditions to ensure the safety of the facility.

<Natural phenomena>

(1) Natural phenomena such as earthquake, tsunami, landslide, depression, typhoon, high tide, flooding, abnormal cold weather and heavy snow

(2) Geological conditions and landform etc. such as foundation condition, soil bearing

capacity and faults,
(3) Meteorological conditions such as wind direction, wind velocity and precipitation
(4) Hydrospheric and hydrologic conditions such as rivers and underground water

<Social environment>
(1) Fires and explosions at a neighboring factory etc.
(2) Missiles etc. by air craft crash etc.
(3) Conditions of land use in relation to food production such as agriculture, livestock farming and fishery industry, and conditions of population distribution etc.

G3.2 Information for general public

The license application documents and other related information are made open to the public at the Nuclear Energy Library and at the Nuclear Library Room of JNES, except for the information relevant to nondisclosure causes such as safeguards and commercial sensitiveness. Such information is also accessible and available at the National Diet Library. A document requested to an administrative agency under the "Act on Access to Information held by Administrative Organs“ is also disclosed in accordance with the provisions of the Act, unless it is subject to nondisclosure causes.

G3.3 Relation with neighboring contracting parties

The government of Japan does not have it a rule to consult the neighboring countries about siting of nuclear facilities. The Government of Japan provides neighboring countries with information on nuclear energy through bilateral consultation, etc. The government of Japan will release information promptly in the case when any significant event has occurred at any of nuclear installation in Japan.

G4 Design and Construction of facilities

Article 7

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

(i) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;

(iii) the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.

G4.1 Prevention of radiological impacts on individuals, society and the environment

A licensee for nuclear reactor establishment, spent fuel storage or reprocessing must describe the design and construction methods for the relevant spent fuel storage facility in the application document for the approval of the design and construction methods for the proposed facility and must attach a document demonstrating the conformity of design and construction methods to the technical standards applicable to the proposed facility, pursuant to the Reactor Regulation Act. The Minister of METI examines the application and gives approval after confirming that the design and construction methods are consistent with the "contents of license” and the “technical standards” provided in the Reactor Regulation Act.
The "technical standards for the design and construction methods” for spent fuel storage facility provides the standards for confinement function, shielding, etc., to prevent radiation hazards (See Annex L: Table G4-1).

The design, construction and inspection of a commercial nuclear power reactor facility is governed by the “Electricity Business Act” instead of the “Reactor Regulation Act”, but the requirements are essentially the same.

G4.2 Provisions for the decommissioning of a spent fuel management facility at the design stage

Reactor facility and reprocessing facility as well as spent fuel storage facility have spent fuel storage system which is regulated by the Reactor Regulation Act and other relevant laws individually for each activity. When abolishing the facility, the operator has to establish a decommissioning program and get the approval for it from the Minister of METI.

G4.3 Technologies incorporated in the design and construction of a spent fuel management facility

At the stage of design and construction, a licensee applies the proven technologies inside and outside Japan.
The regulatory body is promoting the studies on the safety of nuclear facilities, environmental radiations and radioactive waste. The safety studies on nuclear facilities are being conducted with the objectives to respond to the expansion and diversification of future nuclear development and utilization and to promote the public consensus on the safety of nuclear facilities. In particular, the studies for developing safety standards, safety guides and reference documents for safety review and the studies for safety improvement are being conducted by JAEA, JNES, CRIEPI and other institutes. For example, JNES is conducting the development of the standards, the long-term integrity tests, and the development and improvement of safety analysis codes for the interim storage facility of spent fuel, and CRIEPI is conducting the studies on the long-term integrity test for interim storage equipment, etc.
In the process of safety review of nuclear facilities, the regulatory body conducts, as appropriate, independent analyses to confirm the validity of applicant’s safety analysis results. A recent example related to this Convention is that the regulatory body conducted

independent analyses for criticality, shielding, heat removal, structures and seismic design as a part of the safety review for the license application of the Recyclable-Fuel Storage Center.

G5 Assessment of safety of facilities

Article 8

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

(i) before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(ii) before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

G5.1 Safety and environmental assessment of a spent fuel management facility

In Japan, activities concerning the spent fuel storage within reactor facilities, spent fuel storage facilities, and reprocessing facilities are corresponding to spent fuel management defined in the Convention. These activities are individually subject to the license under the Reactor Regulation Act. An applicant for an each license carries out a systematic safety assessment and an assessment of radiological impacts on the environment, including the assessment of the meteorology, ground structure, hydraulic phenomena, earthquake, social environments around the site and safety design of the facility. On the basis of such assessments, the regulatory body examines the appropriateness of siting and basic design of the facility, systems and components from the viewpoint of hazard prevention.

The guide "Safety Review Guide for Spent Fuel Interim Storage Facility using Metallic Dry Casks" provides for radiation control, environmental safety, criticality safety and other safety measures assuming 40-60 year period of spent fuel storage.

G5.2 Update of safety and environmental assessment of a spent fuel management facility

The Reactor Regulation Act provides for the procedures for "licensing and notification of modification" to appropriately address a change of the descriptions in the application documents for the license granted in accordance with the Act. Thus the procedures are in place for updating and detailing the safety assessment and environmental assessment when deemed necessary to complement those assessments.

G6 Operation of facilities

Article 9

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

(i) the licence to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article 8, are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures;

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility;

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

(vi) programmes to collect and analyze relevant operating experience are established and that the results are acted upon, where appropriate;

(vii) decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.

G6.1 Permission to operate a spent fuel management facility

The Reactor Regulation Act provides that spent fuel storage facility shall not be used before getting through the inspections conducted by the Minister of METI for the construction and performance of the facility. The facility passes the pre-serve inspection only if it is confirmed that "the construction has been done in accordance with the approved design and construction plan" and "the performance of the facility meets the technical standards for performance". "The technical standards for performance" are specified by the Minister of METI as follows:

- The alarm system, emergency power supply system and other emergency systems and interlocks (devices to actuate the systems or equipment only under specific conditions) described in the license application documents or their annexes shall operate reliably under the conditions described in those documents.
- The radioactive waste disposal systems shall have more capability than described in the license application documents or their annexes.
- The main radiation control systems shall the capability described in the license application documents or their annexes.
- Dose equivalent rate and concentrations of airborne radioactive materials in the always-manned areas of the spent fuel storage facility, the areas with workers during the operation of the facility, and other areas that require radiation control shall be less than those described in the license application documents or their annexes.
- Capabilities for preventing spent fuel from reaching criticality and for confining spent fuel and spent-fuel-contaminated materials within restricted areas shall meet the capabilities described in the license application documents or their annexes.

The same steps as described above for spent fuel storage facility are taken also for reactor facility and reprocessing facility that are within the scope of spent fuel management facilities defined in this Convention.

As described above, steps are taken in Japan to ensure that the license to operate a spent fuel storage facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of the pre-service inspection demonstrating that the facility, as constructed, is consistent with design and safety requirements.

G6.2 Operational limits and conditions

The operator regulated by the Reactor Regulation Act must establish “Operational Safety Program” and obtain approval before starting operation of the facility. The Operational Safety Program have to specify concrete steps for operation of the facility, checks and the maintenance of the facility, radiation monitoring and quality assurance and so on. The operation and maintenance of the facility have to be performed in accordance with the specific operational limits defined in the Operational Safety Program. The operator must undergo quarterly inspection (Operational Safety Inspection) by the regulatory body to confirm the compliance with the Operational Safety Program. In addition, the conformity of the facility performance to prescribed technical standards and measures for the maintenance of the facility are confirmed by annual periodic inspection of the facility and other inspections. When any violation is found by those inspections, the Minister of METI may order the operator to take necessary safety steps such as suspension of operation, modification, repair, or instruction on the facility operation.

G6.3 Operation, maintenance, monitoring, inspection and testing of a spent fuel management facility

When operating a spent fuel storage facility, the operator must take safety steps for “maintenance of spent fuel storage facility”, “operation of spent fuel storage facility ” and “transportation of spent fuel or transportation, storage and disposal of the materials contaminated with spent fuel” in accordance with the provisions of the Reactor Regulation Act. As safety steps, “access control to controlled areas”, “measures for radiation dose”, “patrol and inspection of spent fuel storage facility”, “periodical self-inspection of spent fuel storage facility”, “operation of spent fuel storage facility”, “on-site transportation”, “on-site waste management”, and “Periodical Safety Review of spent fuel storage facility” are provided in a relevant ministerial ordinance.

The operator must establish its Operational Safety Program covering the above steps and obtain approval of the Minister of METI before starting operation of the facility. (Items to be described in the Operational Safety Program are shown in the Annex L Table G6-1.)
In addition, operator must undergo Operational Safety Inspection conducted quarterly by the Minister of METI to check the status of compliance with the Operational Safety Program.

The same steps are taken also for reactor facility and reprocessing facility that are within the scope of spent fuel management facilities defined in this Convention.

G6.4 Measures for ensuring that engineering and technical support in all safety-related fields is available in the period of operation of spent fuel management facility

During operation of a facility, the regulatory body obtains engineering and technical advice of expert committees on operational management, inspection and radiation control and feeds it back, when necessary, to the safety regulation on operation and maintenance.
For example, NISA has a system to collect experts' engineering and technical advice through the deliberations on the specific safety regulation policies by the advisory councils set up under the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy.

The joint working group consisting of the members of the “interim storage working group of the nuclear fuel cycle safety subcommittee” and “transport working group”, established under the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy performed an inspection to confirm integrity of metallic casks and contents during storage of spent fuel at the interim storage facility, and studied the reasonable method of pre-shipment inspection for the transport of casks after the completion of storage.

In addition, because the license for the transport of metallic casks remains to be valid throughout the period while spent fuel is stored at the interim storage facility, consistent management of these regulations was also considered, and organized in the report published in June 2009.[*1] On the basis of this report, the regulatory body revised the relevant ordinance, and allowed a Holistic Approach to be taken, by which metallic casks can be shipped without confinement function of the lids etc being lost, during and after the storage period of spent fuel at the interim storage facility.

[*1]: "Long-term integrity of metallic dry casks and their contents at the spent fuel interim storage facility using metallic dry casks" [June 2009, the "interim storage working group of the nuclear fuel cycle safety subcommittee" and "transport working group" of the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy)]

G6.5 Report to the regulatory body in a timely manner by the licensee

The Reactor Regulation Act provides that an operator shall report without delay the status of the event and other necessary matters when an accident accompanying personal injury (including the case with potential personal injury) or a failure or other event has occurred in a reactor facility, a spent fuel storage facility, or a reprocessing facility. Reportable events are specified by a ministerial ordinance that regulates the business concerned. Examples of reportable events are shown in the Section L table G6-3.

G6.6 Programs to collect and analyze relevant operating experience

Upon receipt of a report on an accident or failure, the regulatory body immediately makes it open, examines and evaluates the status of cause investigation and recurrence-prevention measures and publicizes the results. The information on the accident or failure is further investigated to extract lessons on safety and to improve safety regulation as appropriate.
For the accumulation of information, NISA instructs JNES to maintain a system to collect and evaluate domestic and overseas safety information. The accumulated information is shared between NISA and JNES through the meeting regularly held to appropriately feed back the information to a regulatory response or its follow-up.
As for international information exchange, Japan shares accident/failure information through cooperation with international organizations such as IAEA and OECD/NEA as well as through bilateral cooperation.

The electric utilities collect and analyze domestic and overseas information on operating experiences in their own companies and in the Central Research Institute of Electric Power Industry. The electric utilities established the Nuclear Information Archive "NUCIA", as a tool for national sharing of safety information about domestic commercial nuclear power plants including information on minor events, and released to the public on internet (http://www.nucia.jp/) in October 2003. The electric utilities exchange information on operating experience with foreign counterparts through the Institute of Nuclear Power Operations (INPO) and the World Association of Nuclear Operators (WANO) Tokyo Center. In addition, each electric utility has information exchange agreements with reactor manufacturers and electric utilities in France, Germany, the United States and other countries to collect information. Based of recognition of the importance of safety information sharing and cultivation of safety culture throughout the nuclear industry, a private organization "NS Net" was established in December 1999 jointly by concerned bodies to make continuous activities including peer reviews. NUCIA and NS Net were integrated into the Japan Nuclear Technology Institute (formerly, an intermediate corporation limited, presently, a general incorporated association) in April 2005 and have been actively continuing their activities.

G6.7 Decommissioning plans for a spent fuel management facility

An operator that plans to abolish its facility must take necessary steps for “decommissioning” such as dismantling of the facility, assignment of nuclear fuel material inventory and disposal of materials contaminated with nuclear fuel materials, pursuant to the Reactor Regulation Act. For that purpose, the operator has to establish a “decommissioning program” and obtain an approval of the Minister of METI for it.

The criteria for approving decommissioning program are that all nuclear fuel materials have been removed from the facility; nuclear fuel materials are appropriately assigned; nuclear fuel materials and materials contaminated with nuclear fuel materials are appropriately managed and disposed; decommissioning work is appropriately implemented in a way to prevent a hazard due to nuclear fuel materials or materials contaminated with nuclear fuel materials, as provided in the Reactor Regulation Act. The information obtained during operation of the facility to be decommissioned should be used for the management and disposal of contaminated material and hazard prevention. Therefore, the decommissioning program is developed by using the information obtained during the operating period of the facility. The procedures for “Approval for Modification of Decommissioning Program” are provided by the relevant ordinance to allow update of the decommissioning program when necessary. In addition, the process of approval for decommissioning program ensures that the plan is reviewed by the regulatory body.

Section H Safety of Radioactive Waste Management

In Japan, activity related to radioactive waste consists of following activities; waste treatment, storage and disposal. Waste treatment means all activities that relate to the handling, pretreatment, treatment, conditioning, or on-site storage of radioactive waste. Radioactive waste management in all Japanese nuclear facilities including nuclear reactor facility and reprocessing facility is in the scope of the Convention. Since the waste management in a fuel processing facility, spent fuel storage facility and reprocessing facility is governed by the similar safety regulation system to that for regulations concerning waste disposal or storage activities, the regulations concerning waste disposal or storage activities is described in this section as a representative, unless specially noted. The design, construction and inspection of a commercial nuclear power reactor is governed by the “Electricity Business Act” instead of the “Reactor Regulation Act”. The requirements of both Acts are essentially the same. Therefore, this section describes the safety regulation of “waste disposal and waste storage.”

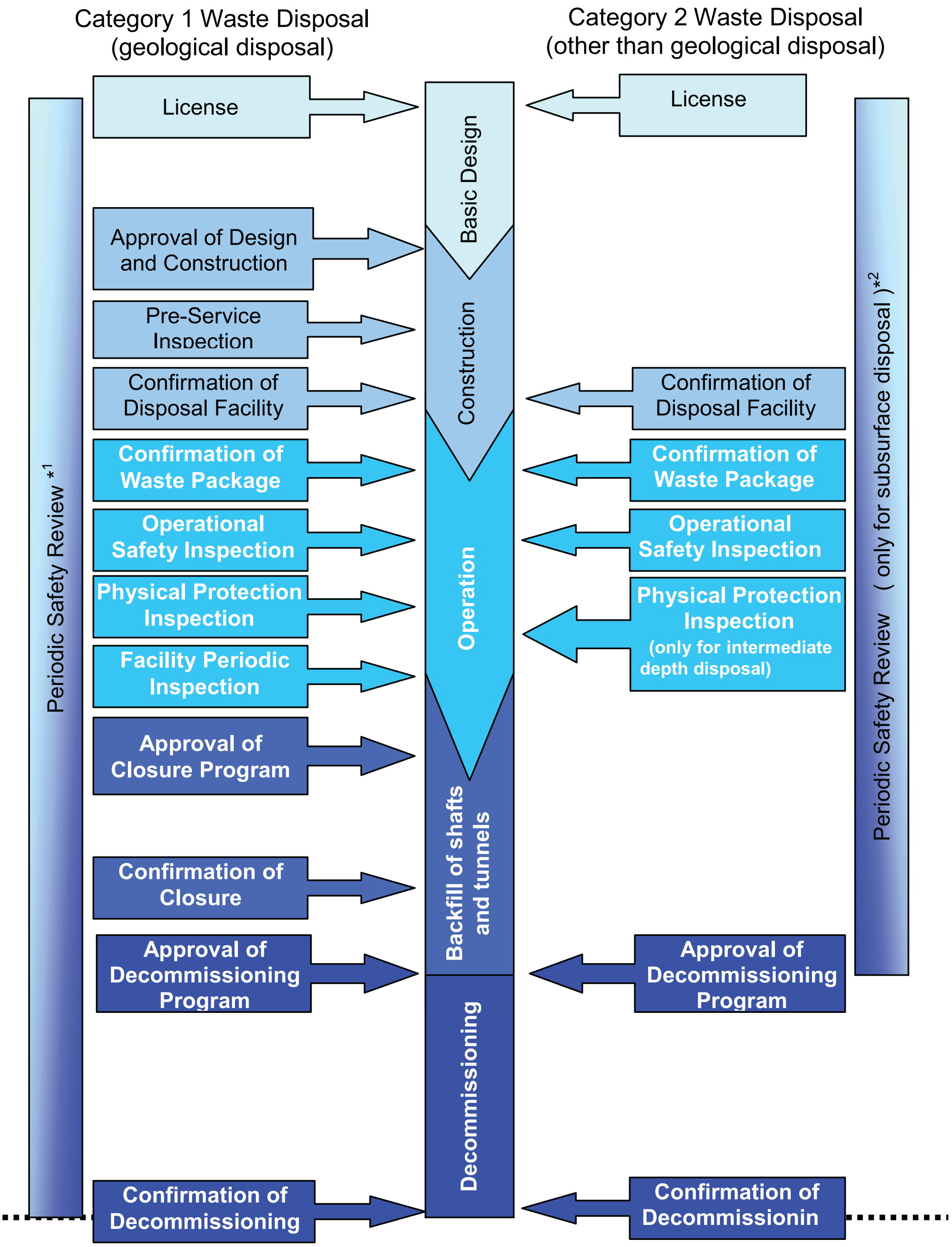
In Japan radioactive wastes are grouped into HLW that is generated from spent fuel reprocessing and the rest, LLW. The LLW is further classified into TRU waste which is generated from operation and dismantling of reprocessing facilities or MOX fuel fabrication facilities, “uranium waste” which is generated mainly from nuclear fuel fabrication facilities, “waste from power reactors” which is generated from nuclear power plants, and “waste from research facilities, etc.” which is generated from research facilities, medical care facilities, etc. Depending on radioactivity characteristics of radioactive waste to be disposed of and on the conditions of geological environment, radioactive waste is finally disposed of with any of the “geological disposal” in a stable geologic stratum, “intermediate depth disposal” in the underground deeper than 50 meters, “near surface pit disposal” in a structure such as concrete pit in relatively shallow underground near the surface and the “near surface trench disposal” directly in shallow underground (See Fig. L6-1). Wastes with very low radioactivity concentration which does not need to be dealt with as radioactive waste (wastes cleared from regulation) can be exempted from the radioactive waste control, after confirmed by the regulatory body.

The HLW is a stabilized waste in the form of “vitrified waste.” The liquid effluent containing fission products separated through the spent fuel reprocessing process is solidified with glass frit at an elevated temperature and put into a stainless steel canister and sealed to form vitrified waste. The vitrified waste is stored for 30 to 50 years for cooling in the specific waste storage facility, and then finally disposed of (geological disposal, See Fig. L6-4), being isolated from the environment.
Highly radioactive TRU waste is to be geologically disposal of like high level radioactive waste, and is regulated in the same way.
Geological disposal deals with high radioactive TRU waste containing many long-lived nuclides that require very careful radiation control (See Fig. L6-4). Since HLW needs to be isolated from the environment over a long period of time, enhanced regulatory procedures are applied, in addition to the safety regulation for LLW, to ensure reliable closure of an underground facility through approval of a closure program and confirmation that the steps have been taken as described in the approved closure program.
Low radioactive TRU wastes generated from the operation and disassembling of reprocessing facility or MOX fuel fabrication facility and power-plant wastes are finally disposed of with any of the “subsurface disposal (See Fig. L6-3-1)”, “near surface pit disposal (See Fig. L6-2)” or “near surface trench disposal”, depending on the radioactive nuclides and their radioactivity concentration, and stepwise control is conducted according to radioactive decay.

At present, as the first step operation, Waste from Research Facilities, etc. is to be disposed of by the method of “near surface trench disposal” or “near surface pit disposal”

Figure H-1 shows the safety regulation process for Category 1 disposal and Category 2 disposal.

Following partial amendment of the Radiation Disease Prevention Act in May 2010, MEXT has introduced Clearance System.



*1: At an interval not exceeding 20 years after grant of license or when closure program or decommissioning program of auxiliary facility is planned.

*2: At an interval not exceeding 20 years after grant of license or when stage of step-wise control advances.

Fig. H-1 Safety regulation processes for “Category 1 waste disposal” and “Category 2 waste disposal.”

H1 General safety requirements

Article 11

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards. In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed;
(ii) ensure that the generation of radioactive waste is kept to the minimum practicable;
(iii) take into account interdependencies among the different steps in radioactive waste management;
(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;
(v) take into account the biological, chemical and other hazards that may be associated with radioactive waste management;
(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;
(vii) aim to avoid imposing undue burdens on future generations.

H1.1 Prevention of criticality and removal of residual heat

1. Measures to prevent criticality

In Japan, spent fuel is to be reprocessed and, therefore, is not dealt with as radioactive waste. As the radioactive wastes dealt with in Japan contain almost no fissile nuclide. When there is no need to consider the criticality due to extremely low concentration of nuclear material such as uranium-235 or plutonium-239, criticality-prevention capability is not required.

2. Measures for residual heat removal

Adequate heat removal measures are taken in every step of handling process for HLW that generate decay heat.
Specifically, for the “specific waste storage” to temporarily store HLW, adequate removal of decay heat is taken into consideration in the safety design of the facility.

HLW disposal facility is designed to prevent degradation of barrier material or waste itself by increasing temperature by residual heat. However, through the term from acceptance of the HLW to emplacement in underground, backfilling and closure, under some conditions of types, quantities and concentrations of radioactive materials, significant heat could be generated by radioactive decay. If such heat could significantly degrade the containment or shielding functions, cooling function should also be considered as appropriate.

H1.2 Minimization of generation of radioactive waste

Laws and regulations in Japan do not require the minimization of radioactive waste generation, but the "Framework for Nuclear Energy Policy" provides for the principle of minimization of radioactive waste generation. In addition, radioactive waste storage facilities and radioactive waste disposal site have only limited capacities. Therefore, the necessity to minimize radioactive waste generation is widely recognized.

In Japan, spent fuel is reprocessed to recycle valuable materials as a part of fuel cycle in accordance with the nation’s fundamental nuclear energy policy. It is understood that reprocessing of spent fuel is more effective than direct disposal in reducing the amount of high level radioactive wastes.
Operators are striving to minimize the amount of radioactive wastes generated from the operation of their activity by appropriate measures such as evaporation/concentration of liquid radioactive wastes and incineration of solid radioactive wastes.
By establishing the clearance system, a part of concrete waste generated from the decommissioning of a nuclear facility can be dealt with as an object cleared from regulation

which does not need to be dealt with as radioactive waste. That can contribute to the reduction of radioactive wastes.

H1.3 Interdependencies among the different steps in radioactive waste management

The waste treatment processes for disposal are designed considering final disposal of waste. For example, high level vitrified radioactive waste is packed enclosed into a container called canister, the geometry of which is designed for common handling at reprocessing facility where the waste is generated, waste storage facility for temporary storage, and Category I waste disposal facility for final disposal.
Radioactive waste controlled by the Radiation Disease Prevention Act, is also classified in the similar way in the waste processing process, considering the final disposal, etc.

H1.4 Radiation Protection based on International Standards

Japanese laws and regulations adopt the recommendations of ICRP as the criteria for radiation protection. One of the unique criteria applied to a radioactive waste disposal site is to adopt the reference dose which used after the period of its management.

The Radiation Council Basic Committee published a report, titled “the Basic Principles Concerning Radiological Protection for Radioactive Solid Waste Disposal and Clearance,” in January 2010, based on the new ICRP recommendation proposing the framework of radiation protection for radioactive waste disposal, and the new IAEA safety requirement proposing the standard of radiation protection of the public after the closure of near surface disposal facilities, etc. Both of these publications were released after the Radiation Council’s former report was issued in 1987. The Radiation Council’s recent report suggests that it is appropriate to define the upper bounds of the public dose for the period after management of radioactive solid waste disposal sites to be a dose constraint of 300μSv/year, regardless of types of the disposal method. With regard to the criteria in which the potential exposure to long-lived radionuclides is taken into consideration, the report suggests that it is appropriate to define the upper bounds to be a dose constraint of 300μSv/year, for exposure due to natural processes, regardless of types of the disposal method, and to be 20mSv/year for exposure that the future public may receive due to inadvertent human intrusion into the radioactive solid waste disposal site.

NSC introduced the risk-informed safety assessment in order to appropriately take into account uncertainty associated with long-term prediction after the period for active control. Specifically, as shown in the “Policy of the Safety Assessment of Subsurface Disposal after the Period for Active Control” (April 2010) and the “Basic Guide for Safety Review of Category 2 Radioactive Waste Disposal” (August 2010), NSC requires the license applicants to evaluate four scenarios in the safety assessment for the period after active control. These scenarios are related to the radiation doses to residents or intruder, depending on disposal method, and the “target dose” set out for each scenario shall be complied. These principles are comply with the criteria, proposed by IAEA, ICRP and other organizations in the world, to be used for safety assessment of the repositories after the period for active control.

H1.5 Biological, chemical and other hazards that may be associated with radioactive waste management

The Reactor Regulation Act requires that nuclear facilities shall not impair the prevention of hazards due to nuclear fuel materials and materials contaminated with nuclear fuel materials, and also requires the measures for preventing loss of functions to confine the wastes due to various causes. For example, in the process of radioactive waste treatment for disposal, a fabrication facility is required to use waste containers of leak-tight design to prevent leakage of waste.

In a reprocessing facility, various chemicals including organic solvent are used and they could be entrained into the wastes generated at the facility. To cope with that, the “Rule on the Technical Standard for the Design and Construction Methods of Reprocessing Facility” provides for legal requirements, for example, for the handling of organic solvent to prevent damages due to fire, the measures to prevent hydrogen gas generated from high level liquid radioactive waste from accumulating in a storage tank, and the storage methods of extremely oxidizable solid waste like zirconium metallic powder.

As for a waste disposal facility, the “Rules on the Technical Standard for the Design and Construction Methods of Specific Waste Disposal Facility or Specific Waste Storage Facility” requires that a disposal facility shall take explosion-prevention measures for the systems to handle or manage radioactive waste that could generate hydrogen. In addition, the law and regulation on disposal business provide necessary measures to prevent a waste package from containing materials that could impair its integrity.
The similar measures are required by Radiation Disease Prevention Act.

H1.6 To avoid impacts on future generations

In Japan, radioactive wastes generated from the operation of individual nuclear related activities are finally disposed of at a waste disposal site after appropriate treatment and storage within the site. According to the safety regulation for final disposal of radioactive waste, HLW and TRU waste containing radioactive materials that exceed the level specified in the Enforcement Ordinance for the Reactor Regulation Act are disposed of in a stable geological formation according to radiological characteristics and geological environment, while the other sort of TRU waste and waste of core structures, etc. are disposed of at an intermediate depth more than 50 meters, and the other wastes are disposed of at a near surface pit or trench. These steps are to isolate radioactive wastes from the environment appropriately according to their characteristics and conditions. By taking such safety regulatory steps, it can be avoided as far as reasonably achievable to impose impacts on future generations than those permitted for the current generation.

H1.7 To avoid imposing undue burdens on future generations

In order to avoid imposing undue burdens on future generations, the cost and management of disposal are legally specified. (See Section B)

H2 Existing facilities and past practices

Article 12

Each Contracting Party shall in due course take the appropriate steps to review:

(i) the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;

(ii) the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.

H2.1 Review the safety of existing radioactive waste management facility

In Japan, the regulatory body regularly inspects the performance of the facilities and the compliance with the Operational Safety Program for the radioactive waste management facilities defined in the Convention. In addition, periodic assessment system is implemented in order to ensure the safety of nuclear facilities. For waste disposal, the ministerial ordinance governing such activity requires as follows:

1. Category 1 waste disposal

For the waste disposal site with geological disposal, periodic assessment of the control of radiation exposure due to nuclear fuel materials or materials contaminated with nuclear fuel materials shall be performed with the latest technical knowledge at an interval not exceeding 20 years after obtaining license, and steps necessary for the preservation of the waste disposal facility shall be taken on the basis of the assessment results. In addition, the same steps shall be taken when a closure program or decommissioning program of auxiliary facility is to be established.

2. Category 2 waste disposal

For the waste disposal site with intermediate depth disposal, periodic assessment of the control of radiation exposure due to nuclear fuel materials or materials contaminated with nuclear fuel materials shall be performed with the latest technical knowledge at an interval not exceeding 20 years after obtaining license, and steps necessary for the preservation of the waste disposal facility shall be taken on the basis of the assessment results. In addition, the same steps shall be taken when the stages of step-wise control advances in response to radioactive decay.
The above inspections conducted up to now identified no items which should be improved for continuous operation of the facilities.

H2.2 Review the results of past practices

As a result of review it is found that the past practices caused neither radioactive wastes nor nuclear facilities that require any intervention for reasons of radiation protection.
In Japan, there are small amount of waste rock and mill tailings generated by past activities (test and research) as shown below.*[1]

- Tunnel prospecting and mining and milling tests carried out in Ningyo Toge area, Okayama prefecture from 1957 to 1978.
- Tunnel prospecting carried out in Togo area, Tottori prefecture from 1958 until 1962.
- Tunnel prospecting, solution mining test, and earth sciences research of geologic environment carried out in Tono area, Gifu prefecture from 1972 until 2003.

These sites are managed as ceased mine under the Mine Safety Law. The amounts of waste rock and mill tailings are shown in Table H2-1.
For radiation protection, these sites are managed under the Mine Safety Law so as not to exceed 1mSv/year at the boundary of peripheral monitoring area.

Table H2-1 The amounts of waste rock and mill tailings*

Area	Classification	Volume
Ningyo Toge mine	waste rock	about 330000 m^3
	mill tailings	about 34000 m^3
Togo mine	waste rock	about 32000 m^3
Tono mine	waste rock	about 10000 m^3

*: As these waste rock and mill tailings are not defined as radioactive wastes in Japan, these materials are out of scope of the Convention in accordance with Article 2 of the Convention. However the status of these wastes are reported here in accordance with Paragraph 70 of the Summary Report JC / RM.1 / 06 / Final version (••••In relation to uranium mining and milling wastes, Contracting Parties with such wastes agreed to include them in their National reports. ••••).

H3 Siting of proposed facilities

Article 13

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:

(i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;

(ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;

(iii) to make information on the safety of such a facility available to general public;

(iv) consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.

H3.1 Evaluation of site-related factors

In Japan, evaluation of relevant site-related factors and safety impact of the proposed facility is conducted during the licensing process of each activity. In the Reactor Regulation Act, the criteria for the license are that “granting of the license does not impair the planned implementation of the nuclear development and utilization programs; the applicant has adequate technical capability and financial basis to appropriately carry out the proposed activity; and the location, structure and systems of the proposed facility does not impair the prevention of the hazards due to nuclear fuel materials or the materials contaminated with nuclear fuel materials”. The specific evaluation items for the technical capability and the prevention of hazards are listed in a guide developed by the NSC and are used for the review of an application by the regulatory body.

The regulatory body, when approving operation of a radioisotope waste management facility in accordance with the Radiation Disease Prevention Act, conducts safety review to confirm the descriptions in the application are in compliance with the siting conditions, standards on facility, technical standards etc, provided in the Radiation Disease Prevention Act, and approves when the application is confirmed appropriate. It is provided that facilities should be located at a site where landslide and inundation are unlikely to occur.

The license application document must include the descriptions on “conditions and quantity of nuclear fuel material or matters contaminated with nuclear fuel material to be disposed of”, “the location, structure and systems of the waste disposal facility and the disposal method”, and “time schedule to advance the stages of stepwise control for the Category 2 waste disposal facility in response to radioactive decay”. The document must be supplemented by explanatory materials on “the conditions of meteorology, ground structure, hydrology, seismology, social environment at the site of the proposed waste disposal facility” and “the safety design of the waste disposal facility”. With these information, the applicant is required to make an evaluation of site conditions for the waste disposal facility.
METI examines the application and confirms the contents stipulated in the Reactor Regulation Act that “granting of the license does not impair the planned implementation of the nuclear development and utilization programs"; "the applicant has adequate technical capability and financial basis to appropriately carry out the proposed activity"; and "the location, structure and systems of the proposed facility does not impair the prevention of the hazards due to nuclear fuel materials or the materials contaminated with nuclear fuel materials”. Based on this confirmation, the Minister grants the license after consulting with JAEC and NSC.

As for designated radioactive wastes, based on the Final Disposal Act, METI has to consult for the amendment of final disposal plan and basic policy on site selection of preliminary investigation areas, etc., with JAEC and NSC.

In September 2002, NSC made the report on the environmental requirements, those were for earthquake, fault activity, volcano/volcanic activity, etc., at the stage of site selection of preliminary investigation areas, to give necessary comments from the point of safety regulation view and to establish the criteria to environmental requirements in the process of amendment for final disposal plan, etc.

H3.2 Information for general public

The license application documents based on the Reactor Regulation Act and other related information are made open to the public at the Nuclear Energy Library and at the Nuclear Library Room of JNES, except for the information relevant to nondisclosure causes such as safeguards and commercial sensitiveness. Such information is also accessible and available at the National Diet Library. A document requested to an administrative agency under the ”Act on Access to Information held by Administrative Organs“ is also disclosed in accordance with the provisions of the Act, unless it is subject to nondisclosure causes.

Also as for the safety related information on a facility for waste disposal regulated by the Radiation Disease Prevention Act, a document requested under the ”Act on Access to Information held by Administrative Organs“ is disclosed, unless it is subject to nondisclosure causes.

In September 2006, the Radioactive Waste Subcommittee under the Nuclear Energy Subcommittee of the Advisory Committee for Natural Resources and Energy reported to expect the comprehensive safety explanatory (safety case), etc., when a business entity makes the report on preliminary investigation result and detailed investigation.

The Committee on Final Disposal Safety Investigation of Designated Radioactive Wastes of the NSC established “On Concept of Safety Communication for Geological Disposal” in January 2011, considering that establishment of both the safety regulatory framework with focus on securing robustness of long term safety function of the disposal facility, and the safety communication system which allows stakeholders to be involved to make it reliable enough to ensure long term safety through the framework, in order to establish reliability of long term safety of geological disposal.

H3.3 Relation with neighboring contracting parties

The government of Japan provides neighboring countries with information on the status of the nuclear energy of Japan through bilateral consultation, and various exchange of opinions. Moreover, in the case when a safety significant event should occur at a facility in our country, Japan will provide prompt and comprehensive information to the neighboring countries.

H4 Design and construction of facilities

Article 14

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

(i) the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;

(iii) at the design stage, technical provisions for the closure of a disposal facility are prepared;

(iv) the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

H4.1 Prevention of radiological impacts on individuals, society and the environment

1. Waste Storage facility

Based on the Reactor Regulation Act, the holder of the license for Waste Storage must describe, in the application document for the approval of the design and construction methods for the activity, the methods of the design and construction of the on-site waste treatment and storage systems for the radioactive wastes generated from the operation of the activity, and must demonstrate in the attachments to the application document that the design and construction of the facility are consistent with relevant technical standards. The Minister of METI reviews the application and issues a license based on the Reactor Regulation Act when compliance with the technical standards is confirmed.

The “Technical Standard for the Design and Construction Methods” provides the standards for the confinement function, shielding and other necessary features for the prevention of radiological hazards. As an example of the technical standard for the design and construction methods, the “Technical Standard for the Design and Construction Methods for Specific Waste Disposal Facility or Specific Waste Storage Facility” are shown in the Section L Table H4-1.

2. Category 1 waste disposal facility

Based on the Reactor Regulation Act, the holder of the license for Category 1 waste disposal (Category 1 waste disposal licensee) is required to obtain the approval for the design and construction methods for the specific waste disposal facility including waste receiving system, waste handling system and radiation control system prior to the start of construction, and to pass the Pre-Service Inspection conducted by the Minister of METI before starting operation. The procedures and the technical standards for the design and construction methods are the same as those for Waste Storage facility.

In addition, a Category 1 waste disposal facility is required to undergo Confirmation of Disposal Facility based on the Reactor Regulation Act by the Minister of METI for the disposal site and the shafts and tunnels for the duration of operation. The confirmation is made based on the relevant ordinances on the geography, geology and groundwater at the disposal site as well as the design and structure of the disposal facility, with the criteria “to be consistent with the contents described in the license documents”, “not to dispose explosive materials, materials that significantly corrode other materials and other hazardous materials in the waste disposal site” and “to backfill the site as stated in the license document”. The waste to be disposed of has to undergo the Confirmation of Waste Packages based on the relevant ordinances by METI to confirm that “the waste is encapsulated or solidified”, “radioactivity concentration does not exceed the licensed level”, “the waste package has sufficient strength to endure the loads imposed when disposed” and “the waste is not significantly damaged.”

3. Category 2 waste disposal facility

Based on the Reactor Regulation Act, the holder of the license for Category 2 waste disposal (Category 2 waste disposal licensee) is not required to obtain the approval for the design and construction methods or to undergo pre-service inspection for the waste disposal facility by the Minister of METI, but is required to undergo Confirmation of Disposal facility performed by the Minister of METI for the duration of operation. The waste to be disposed of has to undergo the Confirmation of Waste Packages carried out by the Ministry of METI.

4. Waste management facility under the Radiation Disease Prevention Act

A person to obtain a permission of waste management service shall submit an application for the permission to MEXT. The application shall include the description documents on the method of management, the locations, structures and equipments of waste refilling facility, waste storage facility and waste management facility as attachments.

The provisions concerning the location, structure and equipment of each facility require the applicant, in order to restrain possible radiological effects, to ensure that shielding walls, other shields, ventilation equipments, and drainage equipments are consistent with the technical standards prescribed by laws and ordinances.

The license holder of the radioisotope waste management services is obligated to take Pre-Service Facility Inspections by the Minster of MEXT or his/her representative and obtain its confirmation that the facilities comply with these technical standards.

H4.2 Provisions for the decommissioning of a radioactive waste management facility other than a disposal facility at the design stage

Radioactive waste depositories are installed as auxiliary facilities for the nuclear fuel fabrication facility, reactor facility, spent fuel storage facility, reprocessing facility and radioactive waste storage facility. The decommissioning procedures for each of these facilities are provided for by the Reactor Regulations Act and other relevant laws and regulations. At the stage of decommissioning, the license holder must establish a decommissioning program for each facility and have it approved by the Minister of METI.

Also, under the Radiation Disease Prevention Act, at each stage (including decommissioning) of license application, the license holder shall be subject to the approval for the conformity to the technical standards applicable to the storage or processing facility

H4.3 Provisions for the closure of a disposal facility

Implementation of closure of a waste disposal facility must be described in the license application documents for the radioactive waste disposal. When the Category 1 waste disposal licensee plans to close the shafts and tunnels, based on the Reactor Regulation Act, the licensee is required to establish a closure program and have it approved by the Minister of METI.

H4.4 Technologies incorporated in the design and construction of a radioactive waste management facility

When applying for approval of the design and construction methods, the operator must demonstrate with analysis, etc. that the design and construction methods meet relevant technical standards. The regulatory body reviews the application and issues an approval after confirming that the design and construction methods meet relevant technical standards.

The operator must pass the pre-service inspection conducted by the regulatory body before operating the facility.

Under the Radiation Disease Prevention Act, similar process is applied.

H5 Assessment of safety of facilities

Article 15
Each Contracting Party shall take the appropriate steps to ensure that:
(i) before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;
(ii) in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;
(iii) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

H5.1 Safety and environmental assessment of a radioactive waste management facility

1. General provisions

In Japan, fuel fabrication, establishment and operation of reactors, spent fuel storage, reprocessing, waste storage, waste disposal and utilization of nuclear fuel materials fall within the scope of the radioactive waste management defined in the Convention. These activities are individually subject to the license under the Reactor Regulation Act. An applicant for a license carries out a systematic safety assessment and an assessment of radiological impacts on the environment, taking into account the meteorology, ground structure, hydraulic phenomena, earthquake, social environments around the site and safety design of the facility. On the basis of such assessments, the regulatory body examines the appropriateness of siting and basic design of the facility, systems and components from the viewpoint of hazard prevention.

The guide prepared by the NSC for the safety review for each license provide, as the siting conditions common to nuclear facilities, that “there should be no factor that could induce a serious accident” and that “there should be little factors that could expand accident influence”. The “Basic Guide for Safety Review of Category 2 Radioactive Waste Disposal” is shown in Section L Table H5-1 as an example of safety review guidelines.

2. Waste Storage facility

The “Basic Approach for Safety Assessment of Radioactive Waste Management Facilities” prepared by the NSC for the safety review of a Waste Storage provides that the seismic design of a high level solid radioactive wastes storage facility shall be assessed including that shielding function as well as confinement function is adequately maintained during an earthquake.

In Japan, radioactive waste storage facility, same as one established with reprocessing facility, etc., is established as an independent facility. In spite of the differences of type or treatment process of waste, it is possible to conduct the safety evaluation of radioactive waste storage facility in accordance with the same principal concept as reprocessing facility, because the processes of the radioactive waste storage are involved in the waste storage system of the reprocessing facility etc.
The general provisions described above are applied also to a waste storage.

3. Category 1 waste disposal facility

Based on the Reactor Regulation Act, an applicant for the Category 1 waste disposal license has to show the property and quantities of nuclear fuel materials or materials contaminated with nuclear fuel materials to be disposed of, the location, structure and systems of the waste disposal facility as well as disposal method to the Minister of METI, and obtain license from the Minister. A basic approach to safety review will be established by the NSC in near future considering the progress in the implementation of disposal.

4. Category 2 waste disposal facility

As for Category 2 waste disposal, the NSC prepared the “Basic Guide for Safety Review of Category 2 Radioactive Waste Disposal” for “near surface disposal” and “subsurface disposal” (see section L Table H5-1). This guide adds the safety assessment for subsurface disposal in the safety assessment for the existing low level radioactive waste disposal.

5. Disposal Facility under the Radiation Disease Prevention Act

For granting the license for the disposal facilities under the Radiation Disease Prevention Act, the competent regulatory body examines the appropriateness of the site conditions and the compliance with the technical standards. Relevant guidelines and standards require that the facility be constructed at a site that has little chance to be affected by land slide or flooding, to adopt fire-proof structures or to use incombustible materials for the essential parts of the facility, etc., and to provide with shielding function such as shielding walls.

H5.2 Safety and environmental assessment of after closure of a disposal facility

The safety of disposal facilities is regulated in accordance with the provisions of the Reactor Regulation Act and its enforcement ordinance, and the Ministerial Ordinances or Notifications such as the “Rules for Category 1 Waste Disposal” and the “Rules for Category 2 Waste Disposal.” These rules require the license application document to be attached by “explanation on the control of radiation exposure due to nuclear fuel materials, etc.” that also describes long-term safety assessment including post-closure period. In addition, Periodic Safety Review is conducted on the basis of the latest knowledge, to confirm that long-term safety will be ensured also after the construction of a geological disposal facility or intermediate depth disposal facility. The assessment is performed at an appropriate timing (including timing necessary for technical succession in operators) as a part of safety steps and the necessary measures are taken based on the assessment results. Through this Periodic Safety Review, a systematic safety assessment for the period following closure until termination of the activity is carried out.

The Radiation Disease Prevention Act is also in process to provide the same requirements.

H5.3 Update of safety and environmental assessment of a spent fuel management facility

The Reactor Regulation Act provides for the procedures for "licensing or notification of change of license" to appropriately address a change of the application documents for the license granted in accordance with the Act.

The detailed design of the facility has to follow the procedures for “approval for the design and construction methods” and any change of the design or construction methods is also subject to such procedures. In addition, the government confirms that the facility has been built as approved through “pre-service inspection”.(See Section H4.4 and H6.1)

The Radiation Disease Prevention Act also provides the similar requirements.

H6 Operation of facilities

Article 16

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

(i) the license to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;

(v) procedures for characterization and segregation of radioactive waste are applied;

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

(vii) programmes to collect and analyze relevant operating experience are established and that the results are acted upon, where appropriate;

(viii) decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;

(ix) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

H6.1 Permission to operate a radioactive waste management facility

1. Waste Storage and Category 1 Waste Disposal

The Reactor Regulation Act provides that Waste Storage facility (the radioactivity of the waste is equal to or more than 3.7TBq.) and specified waste disposal facility (Waste Acceptance Facility, Waste Handling Facility, Instrumentation and Control Facility, Radiation Control Facility and Associated Facilities) in Category 1 Waste Disposal shall not be used before getting through the Pre-Service inspections conducted by the Minister of METI for the construction and performance of the facility. The facility passes the pre-serve inspection only if it is confirmed that "the construction has been done in accordance with the approved design and construction plan" and "the performance of the facility meets the technical standards for performance". "The technical standards for performance" are specified by the Minister of METI as follows:

- The alarm system, emergency power supply system and other emergency systems and interlocks (devices to actuate the systems or equipment only under specific conditions) described in the license application documents or their attached documents shall operate reliably under the conditions described in those documents.
- The radioactive waste disposal systems shall have more capability than described in the license application documents or their attached documents.
- The main radiation control systems shall have the capability described in the license application documents or their attached documents.
- Dose equivalent rate and concentrations of airborne radioactive materials in the always-manned areas of the Waste Storage facility and Category 1 waste disposal facility, the areas with workers during the operation of the facility, and other areas that require radiation control shall be less than those described in the license application documents or their attached documents.

In Category 1 Waste Disposal, the facilities other than specified waste disposal facilities must be confirmed by the Minister of METI, similarly as the case with Category 2 Waste Disposal

2. Category 2 Waste Disposal

Category 2 waste disposal requires no approval for the design and construction methods nor pre-service inspection. However, based on the Reactor Regulation Act, the waste disposal facility has to undergo the Confirmation of Disposal Facility by the Minister of METI. The confirmation is conducted at the following timing:

- The confirmation regarding installation of the waste disposal facility is conducted when the dimensions of the major parts of individual system become measurable, except for radiation control system.
- The confirmation regarding installation of radiation control system is conducted when the installation of the system is completed.
- Confirmation regarding the shafts and tunnels (only for intermediate depth waste disposal facility) is conducted when backfill of the shafts and tunnels and closure of the mouth are carried out.
- Confirmation regarding other items is conducted when the waste disposal facility is covered with earth and sand or when the Minister of METI deems appropriate.

The confirmation is conducted according to the technical standards shown in Section L Table H6-1: “1. Technical Standard for Waste Disposal Facilities” and “2.Technical Standard for Radioactive Waste to be Disposed.”

3. Radioactive waste management under the Radiation Disease Prevention Act

The operator of the waste management facility under the Radiation Disease Prevention Act shall be subject to the approval for the license mainly as described in the previous section. And the license holder shall be subject to pass the pre-service inspection before the operation of the facility and shall not use the facility until after it has passed the inspection.

As described above, Government of Japan takes steps to ensure that the license to operate a waste disposal facility or waste storage facility is based upon appropriate assessments as specified in previous Article and is conditional on the completion of a commissioning program demonstrating that the facility, as constructed, is consistent with design and safety requirements.

H6.2 Operational limits and conditions

The operator regulated by the Reactor Regulation Act must establish “Operational Safety Program” and obtain approval before starting operation of the facility. The Operational Safety Program have to specify concrete steps for operation of the facility, inspections of maintaining the facility, radiation monitoring and quality assurance. The operation and maintenance of the facility have to be performed in accordance with the specific operational limits defined in the Operational Safety Program. The operator must undergo quarterly inspection (Operational Safety Inspection) by the regulatory body to confirm the compliance with the Operational Safety Program. In addition, when the annual facility Periodic Inspection indicates that performance of the Waste Storage facility and Category 1 waste disposal facility does not comply with the technical standards, or the operational safety measures for the maintenance of the facility violate provisions of the ministerial order, the Minister of METI may order the operator to take necessary operational safety measures such as suspension of operation, modification, repair, or instruction on the facility operation.

Operator licensed under the Radiation Disease Prevention Act, before the start of operation, shall prepare the Internal Rules for Prevention of Radiation Hazards specifying details of inspections, radiation measuring and treatment of radioactive wastes, and notify it to the Minister of MEXT. The Internal Rules shall specify operational requirements, and the facility shall be operated and maintained in compliance with the Rules.

H6.3 Operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility

1. Waste Storage

When operating a Waste Storage facility, the operator must take operational safety measures for “maintenance of waste storage facility”, “operation of waste storage facility” and “transportation and treatment (only within the premises of the facility that is installed with the waste storage facility) of the nuclear fuel material or material contaminated by nuclear fuel material” in accordance with the provisions of the Reactor Regulation Act. Other measures for, “record of radiation control, etc. (record of monitoring result, etc.)”, “access control to controlled areas”, “measures for radiation dose”, “patrol and inspection of waste storage facility”, ”maintenance of waste storage facility”, “periodical self-inspection of waste storage facility”, “operation of facility relevant to waste storage facility”, “Periodical Safety Review of waste storage facility”, “on-site transportation” and “on-site disposal” are provided for in a ministerial ordinance.

The operator must establish the Operational Safety Program covering the above measures and obtain approval of the Minister of METI before starting operation of the facility. (Items to be described in the Operational Safety Program are shown in the Section L TableH6-2.)
In addition, operator must undergo Operational Safety Inspection conducted quarterly by the Minister of METI to confirm the status of compliance with the Operational Safety Program.

2. Category 1 and 2 waste disposal

For the use of waste disposal facility, the Reactor Regulation Act requires the same steps as described above for Waste Storage facility. The Ministerial Ordinance provides for “periodic evaluation, etc. of waste disposal facility” as the steps to be taken after closure of the waste disposal facility. Specifically, the Ministerial Ordinance requires “to evaluate the radiation exposure control due to nuclear fuel materials, etc. in the light of the latest technical knowledge” and “to take necessary measures for the preservation of waste disposal facility on the basis of the results of such evaluation”.
The timing of the assessment shall be: for Category 1 waste disposal, at an interval of less than 20 years after the date of grant of license and when a closure program or decommissioning program is developed; and for Category 2 waste disposal of intermediate depth disposal, at an interval of less than 20 years after the date of grant of license and when the stage of step-wise control.

3. Waste management under the Radiation Disease Prevention Act

Waste management license holder under the Radiation Disease Prevention Act, before the start of operation, shall prepare the Internal Rules for Prevention of Radiation Hazards and notify it to the Minister of MEXT. The conformity to the Internal Rules shall be confirmed through Periodic Inspections and the On the Spot Inspections conducted by the Minister of MEXT or his representative, through these procedures the appropriate operation of the facility is maintained.

H6.4 Engineering and technical support in all safety-related fields

During operation of a facility, the regulatory body obtains engineering and technical advice of expert committees on operational management, inspection and radiation control and feeds it back, when necessary, to operation, maintenance or safety regulation.
For example, NISA has a system to collect experts' engineering and technical advice through the deliberations on the specific safety regulation policies by the advisory councils set up under the Nuclear and Industrial Safety Subcommittee of the Advisory Committee for Natural Resources and Energy.

Operators are accumulating the latest technological information through collecting domestic and overseas operational experience information, technological development on their own funds, maintenance activities, etc. Private technical support organizations are also making a variety of supporting activities.

H6.5 Characterization and classification of radioactive waste

The Reactor Regulation Act regulates the on-site waste treatment, grouping the wastes into "gaseous waste", "liquid waste" and "solid waste", and provide for the methods of on-site treatment of these groups of waste. Examples of the provisions are shown in Section L Table H6-3.
In addition, the disposal methods by burial are categorized into "Category 1 waste disposal" and "Category 2 waste disposal" according to the concentration of each radioactive nuclide in the wastes that are provided for in the Enforcement Ordinance for the Reactor Regulation Act.

By the Radiation Disease Prevention Act, the equivalent procedures are required in accordance with the specification of wastes except for disposal by burial that is in process of establishment.

H6.6 Report to the regulatory body in a timely manner by the licensee

The Reactor Regulation Act provides that an operator shall report without delay the status of the event and other necessary matters when an accident accompanying personal injury (including the case with potential personal injury) or a failure or other event has occurred in a milling facility, a fuel fabrication facility, a reactor facility, a spent fuel storage facility, a reprocessing facility, waste storage facility, waste disposal facility or a fuel material use facility. Reportable events are specified by relevant ministerial ordinances that regulate the activity concerned. Examples of reportable events are shown in Section L Table H6-4.

The Radiation Disease Prevention Act requires the operators to report to regulatory body without delay about the content and counter-measure of accident in radioactive waste management facility.

H6.7 Programs to collect and analyze relevant operating experience

Upon receipt of a report on an accident or failure, the regulatory body immediately makes the report open to the public. It examines and evaluates the status of cause investigation and recurrence prevention measures, and distributes the results. The information on the accident or failure is further investigated to extract lessons on safety and to improve safety regulation as appropriate.
For the accumulation of information, NISA instructs JNES to maintain a system to collect and evaluate domestic and overseas safety information. The accumulated information is shared between NISA and JNES through regular meetings to appropriately feed back the information to a regulatory response or its follow-up.
As for international information exchange, Japan shares accident/failure information through cooperation with international organizations such as IAEA and OECD/NEA as well as through bilateral cooperation.

H6.8 Decommissioning plans for a radioactive waste management facility other than a disposal facility

An operator that plans to terminate its activity must take necessary steps for “decommissioning” such as dismantling of the facility, assignment of nuclear fuel material inventory and management of materials contaminated with nuclear fuel materials. For that purpose, the operator has to establish a “decommissioning program” and obtain an approval of the Minister of METI for it.

The criteria for approving decommissioning program are that all nuclear fuel materials have been removed from the facility; nuclear fuel materials are appropriately transferred; materials contaminated with nuclear fuel materials are appropriately managed; and decommissioning work is appropriately implemented in a way to prevent a hazard due to nuclear fuel materials or materials contaminated with nuclear fuel materials. The decommissioning program is developed by using the information obtained during the operating period of the facility. The procedures for “Approval for Modification of Decommissioning Program” are provided for to allow update of the decommissioning program when necessary, which ensures that the plan is reviewed by the regulatory body.

An operator of the facility of radioisotope waste management services licensed under the Radiation Disease Prevention Act, in order to terminate the services, shall notify to the Minister of MEXT. The operator shall take measures such as decontamination of materials contaminated by radioisotopes, and the action program shall be prepared by reflecting the operational experience of the facility and the operator shall report to the Minister of MEXT about the program and the measures taken.

H6.9 Plans for the closure of a disposal facility

When the Category 1 waste disposal licensee plans to close the tunnels and shafts, it must take "closure steps" including backfill of tunnels and shafts, closure of pit mouths and dismantling of the underground facilities. Prior to that, the operator must establish a "closure program" and have it approved by the Minister of METI based on the Reactor Regulation Act. The criteria for approving the closure program are that the closure of the facility is carried out according to the conditions described in the license application documents based on the Reactor Regulation Act and in an adequate way to prevent radiological hazards due to nuclear fuel materials or other radioactive materials. The closure program is prepared using such information obtained during the operating period of the facility. The procedures for “Approval for Modification of Closure Program” are provided for to allow update of the Closure Program when necessary, which ensures that the program is reviewed by the regulatory body.

An operator of the facility of radioisotope waste disposal licensed under the Radiation Disease Prevention Act, in order to terminate the operation of disposal facility, shall take necessary measures to prevent radiation hazards. The action program shall be prepared by reflecting the information obtained during the operation of the disposal facility and he shall report to the Minister of MEXT about the measures taken.

H7 Institutional measures after closure

Article 17

Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

(i) records of the location, design and inventory of that facility required by the regulatory body are preserved;

(ii) active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and

(iii) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

H7.1 Preserve of required records

1. Category 1 waste disposal

Licensee shall preserve the following records concerning the waste disposal for a period of time pursuant to the provisions of the Reactor Regulation Act.

- Records on disposal of Category 1 waste
- Inspection records on specified waste disposal facility
- Radiation control records
- Operation records
- Maintenance records
- Records of accidents in waste disposal facility
- Meteorological records
- Level of groundwater
- Records on operational safety education
- Documents on quality assurance program and records on plans, implementation, evaluation and improvement of quality assurance program
- Results of periodic assessment of waste disposal facility for geological disposal
- Records on physical protection
- Results of closure confirmation
- Methods and time of decommissioning, and names of auxiliary systems of the repository to be decommissioned
- Records on materials subject to clearance confirmation

2. Category 2 waste disposal

Similar to the case of Category 1 waste disposal, licensee shall preserve the following records concerning the disposal for a period of time pursuant to the provisions of the Reactor Regulation Act.

- Records disposal of on Category 2 waste
- Radiation control records
- Maintenance records
- Records of accidents in waste disposal facility
- Rainfall records
- Level of groundwater
- Records on operational safety education
- Documents and records on plans, implementation, evaluation and improvement of quality assurance program
- Results of periodic assessment of waste disposal facility for intermediate depth disposal
- Records on physical protection
- Methods and time of decommissioning, and names of auxiliary systems of the repository to be decommissioned
- Records on materials subject to clearance confirmation

H7.2 Active or passive institutional controls

1. Category 1 Waste Disposal

The Reactor Regulation Act provides for decommissioning procedures (dismantling of auxiliary systems of waste disposal site, removal of contamination with nuclear fuel materials, transfer of nuclear fuel materials and other radioactive materials and transfer of radiation control records to an organization assigned by the Minister of METI) after closure of a Category 1 waste disposal. Decommissioning Program of a waste disposal facility is subject to approval by the Minister of METI. For establishing a decommissioning program, the operator is required to perform an assessment of the control of radiation exposure due to nuclear fuel materials and other radioactive materials with the latest technical knowledge and to take necessary measures for the preservation of the waste disposal facility on the basis of the assessment.

The activity terminates after getting confirmation that no radiation hazard prevention measure is required for the site of auxiliary facilities to be decommissioned as well as for the remaining facilities in the site; disposal of nuclear fuel materials, etc. has been completed; and transfer of radiation control records to an organization assigned by the Minister of METI has been completed.

Institutional control of a closed facility is deemed to be helpful to further reduction of undue human activities such as careless intervention in waste and to the promotion of public acceptance of geological disposal and safety.
As an example of specific institutional control, the Final Disposal Act designates the released site as a preservation area in response to the operator's request and restricts excavation work within the conservation area.

2. Category 2 Waste Disposal

“Basic Guide for Safety Review of Category 2 Radioactive Waste Disposal” established by NSC requests to assess radiation dose after the period for active control to the residents or to intruder, according to the 4 scenarios, those are depending on disposal methods, as likely scenario, less-likely scenarios, very unlikely scenario, and human intrusion scenario, and to confirm each result satisfies the target dose for each scenario. The “Basic Guide for Safety Review of Category 2 Radioactive Waste Disposal” also requests, in order to restrain dose to the public as low as reasonably achievable, to control the waste disposal site step wisely (hereinafter referred to as “stepwise control”) until the time when the impact of the radioactive materials to the biosphere will remain at a safe level due to the decrease of radioactivity over time.

The regulatory body requests a license applicant for waste disposal to submit a plan for stepwise control and examines the conformity to the requirements specified in the “Basic Guide for Safety Review of Category 2 Radioactive Waste Disposal.”
The Radiation Disease Prevention Act also provided the similar system.

The Stepwise Control required by “Basic Guide for Safety Review of Category 2 Radioactive Waste Disposal” is as follows.

(1) The case of subsurface disposal[*1]

< Stage up to backfilling >

This is a stage that requires preventing release of radioactive materials using engineered barriers[*2] to the outside of the engineered barriers, and surveillance to verify that there is no release of radioactive materials from the engineered barriers.
In this stage, a perimeter surveillance area shall be established around the waste disposal facilities, to which access control shall be provided. A disposal preservation area shall also be established within the area to provide patrols and inspections.

No release of radioactive materials from the engineered barriers constructed in the waste disposal facilities shall be verified through surveillance, and the engineered barriers shall be checked to determine if they are constructed as designed.

If any release of radioactive materials or abnormal conditions of engineered barriers were to be discovered, then required measures such as repairs shall be taken.

< Stage after backfilling >

This is a stage that requires restricting migration of radioactive materials to the biosphere using engineered and natural barriers[*3], and taking measures to restrict or inhibit specific actions.

In this stage, the disposal preservation area shall be established to provide patrol and inspection as well as to restrict or inhibit specific actions such as unplanned excavations in this area.

Radioactive materials released from the near surface or sub-surface disposal facilities to the biosphere shall be surveyed by, for example, measuring the concentration of radioactive materials in the groundwater or other parameters.

*1 : "Subsurface disposal[*1]"means the disposal of radioactive waste, which is encapsulated in the container or solidified in the waste disposal area provided with the engineered barrier at the depth with sufficient margin for common usage of the underground.

*2 : "Engineered barrier" means the engineered structure which is installed in order to prevent or to reduce leak of the radioactive material from disposed radioactive solid waste into the living environment

*3 : "natural barrier" means the host rock or the foundation that exists around the engineered structure or the solid radioactive material, and is expected to restrict migration of the radioactive material, which leaks from the solid radioactive material into living environment.

(2) The case of pit disposal[*4]

< Stage 1 >

In this stage, a perimeter surveillance area shall be established around the waste disposal facilities, to which access control shall be provided. The disposal preservation area shall also be established in the area to provide patrols and inspections.

No release of radioactive materials from the engineered barriers constructed in the near surface or sub-surface disposal facilities shall be verified through the surveillance. If any release of radioactive materials from the engineered barriers were to be discovered, then required measures such as repairing the engineered barriers shall be taken.

< Stage 2 >

In this stage, a perimeter surveillance area shall be established around the waste disposal facilities, to which access control shall be provided.

Radioactive materials released from the near surface or sub-surface disposal facilities to the biosphere shall be surveyed by, for example, measuring the concentration of radioactive materials in the groundwater and other parameters.

< Stage 3 >

In this stage, a disposal preservation area shall be established to provide patrols and inspections, as well as to restrict or inhibit such actions as farming in this area.

*4 : " Pit disposal" means the disposal of radioactive waste, which is encapsulated in the container or solidified in the near surface of the waste disposal site where the engineered barrier is provided.

(3) The case of trench disposal[*5]

< Emplacement stage >

In this stage, a perimeter surveillance area shall be established around the waste disposal facilities, to which access control shall be provided. A disposal preservation area shall also be established in the area to provide patrols and inspections.

Concentration, etc. of radioactive materials that migrate from the near surface or sub-surface disposal facilities to the biosphere shall be surveyed by, for example, measuring the concentration of radioactive materials in the groundwater and other parameters.

< Preservation stage >

In this stage, a disposal preservation area shall be established to provide patrols and inspections, as well as to restrict or inhibit such actions as farming in this area.

*5：” Trench disposal” means the disposal of radioactive solid waste, which is not solidified in the container, in the near surface of the waste disposal site where the engineered barrier is not provided.

Thus, the safety assessment of the waste disposal facilities during the active control period should be conducted based on the stepwise control described above, taking into account any decrease of performance of the systems in the near surface or sub-surface disposal facilities over time.

The active control should be terminated within 300 to 400years for subsurface disposal and pit disposal. And, in the case of trench disposal without engineered barrier, as the disposed waste is non-solidified concrete etc. with low radioactivity level, emplacement stage and subsequent 50years preservation stage are regarded as the “limited time period”.

H7.3 Intervention measures

When issuing a license, the regulatory body requests the operator to take following measures during each stage of institutional control.

In the First Stage, if a leakage of radioactive material from engineered barriers is detected, the operator who would dispose radioactive waste in the Category 2 by near surface pit disposal facility without artificial barrier should immediately repair the barriers to prevent leakage. In the Second Stage, the operator should monitor leakages from engineered barriers and, if necessary, take measures to retard migration of radioactive material. At the same time, the operator should conduct patrol and inspection of the disposal facility and, if necessary, restore the cover soil and others. In the Third Stage, the operator should conduct patrol and check and, if necessary, restore the soil cover and others.

The Radiation Disease Prevention Act also requires similar control to the waste disposal in its scope.

Section I Transboundary Movement

Article 27

1. Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments.

In so doing:

(i) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

(ii) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;

(iii) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

(iv) a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement;

(v) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

2. A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

3. Nothing in this Convention prejudices or affects:

(i) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;

(ii) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;

(iii) the right of a Contracting Party to export its spent fuel for reprocessing;

(iv) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

The electric power utilities in Japan have concluded reprocessing contracts with British and French firms and had exported 7,100 tons of spent fuel between 1969 and 2001.They, in return, receive nuclear fuel material recovered from the spent fuel and vitrified packages (HLW) generated in the reprocessing. 1,338 vitrified packages were sent back to Japan between 1995 and March 2011 and the remaining packages will be returned in the next ten-odd years. As they are constructing a reprocessing plant at Rokkasho Village in Aomori Prefecture since 1993, there has not been any export of spent fuel originated from commercial nuclear power reactors after 2002.

I1 Transboundary movement

I1.1 Steps to Ensure Prior Notification and Consent of the State of Destination

For the export of the spent fuel or the radioactive waste, the Foreign Exchange and Foreign Trade Control Law provides that an applicant should apply for and obtain the Export Permit from the Minister of METI. This Export Permit should be applied once it is confirmed that the authorities of the State of destination recognized the administrative and technical capacity of the importer.

I1.2 Steps to Ensure Transboundary Movement Subject to International Obligations

Japanese domestic laws, such as the Ship Safety Law, etc, have incorporated obligations under the IAEA Regulations for the Safe Transport of Radioactive Materials and relevant international conventions on each mode of transport, such as International Convention for the

Safety of Life at Sea (SOLAS), etc.

I1.3 Consent as a State of Destination

After being notified by a State of origin of a transboundary movement to Japan of the spent fuel or the radioactive waste, the government of Japan decides whether it gives consent to the transport, and notifies its decision to the State of origin.
Japan expressed that, upon notification from a State of origin, it would consent to the import of returned radioactive waste as long as such transport would comply with the safety regulation of Japan.

I1.4 Confirmation of the Capacity of a State of Destination

The Foreign Exchange and Foreign Trade Control Law provides that an exporter should apply for and obtain the Export Permit from the Minister of METI for the export of the spent fuel or the radioactive waste. The Minister of METI judges the grant of the Export Permit after confirming the general conditions of safety of the country of destination such as its regulatory structure, the membership in relevant international agreements, and the administrative and technical capacity of the importing body.

I1.5 Steps to Permit Re-entry in case of Uncompleted Transboundary Movement

The Import Trade Control Order allows, as special exemption, re-entry of exported goods, in case of uncompleted transboundary movement so long as original characteristics and configuration of exported goods are preserved, and the other case of the exemption is a transport accident. Re-entry of exported spent fuel and radioactive waste is allowed by that provision.

I2 Prohibition of shipment to a destination south of latitude 60 degrees South

The Foreign Exchange and Foreign Trade Control Law provides that an applicant should apply for and obtain the Export Permit from the Minister of Ministry of Economy, Trade and Industry for the export of the spent fuel or the radioactive waste. The Export Permit shall not be granted for the export of spent fuel or radioactive waste to a destination south of latitude 60 degrees south for storage or disposal.

J Disused Sealed Sources

Article 28

1. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal sealed sources takes place in a safe manner.
2. A Contracting Party shall allow for reentry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

J1 The infrastructure for regulatory control of sealed sources

The use of radioisotope and radiation generation apparatus etc, are regulated by the Radiation Disease Prevention Act, as mentioned in paragraph E2.1 Sealed sources are also regulated by this Law.

As there are about 7000 licensees, each licensee is responsible for the safety and radioisotopes including sealed sources are properly controlled.

MEXT, as the competent regulatory authority, has been carrying out safety review and on-spot inspection.

It is recognized that Radiation Disease Prevention Act has been functioning effectively as stated below.

- The person who intends to use more quantities of radioactive sources than specified shall apply to MEXT for license, or notify MEXT.
- Radiation Disease Prevention Act provides technical criteria and requirements, such as criteria relating to the use of facilities, dose limits for radiation workers, etc. For example, the licensee is required, from the point of radiation safety, to; a) limit an access to storage facility, etc. by locking, etc.; b) install walls or fences to restrict easy access to the boundary of controlled area; c) restrict access to controlled area without permission of supervisor of the facility. These safety measures will effectively work also for security, such as physical protection.
- Licensee is responsible for annually reporting to MEXT regarding facility management such as the inventory of radioactive sources. MEXT carries out on-spot inspections of the facility if needed, and check that the inventory of radioactive sources is in conformity with the license.

As a result of this strict regulation system as described above, there has been no incident, such as excess exposure to the public by “orphan sources”.

J2 Management of radioactive sources

The licensee is regulated by law to hand over highly radioactive sources only to license holders who are authorized to possess and use the sources, and the disused radioactive sources are by practice handed over from the licensees to specific licensees. Licensees have obligation to report the results of such handover to MEXT when they terminate the use of sources.

The licensee has a responsibility to do an annual inventory check of both sealed and unsealed radioactive sources and to report the results to MEXT.

The “Radiation Disease Prevention Act” provides for penalty and clarifies licensee have the responsibility for safe control of the radioactive sources.

Most of sources in Japan are imported from foreign countries and the sources with long half-life and high activity are sent back to the original foreign manufactures.

Regarding the distribution of radioisotopes and sealed sources in Japan, one supplier (Japan Radioisotope Association) carries out consistently from distribution and delivery of almost all radioactive sources to recovery of disused radioactive sources.

As the result of this, there have been no incidents of serious radiation hazard involving radioactive sources or serious radiation hazard involving orphan sources until now.

J2.1 Criteria for the storage of disused sealed radioactive sources

The Radiation Disease Prevention Act lays down technical criteria relating to the storage of sealed sources as stated below.

- Sealed sources shall be put in containers and stored in storage pits or bins.
- Sealed sources shall not be stored in quantities exceeding storage capacity.
- Appropriate measures, such as a) installing a shield, b) distancing personnel from sealed sources, and c) shortening the time during which personnel may be exposed to radiation, shall be taken in order to prevent personnel engaged in handling of radioactive substances from being exposed to radiation exceeding the effective dose limit.
- Appropriate measures, such as immobilizing storage bins, shall be taken in order to prevent containers storing sealed sources from being carried from one place to another without permission.
- Appropriate measures shall be taken to prevent surface contamination from exceeding the surface contamination limit.
- Radioactive contaminated substance whose surface concentration exceeds one-tenth of the surface concentration limit shall not be taken out from the controlled area without permission.
- Notice showing the remarks necessary to prevent radiation hazards shall be posted at appropriate location within storage facilities.
- Appropriate measures shall be taken in order to prevent unauthorized persons from entering the controlled area.

J2.2 Response to missing radioactive sources

In case of loss of any radioactive source, the licensee shall immediately report the matter to the police and MEXT. While MEXT orders the licensee immediately to search the sources, the police carry out criminal investigations, if the loss relates to criminal acts.
In April 2008, MEXT introduced the notification system for evaluated rating of radioactive source events based on the additional guidance of the International Nuclear Event Scale.
Then, in April 2010, MEXT has started to apply the “INES –The International Nuclear and Radiological Event Scale - User’s manual 2008 Edition” issued by IAEA in 2009 to “INES Assessment for usage facility, etc. of Radioisotope” in Japan.

J2.3 Response to orphan sources

In case of find of any orphan source, the police immediately take an initial action including setting of exclusion area, radiation survey and immediate assessment of the situation. MEXT requests the discoverer of the source and relevant people that safety measures should be taken and also dispatch a radiation inspector to confirm that the safety measure has been properly taken. The found orphan source is to be recovered by the experts.

J2.4 Detection for orphan sources

About 30 percent of the operators of scrap metal recycle industry voluntarily carry out radiation monitoring with gate type monitors or portable monitors. At the gateway of almost all the blast furnace or electric furnace steel companies, which use such scrap metal, carry out radiation monitoring on acceptance of the scrap metal for use.
The steel industry and the scrap metal recycle industry are voluntarily taking measures such as development of manuals and training courses to cope with the discovery of orphan sources.
Under the initiative by U.S.DOE the Customs conducts inspections to detect such sources for export and import containers by having set up radiation measurement equipment and X-ray machines in main ports.

J2.5 Response to accident relating radioactive sources

In case of accidents involving radioactive sources, the police and fire service perform initial response immediately depending on the notification. MEXT dispatches radiation inspectors to advise the licensee to take suitable measures.

J2.6 Progress in establishing a National Registration System of Sealed Radioactive Sources

Based on the IAEA’s “Code of Conduct on the Safety and Security of Radioactive Sources”, the National Registration System of Sealed Radioactive Sources by which a licensee must report to MEXT the information on specification, receipt, delivery, etc. of sealed radioactive sources that exceed criteria of a certain quantity and have a possibility of affecting serious influence to human health (hereinafter referred to as “specified radioisotope*”) has been introduced by the amendment of the Rules for Enforcement of the Radiation Disease Prevention Act in October 2009 and enforced in January 2011.

The Registration System obligates a licensee to report of the information, such as periodically inventory of the specified radioisotope at the end of fiscal year and every time when the radioactive source is received and/or replaced by source exchange or registered information is changed by a processing and manufacturing etc.

The purpose of the system is to detect and deter an illegal trade and possession of the specified radioisotope. And in case of emergency, database on the registered information which include the specification and transaction etc. will be used for tracking the specified radioisotope against an early emergency response. And the “registration system of specified radioactive source” has been developed since 2007 so that a licensee has been able to report the necessary information by using the dedicated web-site. This system has shifted to a situation of full-scale use in January 2011, through graded trial use by the administrative guidance from August 2009 for the purpose of smooth operation of the system.

*: Equivalent to Categories 1, 2 and part of 3 of the classification based on RS-G-1.9 “Categorization of Radioactive Sources Safety Guide” issued by IAEA

J2.7 Consideration of long-term management of sealed radioactive sources unreturnable to manufacturers

As previously described, most of sealed radioactive sources used in Japan are made abroad, imported and returned to the foreign manufacturers after the use. Therefore, unreturnable sealed radioactive sources hardly exist in Japan. The storage and management of some unreturnable sealed radioactive sources are performed appropriately pursuant to the Radiation Disease Prevention Act, so it is considered that there exist no specific issues concerning to the unreturnable sealed sources under current situation.

J3 Reentry of returning sealed sources

The reentry of approved sealed sources which returned from abroad by a licensee manufacturer is allowed within the license of storage capacity. In this case, legal procedure on export and import that is consistent with the IAEA's “Guidance on the Import and Export of Radioactive Sources” shall be applied. The manufacturer intending to possess or renew the returned sealed sources is required to store them in accordance with the storage criteria mentioned in the regulations specified in the Radiation Disease Prevention Act.

J4 Compliance with the Code of Conduct on the Safety and Security of Radioactive Sources

As mentioned in the above paragraph J1 and J2, fulfillment of the IAEA's “Code of Conduct on the Safety and Security of Radioactive Sources” can be achieved under the regulation based on the Radiation Disease Prevention Act, etc.

For example, the “Guidance on the Import and Export of Radioactive Sources” issued by IAEA has already been introduced since January 2006 by the amendment of the Export Trade Control Order.

In addition, National Registration System of Sealed Radioactive Sources was introduced by the amendment of the Rules for Enforcement of the Radiation Disease Prevention Act (promulgated in October 2009 and enforced in January 2011) as mentioned in item J2.6.

MEXT made the interim guideline as provisional edition in May 2006 and is to complete the guideline for security of radioactive sources which operators should adopt. The domestic guideline hereafter will be completed by using the guideline for security of radioactive sources issued by IAEA in May 2006 as a reference.

Section K Planned Activities to Improve Safety

K1 Development of laws and related rules

There are safety examination guides and legislations, etc. to be prepared for safety regulations of radioactive waste management from now on, such as disposal of HLW, disposal of low level radioactive wastes with a comparatively high radioactivity concentration, disposal of uranium wastes, disposal of TRU wastes and radiation level which distinguishes materials not requiring management as radioactive wastes. These are shown in Table A1-1 as the status of activities concerning preparation of regulation on radioactive waste disposal.

NSC and the related regulatory bodies continue to study and prepare these safety examination guidelines and legislations etc.

Safety regulation for geological disposal of HLW is to be implemented as the safety review of the license application for geological disposal based on the Reactor Regulation Act. At the siting for selection of a final disposal site, NISA, as the involvement to the 3 staged site selection processes (selection of preliminary investigation areas, selection of detailed investigation areas, and selection of a final disposal facility) provided by the Final Disposal Act, deems to review adequacy of the outcome on safety conducted by the licensee.

K2 Safety research and regulatory support research

Since fiscal year 1976, NSC has been promoting research projects concerning the safety of nuclear installations, environmental radioactivity and radioactive waste through formulation of Five-year research plans (2001-2005) on nuclear safety and evaluation of their achievements. The products of these safety research projects have been reflected in the formulation of various standards and guidelines, including establishment of principles such as safety-ensuring policy, basic ideas, etc. and establishment of standards on specific means of achieving safety and specific guidance to be adapted to expansion and diversification of development and utilization of nuclear energy. NSC developed in August 2009 the “Prioritized Nuclear Safety Research Plan (Second Term)” that showed the prioritized items for safety research in the area of radioactive waste management and decommissioning to be challenged for 5 years started from 2010, in coordination with the status of preparation of relevant regulations (Table A1-1), environmental requirements for the stepwise procedure of site selection of high level radioactive waste final disposal and the development schedule of the regulatory guides.

NISA got together regulatory needs of “geological disposal”, “subsurface disposal”, “near surface disposal”, “clearance”, “returned waste”, and “decommissioning” in “On Needs for Nuclear Safety Research by NISA” (March 2006), and the regulatory support research has been conducted by the technical support organizations of NISA. Then, NISA reconfirmed the regulatory needs on the basis of changes of circumstances around the safety regulations of radioactive waste, such as amendment of the Reactor Regulation Act in 2007 and the review of Regulatory Guides by the NSC, etc., and then the report “Policy on Regulatory Support Research for Radioactive Waste Management and Disposal (2010-2014)” was established by Radioactive Wastes Safety Subcommittee of NISS/ACNRE in October 2009, and also the report “Policy on Regulatory Support Research for Decommissioning (2010-2014)” by Decommissioning Safety Subcommittee of NISS/ACNRE in November 2009. Then NISA established the Regulatory Support Research Program for Radioactive Wastes Management / Disposal and Decommissioning (2010-2014), which laid out yearly the research items which satisfied the regulatory needs.

The Regulatory Support Research Program is to be carried out mainly by JNES and it should be planned to develop the program by centralizing the outcomes which will be gained from all of the regulatory support researches, promoted under solid coordination with NISA. Regulatory support research program should also be intended to support assessment which will be conducted by the NSC, reviewing the timely report of the results of regulatory support research, because the regulatory support research is performed based on “Prioritized Nuclear Safety Research Plan” developed by the NSC. JNES is conducting its safety research comprehensively and systematically all over the nuclear area including radioactive waste management / disposal and decommissioning, however, as for its own safety research on these areas, research which has been carried out by JNES as its own regulatory support research has principally been the same as those in the programs. JNES is promoting exchange of technical information positively with universities, licensees, national basic research development agencies, academic institutes, and private companies, and is also promoting regulatory support research by utilizing the outcome gained from other than regulatory support research, taking into consideration the international trend of safety research on radioactive waste management / disposal promoted by IAEA and foreign countries.

In order to sustain the regulatory support research, JNES intends to promote meetings for information exchange in order to grasp trends of research among the relevant academic institutes and operators and to make discussion to find out any new items to be studied, from a viewpoint of both carrying out regulatory support research flexibly to utilize any new programs developed by licensees and also to utilize, if possible, any outcome to be gained from these researches other than regulatory support research.

K3 Measures to ensure reliability of technology by experiences, tests and analyses

For management of radioactive wastes, especially for disposal, it is important to improve its safety and reliability of disposal technologies.

Therefore, regulatory bodies continuously obtain specialist's engineering and technical advices and reflect them in operation and maintenance and safety regulations, as needed.
As safety research conducted by regulatory needs of the NISA in the area of the safety of spent fuel management and the safety of radioactive waste management, the study on safety technology of radioactive waste disposal (scheduled to be completed in 2013) is now being implemented.

On the other hand, operators continuously promote to buildup the latest technical information by collection of the internal and external information on operational experiences, technological developments by self-finance, maintenance and repair activities, etc.
For researches and developments of reliability improvement, the implementing body, NUMO continues to takes charge of technical development on geological disposal of HLW, aiming at safe operation and improvement for economical and efficient final disposal.

The national government and related research agencies are conducting researches and developments necessary for establishing safety regulations and assessment for final disposal, fundamental researches such as geoscientific research of deep underground and technical developments for reliability improvement of geological disposal technologies.
Especially, the institutes leaded by JAEA promote R&D under mutual independency for understanding of deep geological environments, confirmation of the reliability of geological disposal technologies, development of the advanced safety assessment methodology and contribution to the safety regulation along with “The basic research and development program on geological disposal of high level radioactive waste” (ANRE of METI and JAEA, December 2006) and “Important Research Program on the Nuclear Safety, the second stage ”(NSC, 2009).

And also, two deep underground research laboratories of JAEA are planned and expected to facilitate not only as the place of research and development of geological disposal, but also used as a cooperation to the activities of the government and the implementing body to deepen public understanding of the geological disposal in Japan.

Moreover, in July 2003, the Radioactive Wastes Safety Subcommittee of NISS/ACNRE showed the important research tasks which should be investigated from now on in the "Toward Ensuring Foundation for the Safety Regulation of High-Level Radioactive Waste Disposal", and those tasks will be promoted by the technical support organization for safety regulations, JNES, as a center, utilizing the results of researches of all organizations including the above-mentioned deep underground research laboratories, and the outcomes will be reflected in the preparation of the future safety regulation system.

K4 Continued research to improve reliability of disposal technology

In October 2009, basic policy for developing regulatory support research program was proposed in the report "On Regulatory Support Research for Radioactive Waste Management and Disposal (2010-2014)" established by the Radioactive Wastes Safety Subcommittee of NISS/ACNRE, and at the same time, the following suggestion was indicated as the recommendable system for regulatory support research:

- JNES is relevant to undertake scheduling the program by reviewing progress of regulatory support research and unifying outcomes under solid coordination with NISA. JAEA and Research Core for Deep Geological Environment of AIST are expected to provide assistance.
- In the area of geological disposal, it is desirable that JNES, JAEA, and AIST are to enter into "The Agreement of Cooperative Research on the Safety of the Geological Disposal of Radioactive Waste" and to promote implementation of cooperative research, exchange of human resources, and sharing of data. Utilization of the framework for research cooperation by these three agencies is also desirable to promote regulatory support research. It is also desirable to extend the scope of the cooperative research to the subsurface disposal which has much in common with geological disposal, and to intensify exchange of human resources among these agencies.
- In order to utilize the accumulated domestic and foreign research outcome appropriately, it is important that knowledge and experience are smoothly succeeded to the next generation. To that end, it seems useful for cultivation of human resources to utilize such chance like, for example, periodical development of "Regulatory Research Report for the Safety of Geological Disposal (tentative) ".

Based on the above proposal, the subcommittee approved "On Regulatory Support Research for Radioactive Waste Management and Disposal Program (2010-2014) " submitted by JNES. In the subcommittee, the outcome from the past research was laid out concretely, and at the same time detailed item to be studied was determined as regulatory support research by excluding one with less necessity, because the outcome from the research other than the regulatory support research could be utilized. Then, the research program, which meets the achievement date required by NISA, was finalized with the detailed and yearly-laid-out research item.

Thus, following the above research implementation system and the needs from NISA, the coordinated research projects, such as "Research on Applicability of the Safety Assessment Method for Horonobe Underground Research Program", are successively promoted under the agreement of research cooperation between JNES, JAEA, and AIST.

ANRE, in charge of NUMO, an implementing body, suggested in the interim report "On the Approach to the Research and Development of Geological Disposal" developed in May 2009, by Radioactive Waste Disposal Technical WG of Nuclear Energy Subcommittee of Electric Business Sectional Committee of ACNRE, the importance of more intensified coordination among the relevant agencies in the coordination meeting for basic research and development of geological disposal, of pointing out the needs from NUMO as the user of the outcome from the basic research, and of making request to increase younger participants into these research projects carried out by NUMO.

Also in October 2009, NUMO presented the strategy for rearrangement and presentation of its needs, roll-out of technical development in accordance with outcome from research, and improvement of technical capacity through medium-term acquisition and cultivation of human resources and also technical transfer from other research organizations.

In order to promote geological disposal project, NUMO reviewed needs for technical development in order to select detailed investigation areas, and developed the report in June 2010. NUMO published the report on technical achievement for geological disposal (review version) in November 2010, and the review by a special committee of Japan Atomic Energy Society was finished in the end of March 2011.

K5 Operation of sealed radioactive source tracking system

Based on the “Code of Conduct for Safety and Security of Radioactive Sources” adopted in the IAEA General Assembly in September 2003, MEXT introduced the registration system of radioactive sources, by amending the Rules for Enforcement of the Radiation Disease Prevention Act in 2009 and has started formal operation of the system since January 2011.

This target of the Registration System is the sealed sources with large amount of radioactivity that will affect to human health (specified radioisotope mentioned in the RS-G-1.9), as described in J 2.6, and the licensee must report the information such as specifications, receipt and delivery etc. to MEXT.

The Registration System obligates a licensee to report of the information, such as periodically inventory of the specified radioisotope at the end of fiscal year and every time when the radioactive source is received and/or replaced by source exchange or registered information is changed by a processing and manufacturing etc.

The purpose of the system is to detect and deter an illegal trade and possession of the specified radioisotope. And in case of emergency, database on the registered information which includes the specification and transaction etc. will be used for tracking the specified radioisotope against an early emergency response. And the “registration system of specified radioactive source” has been developed since 2007 so that a licensee has been able to report the necessary information by using the dedicated web-site. This system has shifted to a situation of full-scale use in January 2011, through graded trial use by the administrative guidance from August 2009 for the purpose of smooth operation of the system.

Section L　Annexes

L1　Inventory of spent fuel

Nuclear operators and facilities		Inventory (t)	Stored spent fuel
JAPCO	Tokai No2 Power Station	370	Uranium oxide fuel assemblies
	Tsuruga Power Station	580	
Hokkaido Electric Power Co., Inc.	Tomari Power Station	370	
Tohoku Electric Power Co., Inc	Higashidori Nuclear Power Station	60	
	Onagawa Nuclear Power Station	420	
TEPCO	Fukushima Daiichi Nuclear Power Station	1,860	
	Fukushima Daini Nuclear Power Station	1,120	
	Kashiwazaki Kariwa Nuclear Power Station	2,270	
Chubu Electric Power Co., Inc.	Hamaoka Nuclear Power Station	1,140	
Hokuriku Electric Power Co., Inc.	Shika Nuclear Power Station	120	
The Kansai Electric Power Co., Inc.	Mihama Power Station	370	
	Ohi Power Station	1,370	
	Takahama Power Station	1,200	
The Chugoku Electric Power Co., Inc.	Shimane Nuclear Power Station	390	
Shikoku Electric Power Co., Inc.	Ikata Power Station	560	
Kyushu Electric Power Co., Inc.	Genkai Nuclear Power Station	840	
	Sendai Nuclear Power Station	850	
JAEA	Reactor Decommissioning R&D Center	70	Uranium oxide fuel assemblies MOX fuel assemblies
	FBR Research and Development Center	0	
	Tokai Research and Development Center, Nuclear Fuel Cycle Technology Development Directorate, Reprocessing Facility	41	Uranium oxide fuel assemblies MOX fuel assemblies
	Tokai Research and Development Center, Nuclear Science Research Institute	18	Uranium oxide fuel assemblies
	Oarai Research and Development Center	16	Uranium oxide fuel assemblies MOX fuel assemblies
JNFL	Rokkasho Reprocessing Plant	2,834	Uranium oxide fuel assemblies
Total		16,869	

L2 Inventory of radioactive waste

L2.1 High level radioactive waste

Facility		Vitrified waste (number of containers*)	High level liquid radioactive waste
JAEA	Reprocessing facility	247	380 m^3
JNFL	Reprocessing facility	118	0
	Waste Storage Facility	1,338	0
Total		1,703	380 m^3

* : 120 litter container

L2.2 Power station waste

1. Homogeneous solid, packed solid and miscellaneous solid

Power station		Homogeneous solid (drum)	Packed solid (drum)	Miscellaneous solid (drum)	Total (drum)
JAPCO	Tokai- Power Station	0	0	1,433	1,433
	Tokai No2 Power Station	453	347	54,933	55,733
	Tsuruga Power Station	2,496	382	65,202	68,080
Hokkaido Electric Power Co., Inc.	Tomari Power Station	576	0	6,870	7,446
Tohoku Electric Power Co., Inc	Onagawa NPS	1,684	0	25,384	27,068
	Higashidori NPS	0	0	7,860	7,860
TEPCO	Fukushima Daiichi NPS	-*	-*	-*	-*
	Fukushima Daini NPS	644	1,658	15,008	17,310
	Kashiwazaki Kariwa NPS	0	0	31,923	31,923
Chubu Electric Power Co., Inc	Hamaoka NPS	3,295	1,576	29,939	34,810
Hokuriku Electric Power Co., Inc.	Shika NPS	8	562	4,964	5,534
The Kansai Electric Power Co., Inc.	Mihama Power Station	2,240	1,882	24,774	28,896
	Takahama Power Station	5,041	0	41,597	46,638
	Ohi Power Station	3,522	4,132	25,387	33,041
The Chugoku Electric Power Co., Inc.	Shimane NPS	252	1,897	25,567	27,716
Shikoku Electric Power Co., Inc.	Ikata Power Station	1,317	724	27,978	30,019
Kyushu Electric Power Co., Inc.	Genkai NPS	3,907	1,100	33,138	38,145
	Sendai NPS	2,339	0	16,638	18,977
JAEA	Reactor Decommissioning R&D Center	2,016	0	17,288	19,304
	Fast Breeder Reactor Research and Development Center (Monju)	20	0	4,944	4,964
Total		29,810+(*)	14,260+(*)	46,0827+(*)	504,897+(*)

Inventories are in the number of 200 litter drums (or converted into number of drums for miscellaneous solid).

* ; Under evaluation due to the affect by the Tohoku District – off the Pacific Ocean Earthquake

2. Steam generator (SG)

Power station		Number of SGs
The Kansai Electric Power Co., Inc.	Mihama Power Station	7
	Takahama Power Station	6
	Ohi Power Station	8
Shikoku Electric Power Co., Inc.	Ikata Power Station	4
Kyushu Electric Power Co., Inc.	Genkai NPS	4
	Sendai NPS	3
Total		32

3. Control rod, channel box, etc.

Power station		Control rod (number)[*1]	Channel box (number)	Others (m^3)	Resin, etc. (m^3)
JAPCO	Tokai Power Station	91 m^3	0	1,299	60
	Tokai No 2 Power Station	273	3,591	16	881
	Tsuruga Power Station Unit 1	165	1,850	49	829
	Tsuruga Power Station Unit 2	353	0	0	87
Hokkaido Electric Power Co., Inc.	Tomari Power Station	300	0	0	90
Tohoku Electric Power Co., Inc	Onagawa NPS	195	3,103	1	484
	Higashidori NPS	50	408	0	86
TEPCO	Fukushima Daiichi NPS	-[*2]	-[*2]	-[*2]	-[*2]
	Fukushima Daini NPS	699	9,233	43	5,170.2
	Kashiwazaki Kariwa NPS	710	12,927	0	2,414
Chubu Electric Power Co., Inc	Hamaoka NPS	536	11,057	31	2,585
Hokuriku Electric Power Co., Inc.	Shika NPS	44	886	0	141
The Kansai Electric Power Co., Inc.	Mihama Power Station	690	0	0	111
	Takahama Power Station	1,336	0	0	115
	Ohi Power Station	1,112	0	0	113
The Chugoku Electric Power Co., Inc.	Shimane NPS	269	4,416	56	847
Shikoku Electric Power Co., Inc.	Ikata Power Station	637	0	0	155
Kyushu Electric Power Co., Inc.	Genkai NPS	777	0	0	165
	Sendai NPS	444	0	0	142
Subtotal		8,590 +[*2] +(91 m^3)	47,471+[*2]	(1,495+[*2]) m^3	(14,475+[*2]) m^3
		Control rod (number)	Neutron detector (number)	Others (number)	Resin, etc. (m^3)
JAEA	Reactor Decommissioning R&D Center	5	102	0	216
		Control rod drive mechanism guide tube, etc .(number)			
JAEA	Fast Breeder Reactor Research and Development Center (Monju)	5			

[*1] For other than Tokai Power Station.

[*2] Under evaluation due to the affect by the Tohoku District – off the Pacific Ocean Earthquake

L2.3 Long-lived low heat generation radioactive waste

Facility		Drum (drums)	Bituminized solid (drums)	Plastic solid (drums)	Other waste (drums)	Total (drums)
JAEA	Reprocessing facility	32,147	29,967	1,812	11,813	75,739
JNFL	Reprocessing plant（Reprocessing facility）	10,423	0	0	16,174	26,597
JNFL	Reprocessing plant（Waste storage facility ）	1,064	0	0	44	1,108
Subtotal		43,634	29,967	1,812	28,031	103,444

		Sheared cladding (drums)	Spent filter (drums)	Sample bottle (drums)	Total (number)
JAEA	Reprocessing facility	4,956	302	1,356	6,614
JNFL	Reprocessing plant	219*1	0	0	219

		Low activity concentrated liquid waste (m^3)	Sludge (m^3)	Waste solvent (m^3)
JAEA	Reprocessing facility	2,768	1,136	105

The storage unit is (or is converted into) 200 litter drum.

*1: The sheared cladding pieces are stored in 1,000 litter drums.

L2.4 Uranium waste

		Drum (drums)	Other waste (drums)	Total (drums)	Low level liquid waste (m^3)
Global Nuclear Fuel - Japan Co., Ltd.		15,625	2,769	18,394	0.14
Mitsubishi Nuclear Fuel Co., Ltd.		9,703	828	10,531	1.80
Nuclear Fuel Industries, Ltd.	Tokai Works	5,515	867	6,382	7.15
	Kumatori Works	7,155	46	7,201	11.6
JAEA	Prototype Uranium Enrichment Plant	524	56	580	0
JNFL	Enrichment and Disposal Office	4,786	1,192	5,978	1.47
Total		43,308	5,758	49,066	22.16

The storage unit is (or is converted into) 200 litter drum.

L2.5 Waste stored in research facilities

The data shown in this table is arranged using

the data in “Radioactive waste management status report (FY2010)” based on the “Periodic report on management of the radioactive waste (notice)” issued by Director, MEXT, Nuclear Safety Division, Science and Technology Policy Bureau, the data ordered for reporting for FY2010 on Reactor Regulation Act, Article 67 Clause 1 and the data ordered for reporting on the data in “Radiation management status report (FY2009)” pursuant to Radiation Disease Prevention Act Article 42 Clause 1 and Ordinance and Rules for Enforcement of the Act, Article 39 Clause 3 etc.

Facility		Solid waste (drums*1)	Liquid waste (m^3)	Description
JAEA	Tokai Research and Development Center Nuclear Science Research Institute	135,460	－	Reactor facility, using facility for nuclear material (hereinafter referred to as “using facility”)
	Tokai Research and Development Center Nuclear Fuel Cycle Engineering Laboratories	62,032	26.3	Using facilities
	Oarai Research and Development Center(North Area)	1,478	－	Reactor facility, Using facilities
		29,075	－	Waste management facility
	Oarai Research and Development Center(South Area)	135	0.03	(*1)Reactor facility (temporary storage) (*2)Using facility
	Ningyo-toge Environmental Engineering Center	14,951	10.1	Using facility
	Aomori Research and Development Center Mutsu Office	1,060	21.5	Reactor facility
The University of Tokyo, Nuclear Professional School, School of Engineering		26	2.7	(*1)Reactor facility, Using facility (temporary storage) (*2)Reactor facility.
Kyoto University, Research Reactor Institute		63	0.0	Reactor facility, Using facility
National Institute of Radiological Science		918	－	Using facility
Nuclear Material Control Center	Tokai Safeguards Center	201	－	Using facility
	Rokkasho Safeguards Analytical Laboratory	213	－	Using facility
Rikkyo University Institute for Atomic Energy		15	7.2	Reactor facility
Tokyo City University (former Musashi Institute of Technology) Atomic Energy Research Institute		5	－	Reactor facility
Kinki University Atomic Energy Research Institute		3	－	Reactor facility
Nuclear Fuel Industries, Ltd, Tokai Works		6,382	7.2	Using facility(same in the Table L2.4; this facility is also categorized as fabrication facility)
Nippon Nuclear Fuel Development Co., Ltd.		294	13.3	Using facility
Nuclear Development Corporation		1,754	－	Using facility
Toshiba Corporation	Research Reactor Center	73	－	Reactor facility
	Nuclear Engineering Lab.	1,597	0.7	(*1)Reactor facility, Using facility (*2)Using facility.
Hitachi, Ltd. Power & Industrial Systems Nuclear System Division Ozenji Hitachi Training Reactor Center		494	－	Reactor facility
Total		256,229	89.0	
The wastes stored by the licensee who is not applied to usage facility of nuclear fuel materials by Order for the Reactor Regulation Act, Article 41				
Other small Using Facilities（195 facilities）		76,866 drums*1		The sum of solid waste inventory and liquid waste inventory

* This data includes the data of inventory of Long-lived low hear generation radioactive waste and Uranium waste which generated in the using facilities.

*1 ; The storage unit is (or is converted into) 200 litter drum.

<Waste Inventory data reported under the Radiation Disease Prevention Act>

		Waste (drums *)	Description
Facilities of the waste management business		-	
The University of Tokyo, Radioisotope Center		0	
Japan Radioisotope Association	Kanto Waste Relay Station II	8,501	
	The Kaya Memorial Takizawa Laboratory	747	
	Ichihara Office	66,818	
	Kansai Waste Relay Station	0	
VESTA Co., Ltd.		41,038	
JAEA	Tokai Research and Development Center Nuclear Science Research Institute	96,223	This data is also reported under the Reactor Regulation Law.
	Oarai Research and Development Center (North Area)	28,836	This data is also reported under the Reactor Regulation Law
T.N. Technos Co., Ltd. Tsukuba Laboratory		214	
Total		242,377	

Outside this inventory, the wastes of 12,619 drums are stored by licensees approved by Radiation Disease Prevention Act Article 3 Clause 1

*;The storage unit is (or is converted into) 200 litter drum. This data includes the inventory of liquid waste.

L3 Excerpt of Regulation Relevant to Section G

Table G4-1 Technical Standard for the design and construction methods of Spent Fuel Storage Facility

(Prevention of spent fuel criticality)

Article 3 A spent fuel storage facility shall be provided with adequate measures such as criticality-safe geometries to eliminate the possibility of spent fuel going critical.

(Prevention of fire damage)

Article 4 If the safety of a spent fuel storage facility could be significantly impaired by a fire, the facility shall be provided with fire extinguishing and alarm systems as appropriate (limited to systems that automatically detect a fire and set off an alarm, such as automatic fire-alarm box and electric fire alarm system).

2 Any failure, damage or malfunction of the fire extinguishing system and alarm system in the preceding paragraph shall not significantly impair the safety of the spent fuel storage facility.

3 A System important to safety, such as emergency power supply system, that could be damaged by a fire shall consist of noncombustible or nonflammable materials as far as possible and shall be provided with adequate fire protection measures such as fire walls where necessary.

(Seismic design)

Article 5 A spent fuel storage facility shall be designed so as not to have a serious radiological impact on the public when damaged by seismic forces applied on it.

2 The seismic forces mentioned in the preceding paragraph shall be estimated taking account of the conditions of foundation ground, degree of earthquake damages in the region estimated from past earthquake records, characteristics of seismic activities and other various factors, on the basis of the structures of the spent fuel storage facility and the degree of hazards due to the damages to the facility.

(Materials and structures)

Article 6 The materials and structures of the vessels, pipes and support structures in a spent fuel storage facility that are important to ensure the safety of the facility (hereinafter in this Article referred to as “vessels”) shall be adequate for ensuring the strength and corrosion resistance required by the design of the vessels.

2 The vessels and pipes in the spent fuel storage facility that are important to ensure the safety of the facility shall be designed so as to endure appropriate pressure test or leakage test without significant leakage.

(Heat removal)

Article 7 A spent fuel storage facility shall be designed so as to safely remove the decay-heat of spent fuels.

(Confinement function)

Article 8 A spent fuel storage facility shall be so designed to have the function for confining spent fuel or materials contaminated with spent fuel (hereinafter referred to as “spent-fuel-contaminated materials”) within restricted areas pursuant to the following requirements:

(1) The structure of a container containing spent fuel shall not allow any leakage of spent fuel or spent-fuel-contaminated materials to the outside.

(2) When a pipe delivering any liquid not containing spent-fuel-contaminated materials is connected to a vessel or pipe containing spent-fuel-contaminated materials, the structure shall ensure that the contaminated liquid does not flow back into the pipe delivering liquid not containing spent-fuel-contaminated materials.

(3) A facility that has equipment for handling any liquid contaminated with spent fuel (solely for those areas where leakage of the liquid contaminated with spent fuel may expand), shall be designed pursuant to the following requirements:

  (a) The surfaces of floors and walls inside of the facility shall have structures to inhibit the leakage of the liquid contaminated with spent.

  (b) The periphery of a facility handling the liquid contaminated with spent fuel or gateways leading to the outside of the facility or its vicinity shall be provided with lashers to prevent the liquid contaminated with spent fuel from leaking outside the facility, unless the floors inside of the facility are lower than the floors of the adjacent facilities or the ground surface and the liquid contaminated with spent fuel cannot leak to the outside of the facility.

(c) The floors of a spent fuel storage facility shall be above the discharge water channels that discharge effluent to the outside of the facility site (excluding ground water drainage channels which have no opening in the controlled areas that could be contaminated with materials contaminated with spent fuel), unless those discharge water channels are provided with the system that safely disposes the effluent containing spent-fuel-contaminated materials and instrumentation to monitor the items listed in Article 15-2.

(Shielding)

Article 9 Shielding with capability required for preventing radiation hazards shall be provided if the prevention of the radiation hazards due to external radiation in a spent fuel storage facility site is required. For the prevention of radiation hazards. In such case, measures to prevent radiation leakage shall be taken if necessary to prevent radiation hazards due to any opening, pipe or other penetration in the shielding structures.

(Ventilation)

Article 9-2 Ventilation system that meets the following requirements shall be provided, if it is required to prevent radiation hazards due to the air contaminated with spent fuel or spent-fuel-contaminated materials in the spent fuel storage facility:

(1) The ventilation system shall have necessary capability for preventing radiation hazards.

(2) The structure of the ventilation system shall prohibit reverse flow of the air contaminated with spent fuel or spent-fuel-contaminated materials.

(3) Filtering system, if it is installed, shall be capable for appropriate maintenance of its filtering function and shall have a structure to allow easy removal of the materials contaminated with spent fuel or spent-fuel-contaminated materials or easy replacement of the system.

(4) The ventilation system shall have air intake ports that prohibit intake of the air contaminated with spent fuel or spent-fuel-contaminated materials.

(Prevention of contamination by spent-fuel-contaminated materials)

Article 10 As for the spent fuel storage facility buildings that are frequently accessed, the surfaces of their walls, floors and other parts, that could be contaminated by spent-fuel-contaminated materials and could be touched by people, shall be easy to remove the spent-fuel-contaminated materials.

(Systems important to safety)

Article 11 The systems important to safety such as emergency power supply system shall be designed to meet the following requirements:

(1) If a system is shared among two or more nuclear facilities (such as fabrication facility, reactor facility, spent fuel storage facility, reprocessing facility, waste disposal facility and nuclear material utilization facility), the functions to ensure the safety of spent fuel storage facility shall not be impaired by such sharing.

(2) Inspection or test to confirm the functions to ensure the safety of spent fuel storage facility, and maintenance or repair for maintaining the integrity of such functions shall be possible.

(Transportation and receiving systems)

Article 12 The systems used for the transportation and receiving of containers containing spent fuel shall be designed to meet the following requirements:

(1) The systems for the transportation and receiving of containers containing spent fuel shall have capability for safe handling of the containers.

(2) The containers containing spent fuel shall be safely retained in case of loss of power supply for the transportation and receiving systems.

(Instrumentation and control systems)

Article 13 A spent fuel storage facility shall be provided with the instrumentation to measure the following parameters. If it is difficult to directly measure any of such parameters, indirect instrumentation may be used as an alternative:

(1) Surface temperature of container containing spent fuel.

(2) Pressure at the closure head of container containing spent fuel for monitoring seal performance of the head (excluding welded closure head).

(3) Temperatures of air supply and exhaust of the buildings where spent fuel is stored.

2 A spent fuel storage facility shall be provided with the devices for reliable detection and quick alarming of such situations as: when safety of spent fuel storage facility could be significantly impaired due to loss of equipment function, malfunction or any other cause; when the concentration of radioactive materials described in Article 15 (ii) or the dose equivalent of external radiation described in Article 15 (iv) shows significant increase; or when significant amount of liquid radioactive materials could leak from liquid radioactive waste disposal system.

(Disposal systems)

Article 14. Radioactive waste disposal system (excluding radioactive waste retaining system) shall meet the following requirements:

(1) Radioactive waste disposal system shall be capable of disposing radioactive wastes generated in the spent fuel storage facility so that concentration of airborne radioactive materials outside the environmental monitoring area and concentration of radioactive materials in the water at the outer boundary of the environmental monitoring do not exceed the values specified by the Minister of Economy, Trade and Industry.

(2) Radioactive waste disposal system shall be installed separately from non-radioactive waste disposal system, unless the system that leads non-radioactive liquid waste to radioactive liquid waste disposal system is provided with the measures to prohibit for radioactive liquid waste to flow back into non-radioactive liquid waste systems.

(3) Gaseous radioactive waste disposal system shall not discharge gaseous wastes at any part of the system other than exhaust port.

(4) If filtering system is installed in the gaseous radioactive waste disposal system, it shall be capable for appropriate maintenance of its filtering function and shall have a structure to allow easy removal of the materials contaminated with spent fuel or spent-fuel-contaminated materials or easy replacement of the system.

(5) Liquid radioactive waste disposal system shall not discharge liquid waste at any part of the system other than water discharge outlet.

(Radiation control system)

Article 15 A spent fuel storage facility site shall be provided with the radiation instrumentation to measure the values listed below. If it is difficult to directly measure any of such parameters, indirect instrumentation may be used as an alternative:

(1) Dose equivalent rate at the side wall of radiation shielding structure of spent fuel storage facility

(2) Concentration of radioactive materials in exhaust gases at or near the gaseous radioactive waste exhaust port

(3) Concentration of radioactive materials in discharge water at or near the liquid radioactive waste discharge outlet

(4) Dose equivalent of external radiation, concentration of airborne radioactive materials and densities of radioactive materials on the surface of contaminated items in the controlled area

(5) Dose equivalent of external radiation in the environmental monitoring area

(Emergency Power Supply System)

Article 16 A spent fuel storage facility shall be provided with power generating system driven by internal combustion engine, or other power generating system with equal or more capability, in order to maintain the function of the systems necessary for ensuring the safety of the facility in the event of loss of electric power supply from off-site power grid.

2 Systems especially important for ensuring the safety of spent fuel storage facility shall be provided with an uninterruptible power supply device or other power supply system with equal or more capability.

Table G5-1 Regulatory Guide for Reviewing Safety Assessment of the Spent Fuel Interim Storage Facility Using Metal Dry Casks

Siting Condition

Guideline 1 Basic conditions

The following events shall be investigated for the site and its surroundings of the spent fuel interim storage facility, and it shall be confirmed that the adverse conditions for ensuring safety does not exist.

1. Natural environment
   - (1)Natural phenomena such as earthquake, tsunami, landslides, depression, typhoon, high tide, flood, abnormal cold weather, heavy snowfall.
   - (2)Geological conditions and landform etc. such as ground conditions, soil bearing capacity, fault.
   - (3) Meteorological conditions such as wind direction, wind velocity, waterfall.
   - (4) Hydrological and hydraulic conditions of rivers, underground water, etc.
2. Social environment
   - (1) Fire, explosion at a neighboring factory etc.

(2) Missiles etc. by air craft crash, etc.
(3)Conditions of land use in relation to food production such as agriculture, livestock farming, fishery industry and condition of population distribution etc.

Guideline 2 Normal conditions

The dose in normal condition of the general public due to the spent fuel interim storage facility shall be lower than the dose limit specified by the law and regulation, and it shall be as low as reasonably achievable.

Guideline 3 Accident conditions

Under the assumption of the occurrence of the maximum credible accident at the spent fuel interim storage facility, the general public shall not receive excessive radiation exposure.

1. Selection of accidents

In the design of the spent fuel interim storage facility, accidents, which occurrence is technically possible to be assumed in the worst case and is considered important in view of radiation exposure to the general public, shall be selected by thoroughly studying the possibility of occurrence of accidents that may significantly fail the fundamental safety functions of metal casks from the technical point of view considering aging of metal cask components by long term storage, such as:
(1)Collision or fall of metal cask caused by wrong operation etc. during transfer in the facility
(2)Natural disaster etc.

2. Calculation of release amount of radioactive materials etc.

The release amount of radioactive materials etc. shall be calculated for each accident selected in accordance with the paragraph 1 above, applying appropriate analytical model and parameters and setting appropriate conditions with safety margin, by thoroughly studying the followings:
(1)Amount of leakage of radioactive materials from the fuel cladding
(2)Integrity of metal casks concerning their confinement function and radiation shielding function
(3)Number of metal casks to be assumed for leakage of radioactive materials
(4)Conditions of atmospheric dispersion of radioactive materials
(5)Period of release for the evaluation

3. Dose evaluation

It shall be confirmed that the general public does not receive excess radiation exposure from the dose even in case of the maximum credible accident, which is defined as an accident which effect to the general public is the maximum among accidents selected by the paragraph 1 as the result from the calculation in accordance with the paragraph 2 above. However, this evaluation is not required when there is no radiation exposure to the general public due to the accident selected by the paragraph 1.

Radiation Control

Guideline 4 Confinement function

The spent fuel interim storage facility shall be designed to confine radioactive materials in the limited area with the following measures.

1. The metal cask shall be designed to maintain the negative pressure in the space where spent fuel assemblies are contained throughout the design storage period.
2. The metal cask shall be designed to isolate the space where spent fuel assemblies are contained from outside of the cask with the multi-layered confinement structure at the cap portion. And its confinement function shall be monitored.
3. The metal cask shall be designed with considerations of the restoration capability of confinement function such a design as that allows the attachment of an additional cap to cope with unlikely event of confinement function abnormality of cap structure.
4. The metal cask shall be designed to maintain the temperature of fuel claddings low throughout the design storage period in view of maintaining the integrity of fuel cladding.
5. The metal cask shall be designed to keep the temperature within the range to maintain the integrity of the structures throughout the design storage period in view of maintaining its confinement function.

Guideline 5 Radiation shielding

The spent fuel interim storage facility shall be appropriately shielded to lower the exposure dose of the general public by the direct and sky shine ray.

In addition, the sufficient radiation shielding shall be provided considering working conditions of personnel engaged in radiation work.

In case the radiation shielding of concrete etc is used, in addition to the metal cask, the shielding material shall be designed to maintain the temperature low enough not to impair its radiation shielding capability.

Guideline 6 Radiation exposure control

1. Radiation exposure control in working environments

(1) In order to monitor and control working environments of personnel engaged in radiation work, the monitoring system and measuring equipment for dose rates etc. and alarm system for unusual increase in the dose rate should be prepared.
(2) The important information from the above-mentioned monitoring system and alarm system should be designed that the centralized monitoring is possible at an appropriate place.

2. Equipments, such as dosimeters required for individual exposure control for personnel engaged in radiation work should be prepared.
3. The control area of the spent fuel interim storage facility shall be designed so that the appropriate access control could be implemented in accordance with the dose rate and surface contamination density.

Environmental safety

Guideline 7 Discharge control of radioactive wastes

The spent fuel interim storage facility should be designed so that the concentration of radioactive materials released to the environment is as low as reasonably achievable with appropriate treatment of radioactive wastes generated during the storage.

Guideline 8 Consideration for long-term storage etc.

The spent fuel interim storage facility should be designed to maintain the integrity of spent fuel assemblies and the integrity of the components that have fundamental safety functions throughout the design storage period by taking the following measures, in considerations of degradation etc. accompanied by the long-term storage.

1. Components of metal cask important to maintain fundamental safety functions should be designed not to lose required safety function maintaining required strength and performance by selecting materials that have sufficient reliability in the environments such as temperature and radiation during design storage period and to the degradation such as corrosion, creeping, and stress corrosion cracking under the above environments.
2. The metal cask should contain and store the spent fuel assemblies together with sealing inert gases.
3. The metal cask should be designed to be able to remove the decay heat from spent fuels in view of maintaining the integrity of spent fuel assemblies and the integrity of the components that have fundamental safety functions.
4. The storage building should be designed to be able to maintain the room temperature in the building low in view of the heat removal from the surface of a metal cask. And, it should be designed to be able to monitor that the room temperature in the storage building will not elevate to the unusual level.

Guideline 9 Radiation monitoring

The spent fuel interim storage facility should be provided with measures to monitor the concentration etc. of radioactive materials in the release path of radioactive wastes appropriately. Moreover, measures to monitor the dose rates, concentrations etc. of radioactive materials in the surrounding environment should be taken appropriately in consideration to the potential release of radioactive materials.

Criticality

Guideline 10 Criticality safety of a single metal cask

A single metal cask in the spent fuel interim storage facility should be designed to prevent the criticality under any technically conceivable conditions when spent fuel assemblies are contained in the cask.

In case the internal basket shares the criticality prevention function, the metal cask should be designed to keep the structural integrity of the basket throughout the design storage period.

Guideline 11 Criticality safety of multiple metal casks

The spent fuel interim storage facility should be provided with measures to prevent the criticality under any technically conceivable conditions considering the neutron interference among metal casks in the facility.

Guideline 12 Consideration for nuclear criticality accidents

If any possibility of a nuclear criticality accident caused by operational error etc. at the spent fuel interim storage facility should not be neglected, appropriate measures for the unlikely event of nuclear criticality accident shall be prepared.

When Guideline 10 and Guideline 11 are conformed and when spent fuels are contained in the metal cask, criticality could not physically occur, so that the application of this guideline is exempted.

Other safety measures

Guideline 13 Consideration for earthquake

The spent fuel interim storage facility should be designed to maintain the fundamental safety functions against design earthquake force considered to be the most appropriate referring to the results of site investigation of past records at the site and its peripheral area.

Guideline 14 Consideration for natural phenomena other than earthquakes

The facilities important to safety of the spent fuel interim storage facility should be designed considering the severest natural force of natural phenomena other than earthquake referring to the results of site investigation of past records at the site and its peripheral area.

Guideline 15 Consideration for fire and explosion

The spent fuel interim storage facility should be provided with appropriate measures to prevent occurrence of a fire and a explosion, and measures to prevent propagation of fire and explosion, and to control excessive release of radioactive materials into the outside of facility.

1. The spent fuel interim storage facility should be designed to use nonflammable or fire-retardant materials as much as reasonably possible.
2. In case flammable material is used in the spent fuel interim storage facility, appropriate measures such as elimination of fire source, prevention of unusual temperature rise, prevention of leakage-out or leakage-in of flammable material etc. should be taken.
3. In order to prevent propagation of a fire, the appropriate measures to reduce the influence by fire should be taken in addition to installation of appropriate detection and alarm systems and the fire protection equipment.

Guideline 16 Consideration for loss of electric power

A power supply system with sufficient capacity and reliability to operate following equipments required for safety should be installed in the spent fuel interim storage facility to be prepared for the loss of function of external power supply systems such as blackout.

1. Monitoring equipment for confinement function of metal casks
2. Radiation monitoring equipment
3. Equipment such as fire alarm equipment, emergency communication equipment, and emergency lightning equipment

Guideline 17 Consideration for transfer of metal casks

The spent fuel interim storage facility should be provided with appropriate measures for shipping-out of metal casks containing spent fuels considering the basic safety functions.

Guideline 18 Consideration of accident

The spent fuel interim storage facility should be provided with the appropriate measures for, such as alarm, communication and evacuation of radiation workers depending on the accident condition.

1. Appropriate radiation measuring devices, the radiation protection equipment etc. should be available as required.
2. In the design of the facility, the lighting equipment for evacuation, which function is not lost in a case of loss of normal lighting power source, should be installed and safety evacuation passages with simple, clear and durable signs should be established.

Guideline 19 Consideration for sharing of facilities

The facilities important to safety of spent fuel interim storage facility, which are shared with nuclear facilities other than the concerned spent fuel interim storage facility or shared within the concerned spent fuel interim storage facility, should not cause any inconvenience on the safety of the concerned spent fuel interim storage facility by the sharing judged by its function, structure etc.

Guideline 20 Applicable codes and standards

The design, material selection, manufacturing, construction, and inspection of the facilities important to safety of the spent fuel interim storage facility should be in conformity with codes and standards recognized as appropriate.

1. The spent fuel interim storage facility should be in conformity with Japanese laws and regulations such as the "Reactor Regulation Law", "Construction Standard Law", "Fire Protection Law" etc.
2. The design, material selection, manufacturing, construction, inspection etc. of facilities important to safety should be in conformity with domestic codes and standards recognized as appropriate. For items for which no domestic applicable codes or standards is exist, the codes or standards of foreign countries that are experienced and reliable may be applied.

Guideline 21 Consideration for inspection, repair etc.

The spent fuel interim storage facility should be made to be able to perform inspection, test, maintenance and repair with appropriate methods according to the importance to safety and the needs.

Table G6-1 Contents of the Operational Safety Program for the Spent Fuel Interim Storage Facility (Article 37 paragraph 1 of the Rule for Interim Storage of Spent Fuel)

(1) System of the observance of related laws and operational safety program (including the participation of management persons).
(2) System for safety culture cultivation (including the participation of management persons).
(3) Quality assurance of the spent fuel storage facility (including the methods of root cause analysis and organization for analysis implementation describing the position of working procedure in operational safety program).
(4) The duties of personnel engaged in the operation and management of the spent fuel storage facility and organization
(5) Scope of duty on chief engineer of spent fuel and the contents as well as authority of chief engineer of spent fuel to supervise operational safety and positioning in the organization.
(6) The following items with respect to the operational safety education for radiation workers at the spent fuel storage facility
  (a) Policy for the operational safety education
  (including preparation of education program)
  (b) The contents of the operational safety education as follows
    1) Relevant laws and the Operational safety program
    2) Structure, performance and operation of the spent fuel storage facility
    3) Radiation management
    4) Handling of nuclear fuel materials and objects contaminated by them
    5) Measures to be taken in emergencies
  (c) Other necessary items for the operational safety education of the spent fuel storage facility
(7) Operation of the equipment especially necessary to be managed in view of safety preservation.
(8) Designation of controlled areas, and environment monitoring areas, and restriction of access to these areas
(9) Matters related to gaseous and liquid discharge monitoring equipment
(10) Monitoring of the dose, the dose equivalent, the concentration of radioactive materials and the density of radioactive materials on the surface of objects contaminated by radioactive materials, and the decontamination
(11) Management of radiation measuring instruments and the method of radiation measurement
(12) Patrols and checks of the spent fuel storage facility and their associated measures
(13) Voluntary periodical inspections of the spent fuel storage facility
(14) Receipt, delivery, transport, storage and other handling of spent fuels
(15) Disposal of radioactive waste
(16) Measures to be taken in emergency
(17) Adequate records and reports (including the report on the occurrences of accidents, failures and equivalents to managements.) on the operational safety of the spent fuel storage facility (including the compliance with the Operational Safety Program).
(18) Periodic Assessment of the spent fuel storage facility
(19) Sharing technical information by an operator who conducted maintenance works with other operators of spent fuel storage facilities.
(20) Disclosure of the nonconformity information in occurrence of nonconformity.
(21) Other necessary items for safety preservation of the spent fuel storage facility

Table G6-2 Contents of Decommissioning-related Operational Safety Program (Article 37 paragraph 2 of the Rules for Interim Storage of Spent Fuel)

In order to obtain the license for decommissioning program of a spent fuel storage facility, the operator shall revise the Operational Safety Program for the following points and shall get approval for the revision.

(1) System of the observance of related laws and the operational safety program (including the participation of management persons).
(2) System to cultivate safety culture (including the participation of management persons).
(3) Quality assurance for the spent fuel storage facility (including the methods of root cause analysis and organization for analysis implementation describing the position of working procedure in operational safety program).
(4) Quality assurance for decommissioning (including the methods of root cause analysis and organization for analysis implementation describing the position of working procedure in operational

safety program).
(5) Duties and organization of a person who will carry out decommissioning work.(except for the following Clause).
(6) Scope of duty on chief engineer of spent fuel and the contents as well as authority of chief engineer of spent fuel to supervise operational safety and positioning in the organization.
(7) The following safety training items for radiation workers for decommissioning:
  (a) Implementation principle of safety training (including development of an implementation plan)
  (b) Safety training contents on the following items:
    1) Compliance of relevant laws and regulations and Safety Rules and Regulations.
    2) Structures and performance of the spent fuel storage facility.
    3) Decommissioning of the spent fuel storage facility.
    4) Radiation control.
    5) Handling of nuclear fuel materials and materials contaminated with nuclear fuel materials.
    6) Measures to be taken at an emergency.
  (c) Other necessary matters for safety training on the spent fuel storage facility.
(8) Operation of systems requiring special control for safety.
(9) Establishment of the controlled area, conservation area, and environmental monitoring area, and access control to those areas.
(10) Exhaust monitoring system and discharge water monitoring system.
(11) Monitoring of radiation dose, dose equivalent, concentration of radioactive materials and radioactive material density on the surface of items contaminated with radioactive materials, and removal of contamination.
(12) Control of radiation measuring devices and radiation measurement methods.
(13) Periodic self-imposed inspection of the spent fuel storage facility.
(14) Patrol of the spent fuel storage facility and handling of findings.
(15) Disposal of radioactive wastes.
(16) Measures to be taken at an emergency.
(17) Adequate records and reports (including the report on the occurrences of accidents, failures and equivalents complied with Article 43 Clause 13 to managements.) on the operational safety of the spent fuel storage facility (including the compliance with the Operational Safety Program).
(18). Adequate records and reports (including the report on the occurrences of accidents, failures and equivalents complied with Article 43 Clause 13 to managements.) on the operational safety of the decommissioning (including the compliance with the Operational Safety Program).
(19) Sharing technical information by an operator who conducted maintenance works with other operators of spent fuel storage facilities.
(20) Disclosure of the nonconformity information in occurrence of nonconformity.
(21) Decommissioning management.
(22) Other necessary items for the safety and decommissioning of the spent fuel storage facility.

Table G6-3 Incident and Failure Reporting Standards at the Spent Fuel Interim Storage Facility (Article 43-13 of the Rule for Interim Storage of Spent Fuel)

Upon the occurrence of any of the following events, operators of spent fuel storage facilities shall immediately give notice to that effect to the Minister of Economy, Trade and Industry, and shall report to the minister about the situation of the event and corrective actions taken within ten days of the event:

(1) The spent fuel is stolen or its whereabouts is unknown;

(2) A failure of the spent fuel storage facility is found (excluding a failure that cause minor affection on spent fuel storage);

(3) The concentration of radioactive material in air on the boundary outside a peripheral monitoring area has exceeded the concentration limits provided in the Ministerial Ordinance of METI Minister due to the gaseous radioactive waste release through discharge facilities;

(4) The concentration of radioactive material in water on the boundary outside a peripheral monitoring area has exceeded the concentration limits provided in the Ministerial Ordinance of METI Minister due to the liquid radioactive waste release through discharge facilities;

(5) Spent fuel etc. has leaked outside the controlled area;

(6) Leakage of spent fuel or spent-fuel-contaminated materials inside a radiation controlled area due to a failure of the spent fuel storage system or other unexpected situation except for the following cases (excluding the cases that access control to the leakage area has been

implemented, a new measures such as key control have been taken, or leaked material has spread outside of the radiation controlled area) where:

(a) Leakage of liquid spent fuel or materials contaminated with spent fuel has not spread out of the lasher provided around the leaked equipment.

(b) The function of relevant ventilation system has been properly maintained when gaseous spent fuel or materials contaminated with spent fuel has leaked.

(7) Workers engaged in the radiation work have been exposed to radiation that exceeds or is likely to exceed the dose limits provided in he Ministerial Ordinance of METI Minister; or

(8) In addition to the events of the above paragraphs, a hazard to personnel (excluding minor hazards other than radiation hazards) has occurred or is likely to occur at the spent fuel storage facility.

L4 Excerpt of Regulation Relevant to Section H

Table H4-1 "Technical Standard for the Design and Construction Methods for the Specified Waste Disposal Facility or Specified Waste Storage Facility"

(Prevention of fire damage)

Article 3 If the safety of a specified waste disposal facility or specified waste storage facility could be significantly impaired by a fire, the facility shall be provided with fire extinguishing and alarm systems as appropriate (limited to systems that automatically detect a fire and set off an alarm, such as automatic fire-alarm box and electric fire alarm system).

2 Any failure, damage or malfunction of the fire extinguishing system and alarm system in the preceding paragraph shall not significantly impair the safety of the specified waste disposal facility or specified waste storage facility.

3 A system important to safety, such as emergency power supply system, that could be damaged by a fire shall consist of noncombustible or nonflammable materials as far as possible and shall be provided with adequate fire protection measures such as fire walls where necessary.

4 Systems for handling or managing radioactive wastes that could generate hydrogen shall be designed to prohibit retention.

5 Cells and rooms containing systems for handling or storage radioactive wastes that could generate hydrogen (excluding non-explosive systems) shall be provided with appropriate measures to prohibit hydrogen retention and to prevent explosion in case of hydrogen leakage from those systems.

(Seismic design)

Article 4 A specified waste disposal or storage facility shall be designed so as not to have a serious radiological impact on the public when damaged by seismic forces applied on it.

2 The seismic forces mentioned in the preceding paragraph shall be estimated taking account of the conditions of foundation ground, degree of earthquake damages in the region estimated from past earthquake records, characteristics of seismic activities and other various factors, on the basis of the structures of the specified waste disposal facility or specified waste management facility and the degree of hazards due to the damages to the facility.

(Materials and structures)

Article 5 The materials and structures of the vessels, pipes and support structures in a specified waste disposal facility or specified waste storage facility that are important to ensure the safety of the facility (hereinafter in this Article referred to as "vessels") shall be adequate for ensuring the strength and corrosion resistance required by the design of the vessels.

2 The vessels and pipes in the specified waste disposal facility or specified waste storage facility that are important to ensure the safety of the facility shall be designed so as to endure appropriate pressure test or leakage test without significant leakage.

(Confinement functions)

Article 6 A specified waste disposal facility or specified waste storage facility shall be provided with the functions to confine radioactive wastes within restricted areas pursuant to the following requirements:

(1) When a pipe delivering liquid not containing radioactive waste is connected to a vessel or pipe containing liquid radioactive waste, the structure shall ensure that the liquid radioactive waste does not flow back into the pipe delivering the liquid not containing radioactive waste.

(2) The air flow at the opening of a hood for handling of non-sealed radioactive waste shall be maintained at an appropriate speed.

(3) Inner pressure of a room where contamination by radioactive waste could occur shall be maintained negative as required.

(4) A facility that has a liquid radioactive waste handing system (solely for those areas where leakage of liquid radioactive waste could expand), shall be designed pursuant to the following requirements:

  (a) The surfaces of floors and walls inside of the facility shall have structures to inhibit the leakage of liquid radioactive waste.

  (b) The periphery of a facility handling liquid radioactive waste or gateways leading to the outside of the facility or its vicinity shall be provided with lashers to prevent the liquid radioactive waste from leaking outside the facility, unless the floors inside of the facility are lower than the floors of the adjacent facilities or the ground surface and the liquid radioactive waste cannot leak to the outside of the facility.

  (c) The floors of a specified waste disposal facility or specified waste storage facility shall be above the discharge water channels that discharge effluent to the outside of the facility site (excluding ground water drainage channels which have no opening in the controlled areas that could be contaminated with radioactive waste), unless those discharge water channels are provided with the system that safely disposes the effluent contaminated with radioactive waste and the instrumentation to monitor the items listed in Article 15-3.

(Shielding)

Article 7 Shielding with capability required for preventing radiation hazards shall be provided if the prevention of radiation hazards due to the external radiation in a specified waste disposal facility or specified waste storage facility site is required. In such case, measures to prevent radiation leakage shall be taken if necessary to prevent radiation hazards due to any opening, pipe or other penetration in the shielding structures.

(Ventilation)

Article 8 Ventilation system that meets the following requirements shall be provided, if it is required to prevent radiation hazards due to the air contaminated with spent fuel or spent-fuel-contaminated materials in the specified waste disposal facility or specified waste storage facility:

(1) The ventilation system shall have necessary capability for preventing radiation hazards.

(2) The structure of the ventilation system shall prohibit reverse flow of the air contaminated with spent fuel or spent-fuel-contaminated materials.

(3) Filtering system, if it is installed, shall be capable for appropriate maintenance of its filtering function and shall have a structure to allow easy removal of the materials contaminated with spent fuel or spent-fuel-contaminated materials or easy replacement of the system.

(4)The ventilation system shall have air intake ports that prohibit intake of the air contaminated with spent fuel or spent-fuel-contaminated materials.

(Prevention of contamination by spent-fuel-contaminated materials)

Article 9 As for the specified waste disposal facility or specified waste management facility buildings that are frequently accessed, the surfaces of their walls, floors and other parts, that could be contaminated by spent-fuel-contaminated materials and could be touched by people, shall be easy to remove the spent-fuel-contaminated materials.

(Receiving system or management system)

Article 10 The radioactive waste receiving system of specified waste disposal facility or radioactive waste management system of specified waste storage facility that could be overheated by decay heat and radiations from radioactive waste shall be provided with measures necessary for cooling.

(Treatment and disposal systems)

Article 11 Radioactive waste disposal system (excluding radioactive waste retaining system) shall meet the following requirements:

(1) Radioactive waste disposal system shall be capable of disposing radioactive wastes generated in the specified waste disposal facility or specified waste storage facility so that concentration of airborne radioactive materials outside the environmental monitoring area and concentration of radioactive materials in the water at the outer boundary of the environmental monitoring do not exceed the values specified by the Minister of Economy, Trade and Industry.

(2) Radioactive waste disposal system shall be installed separately from non-radioactive waste disposal system, unless the system that leads non-radioactive liquid waste to radioactive liquid waste disposal system is provided with the measures to prohibit for radioactive liquid waste to flow back into non-radioactive liquid waste systems.

(3) Gaseous radioactive waste disposal system shall not discharge gaseous wastes at any part of the system other than exhaust port.

(4) If filtering system is installed in the gaseous radioactive waste disposal system, it shall be capable for appropriate maintenance of its filtering function and shall have a structure to allow easy removal of the materials contaminated with spent fuel or spent-fuel-contaminated materials or easy replacement of the system.

(5) Liquid radioactive waste disposal system shall not discharge liquid waste at any part of the system other than water discharge outlet.

(Systems important to safety)

Article 12 The systems important to safety such as emergency power supply system shall be designed to meet the following requirements:

(1) If a system is shared among two or more nuclear facilities (such as fabrication facility, reactor facility, spent fuel storage facility, reprocessing facility, waste disposal facility and nuclear material utilization facility), the functions to ensure the safety of specified waste disposal facility or specified waste storage facility shall not be impaired by such sharing.

(2)If necessary for maintaining the functions to maintain the safety of specified waste disposal facility or specified waste storage facility, the system or its parent system shall have appropriate redundancy.

(3)Inspection or test to confirm the functions to ensure the safety of specified waste disposal facility or specified waste storage facility, and maintenance or repair for maintaining the integrity of such functions shall be possible.

(Transport system)

Article 13 Transport system for radioactive wastes (excluding those which have no significant impact on personal safety) shall be designed to meet the following requirements:

(1) Transport system shall be capable of normal transport of radioactive wastes.

(2) When Radioactive wastes shall be safely retained in case of loss of power supply for the transportation of radioactive waste.

(Instrumentation and control system)

Article 14 A specified waste disposal facility or specified waste storage facility shall be provided with the devices for reliable detection and quick alarming of such situations as: when the safety of the facility could be significantly impaired due to loss of equipment function, miss-operation or any other cause; when the concentration of radioactive materials provided in Article 15 (2) or the dose equivalent provided in Article 15 (4) shows significant increase; or when significant amount of liquid radioactive materials could leak from the liquid radioactive waste disposal system.

2 A specified waste disposal facility or specified waste storage facility shall be provided with the circuits to actuate the necessary systems immediately and automatically, when the safety of the facility could be significantly impaired due to loss of equipment function, miss-operation or any other cause and it is required to quickly actuate the system to maintain the function to confine radioactive waste within restricted areas or the system to prevent fire or explosion.

(Radiation control system)

Article 15 A specified waste disposal facility or specified waste storage facility site shall be provided with the radiation instrumentation to measure the values listed below. If it is difficult to directly measure any of such parameters, indirect instrumentation may be used as an alternative:

(1) Dose equivalent rate provided by the Minister of METI at the side wall of radiation shielding structure of waste storage facility and waste receiving facility.

(2) Concentration of radioactive materials in exhaust gases at or near the gaseous radioactive waste exhaust port

(3) Concentration of radioactive materials in discharge water at or near the liquid radioactive waste discharge outlet

(4) Dose equivalent of external radiation, concentration of airborne radioactive materials and densities of radioactive materials provided by the Minister of METI on the surface of contaminated items in the controlled area

(5) Dose equivalent of external radiation provided by the Minister of METI in the environmental monitoring area

(Emergency Power Supply System)

Article 16 A specified waste disposal facility or specified waste storage facility shall be provided with power generating system driven by internal combustion engine, or other power generating system with equal or more capability, in order to maintain the function of the systems necessary for ensuring the safety of the facility in the event of loss of electric power supply from off-site power grid.

2 Systems especially important for ensuring the safety of specified waste disposal facility or specified waste storage facility shall be provided with an uninterruptible power supply device or other power supply system with equal or more capability.

Table H5-1 Basic Guide for Safety Review of Category 2 Radioactive Waste Disposal (Excerpt)

Basic Siting Conditions

The sites of the waste disposal facilities and their vicinity shall not have the possibility of occurrence of such events that would cause significant accidents. In addition, events that would magnify the consequence shall also be unlikely, even in case of accident.

Basic safety measures

1. Design of near surface or sub-surface disposal facilities

The near surface or sub-surface disposal facilities shall be designed taking the following points into account (depending on the disposal methods, so that any radiation dose to the public becomes as low as reasonably achievable with current technologies):

(1) Containment

The near surface or sub-surface disposal facilities shall be provided with the function of containing radioactive materials within a limited area of the facilities, during a certain period.

(2) Restriction of migration

The near surface or sub-surface disposal facilities shall be provided with measures for restricting migration of radioactive materials from the facilities to the biosphere.

(3) Isolation

Solid radioactive wastes shall be disposed of sufficiently deep underground to suppress impacts of radioactive materials on the biosphere assumed to be caused by them, to a level with no safety hazards.

(4) Other considerations

Potential effects, if any, of the heat from the waste packages and chemicals contained in the waste packages shall be considered in the design of the near surface or sub-surface disposal facilities.

Radiation control

1 Radiation protection

(1) The waste disposal facility shall be provided with radiation shielding so that the radiation dose to the public due to direct gamma rays and scattered gamma rays such as the sky-shine gamma rays is as low as reasonably achievable.

(2) When disposal of radioactive materials is anticipated, the facility shall be provided with measures to keep the radiation dose to the public due to the dispersal as low as reasonably achievable.

(3) The waste disposal facilities shall be provided with proper measures such as radiation shielding and ventilation to keep the work environment appropriate for the personnel engaged in radiation work.

2 Radiation exposure control

The waste disposal facilities shall be provided with measures for sufficiently carrying out surveillance on and controlling the radiation dose to personnel engaged in radiation work.

3 Release control of gaseous and liquid radioactive effluents

The level of concentration of radioactive materials released from the waste disposal facilities to the surrounding environment shall be kept as low as reasonably achievable, by taking measures such as appropriate processing of gaseous and liquid radioactive wastes generated in the adjunct facilities to the near surface or sub-surface disposal facilities.

4 Radiation surveillance

(1) In the waste disposal facilities, measures shall be taken to appropriately survey the concentration of radioactive materials at each point of the release pathways of gaseous and liquid radioactive effluents from the adjunct facilities to the near surface or sub-surface disposal facilities.

In addition, measures shall be taken to appropriately survey the radiation dose and concentration of radioactive materials in the surrounding environment, commensurate to the amount of the released radioactive materials.

(2) In the waste disposal facilities, measures shall be taken for a certain period of time to appropriately survey the concentration of radioactive materials that release from the near surface or sub-surface disposal facilities into groundwater and other media, and further being transported to the biosphere.

Other safety measures

1 Design considerations against earthquakes

The waste disposal facilities shall be designed so that the required safety functions are not impaired against the design-base seismic force during a certain period.

The design-base seismic force shall be determined in accordance with the seismic classification based on the significance classification for seismic design that is stipulated in the "Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities".

2 Design considerations against natural phenomena other than earthquakes

The waste disposal facilities shall be designed so that the required safety functions are not impaired against anticipated natural phenomena, anticipated based on surveys of past records and field investigations at the site and its vicinity.

3 Consideration against seepage water

Seepage into the tunnels and caverns shall be properly pumped out. Appropriate measures shall be taken to avoid excessive release of radioactive materials from the waste packages in case of irruptive seepage water.

4 Considerations against fire and explosion

The waste disposal facilities shall be provided with measures to prevent the occurrence of fires and explosions. In addition, measures shall be taken to prevent excessive release of radioactive materials to outside of the facilities in case of fire or explosions.

5 Considerations against loss of power

The waste disposal facilities shall be provided with appropriate measures against the loss of the function of the external power.

6 Applicable codes and standards

The design and construction of the waste disposal facilities shall be conducted in compliance with appropriate codes and standards.

Safety assessment during active control period

1 Normal conditions

Radiation dose to the public during normal operation shall be as low as reasonably achievable in terms of planning of step-wise control, design of the waste disposal facilities and conditions at the site and its vicinity.

2 Accident conditions

Any abnormal event that is technically feasible shall not cause excessive radiation dose to the public.

Termination of active control

It shall be demonstrated that active control of the near surface or sub-surface disposal facilities to be provided for controlling radiation exposure can be terminated in a certain time period, and that the safety of the facilities will be secured even after terminating the active control. It should be noted that records relevant to the near surface or sub-surface disposal facilities shall be transferred to the Government, or an organization assigned by the Government.

Safety assessment after the period for active control

In the safety assessment after the period for active control (the safety assessment in this report refers “safety assessment after the period for active control”), radiation doses to residents or intruder shall be assessed for each of four scenarios; likely, less-likely, very unlikely and human intrusion scenarios, depending on the disposal method. The results shall comply with the target values for each scenario.

(1) Likely scenario

It shall be demonstrated that impacts of radioactive materials on the biosphere assumed to be caused by the disposed solid radioactive wastes will be negligible, by assessing scientific probability of scenarios.

The assessment shall be conducted for likely and normally conceivable scenarios, under likely conditions using the most likely parameters. The scenarios shall be classified into three categories, as shown below, depending on the migration pathway of radioactive materials to the biosphere:

i) Likely groundwater scenarios,
ii) Likely gas migration scenarios, and
iii) Likely land use scenarios.

The evaluation of the likely groundwater and gas migration scenarios shall be conducted for each of the periods set out for defining long-term conditions after the period for active control.

The evaluation of the likely land use scenario shall be conducted for each area of land that will be available for use, assuming geomorphological changes due to uplift/erosion and sea level changes, focusing on the utilization of contaminated areas.

(2) Less-likely scenarios

It shall be demonstrated that the impacts of radioactive materials on the biosphere, assumed to be caused by the disposed solid radioactive wastes, will be limited (even for less-likely scenarios, and considering variation of the likely scenarios).

Likely variables shall be analyzed for parameters, based on likely evolution of events for the likely scenarios.

The less-likely scenarios shall be developed by incorporating safety significant variables exhaustively. The safety assessment shall be conducted, based on new scientific knowledge, using parameters that are considered scientifically reasonable while maintaining appropriate conservativeness. Parameters shall be defined conservatively considering interrelations among parameters, if any.

Evaluation shall be conducted for less-likely scenarios in which some of the functions expected for the disposal system are ignored in order to demonstrate that the long-term safety of the system does not rely excessively on a single barrier function.

As for the likely scenarios, these shall be classified into three categories, as shown below, depending on the migration pathway of radioactive materials to the biosphere:

i) Less-likely groundwater scenarios,
ii) Less-likely gas migration scenarios, and
iii) Less-likely land use scenarios.

As for the likely scenarios, the evaluation of the likely groundwater and gas migration scenarios shall be conducted for each of the periods set out for defining long-term conditions after the period for active control.

As for the likely scenarios, the evaluation of the likely land use scenario shall be conducted for each of lands that will be available for use, assuming geomorphological changes due to uplift/erosion and sea level changes, focusing on the utilization of contaminated areas.

(3) Very unlikely scenarios

It shall be demonstrated that the impacts of radioactive materials on the biosphere assumed to be caused by the disposed solid radioactive wastes will result in conditions that will not require any special measures for radiation protection, even assuming such very unlikely scenarios that cannot be assumed even in the less-likely scenario.

In areas where the possibility of the direct destruction of the disposal facilities due to earthquakes/fault movement and volcanic/igneous activity or extreme thermal/chemical deterioration due to volcanic/igneous activities may not be excluded over a long time frame, scenarios that consider simultaneous loss of several barrier functions or hypothetical degradation with levels beyond the less-likely scenarios shall be evaluated in long time frame.

(4) Human intrusion scenario

With regard to human intrusion scenarios that cannot be excluded, even taking measures to reduce the possibility of occurrence of human intrusion, the waste disposal system shall demonstrate its sufficient robustness against the safety assessment for human intrusion scenarios; the impacts of radioactive materials on the biosphere, assumed to be caused by the disposed solid radioactive wastes due to stylized human actions, will result in conditions that will not require any special measures for radiation protection for residents around the site and for intruders.

Scenarios shown below shall be evaluated to demonstrate the validity of radioactivity concentration, radioactivity in each compartment of the cavern, design of near surface or sub-surface disposal facilities with respect to retarding migration of radioactive materials with engineered barriers, and validity of isolation from the biosphere:

i) Borehole scenarios
ii) Tunnel excavation scenarios, and
iii) A large-scale land use scenario.

(5) Time frame of the assessment

Impacts of radioactive materials on the biosphere, assumed to be caused by the disposed solid radioactive wastes shall be evaluated for the period of safety assessment during which maximum values of radiation dose to residents around the site or intruders will appear for each scenario.

(6) Defining of conditions

1) Defining the long-term evolution of events relevant to the geological environment

Events relevant to the geological environment are categorized into those attributable to plate movement, those attributable to climate change and those attributable to both of these. Their long-term evolution shall be defined for likely and less-likely scenarios.

2) Defining future biosphere conditions

Evaluation shall be conducted for reasonably maximally exposed individuals in the biosphere around the near surface or sub-surface disposal facilities.

Future human lifestyles in the biosphere shall be stylized based on current information relevant to areas around the near surface or sub-surface disposal facilities, as well as general lifestyles currently recognized in Japan.

Natural events that could cause changes in conditions of future lifestyles shall be considered to change according to the scenarios.

3) Defining near surface or sub-surface disposal facilities conditions

Long-term evolution shall be defined focusing on the characteristics of the near surface or sub-surface disposal facilities in a long time range after the period for active control.

Since the near surface or sub-surface disposal facilities could be affected by the surrounding geological environment, physical and chemical phenomena to be caused in the near surface or sub-surface disposal facilities shall be evaluated to define conditions depending on the long-term evolution of the geological environment.

Quality assurance

(1)Quality assurance during the period before terminating active control

Policies on quality assurance activities and formulation of their implementation organization system shall be appropriately demonstrated in order to implement precisely each work concerned covering from design and construction of the waste disposal facilities through termination of their active control.

(2)Quality assurance for models and parameters

Models and parameters to be used in the safety assessment after the period for active control shall demonstrate their validity in light of assessment objectives.

(3) Revisions of safety assessment after the period for active control

Policies shall be demonstrated for formulating and updating a plan to revise the safety assessment after the period for active control to be conducted repetitively until termination of active control and to collect additional scientific and technological knowledge. This shall include information relevant to the near surface or sub-surface disposal facilities to be reflected in the safety assessment, while providing careful considerations to the collection method so as not to reduce safety after terminating the active control due to the collection.

Table H6-1 Technical standards for Waste Disposal Facilities etc.

1. The Technical standards for radioactive waste disposal facility

(1) Technical standards provided in Article 7 of the Rule for Disposal of Category 1 Waste Disposal of Nuclear Fuel Material or Material Contaminated with Nuclear Fuel Material

(1) A waste repository shall be in consistent with the license application documents set forth in Article 51-2 paragraph 1 or Article 51-5 paragraph 1 of the Law and a document describing the conditions for the license granted in accordance with Article 62-2 paragraph 1 of the Reactor Regulation Law (hereinafter referred to as "the license documents").

(2) Tunnels and shafts shall be in consistent with the license documents.

(3) The total radioactivity of specific radioactive materials contained in the radioactive wastes disposed in a waste disposal facility site shall not exceed, due to disposal, the total radioactivity described in the license documents.

(4) Explosive materials, materials that significantly corrode other materials and other hazardous materials shall not be disposed in a waste repository.

(5) A waste repository shall be backfilled in the way described in the license documents.

(2) Technical standards provided in Article 6 of the Rule for Disposal of Category 2 Waste Disposal of Nuclear Fuel Material or Material Contaminated with Nuclear Fuel Material

Article 6

(1) The total amount of the radioactivity for each type of radioactive materials contained in the radioactive waste to be emplaced at the place of business where the waste disposal facility is constructed shall not exceed the total amount of radioactivity for each type of radioactive materials indicated on the application concerning the license as provided in the provisions of Article 51-2 paragraph 1 or Article 51-5 paragraph 1 of the Law, and the document which describe the conditions required for the license as provided in the provision of Article 62-2 Paragraph 1 of the Law ("referred to as "the application etc.", hereinafter in this article, Article 6-3 and Article 8);

(2) Before starting waste repository disposal, the stagnant water at the places for disposal in the waste disposal facility (when the waste disposal facility is demarcated with internal partition equipment of Subparagraph (3) of the following article, the demarked area for the waste repository disposal, the same, hereinafter in this subparagraph) shall be removed, and at the time of waste repository disposal, measures shall be taken to prevent the infiltration of rain water etc. into the places concerned;

(3) In the case of waste repository disposal of solidified concrete etc., measures shall be taken to prevent the scattering of radioactive materials when there is a possibility that the materials may disperse out of the waste disposal facility;

(4) The waste disposal facility shall be taken measures by filling up with the soil etc., so that a void does not remain after waste repository disposal is completed in the waste disposal facility concerned;

(5) Explosive materials, materials that corrode other materials remarkably, and other hazardous

substances shall not be disposed of in the waste disposal facility;

(6) The waste disposal facility where the disposal is completed, the surface shall be covered with the soil, so that the disposed materials and the equipment installed in the waste disposal facility does not expose easily; and

(7) Waste disposal facilities shall have the structure and equipment described in the application etc. other than those provided in the preceding subparagraphs.

2 In case where waste repository disposal is carried out by disposal facility with outer engineered barrier shall be as described in the following subparagraphs, in addition to those provided in the preceding paragraphs:

(1) It shall be constructed following the methods provided by the Minister of METI for the prevention of radiation hazards;

(2) The engineered barrier structure shall be in conformity with the following requirements;

(a)The structure shall be safe from the view point of yield strength against the self weight, earth pressure, seismic force, etc.; and

(b)The measure shall be taken for the effective corrosion prevention according to the quality of the surface water, underground water, and the soil.

(3) The waste disposal facility, which area of opening exceeds 50 square meters or which disposal volume exceeds 250 cubic meters, shall be in conformity with the requirements of the preceding article, and for the prevention of radiation hazards, the place shall be demarcated so that one demarcated area shall not exceed about 50 square meters or one demarcated disposal volume not exceed about 250 cubic meters by a method applied with the internal partition equipment provided by the Minister of METI;

(4) When the waste repository disposal is carried out, the engineered barrier structure and the internal partition equipment described in Subparagraph (3) shall be inspected at any time, and when there is a possibility of destruction of these equipments or leak of radioactive materials, required measures shall be taken to prevent destruction of these equipments, or leak of radioactive materials; and

(5)Waste disposal facility where the waste repository disposal is completed, or where the place is demarcated by the internal partition equipment described in Subparagraph (3), the demarcated area where the disposal is completed, shall be covered by the method provided in the Subparagraph (2) and provided by the Minister of METI for the prevention of radiation hazards as provided in Subparagraph (6) of the preceding article, soon before covering with the soil.

3 In the case of waste repository disposal is carried out by disposal facility without outer engineered barrier shall be as described in the following subparagraphs, in addition to those provided Paragraph 1:

(1) It shall be constructed following the methods provided by the Minister of METI for the prevention of radiation hazards; and

(2) Radioactive waste materials etc. solidified in one piece shall be in conformity with the requirements described in Subparagraph (2) of the preceding Paragraph, and the volume shall not exceed about 500 cubic meters,

2. Technical standards for radioactive wastes to be disposed

(1) Technical standards provided in Article 12 of the Rule for Disposal of Category 1 Waste Disposal of Nuclear Fuel Material or Material Contaminated with Nuclear Fuel Material

(1) Radioactive waste to be disposed shall be waste form.

(2) Technical standards of radioactive waste form shall be as described in the following subparagraphs:

(a) For the prevention of radiation hazards, radioactive wastes shall be enclosed or solidified in the container;

(b) The radioactivity concentration shall not exceed the maximum radioactivity concentration indicated in the application etc.;

(c) Any materials with a possibility of spoiling the integrity of waste form;

(d) It shall have enough strength to bear the potential load that may be extended during waste repository disposal;

(e) There shall be no marked damage; and

(f) Waste form etc. shall be labelled with tag with serial number identifying the waste form as provided by application of the preceding Article. These tag should use the method which does not disappear easily, and be marked at visible spot

(2) Technical standards provided in Article 8 of the Rule for Disposal of Category 2 Waste Disposal of Nuclear Fuel Material or Material Contaminated with Nuclear Fuel Material

Article 8

(1) For subsurface disposal

(a) Radioactive waste to be disposed shall be from a plant or site provided with a fabrication facility (limited to a facility that fabricates only uranium-plutonium mixed oxide fuel), reactor facility or reprocessing facility.
(b) Radioactive waste to be disposed shall be waste packages.
(c) Waste packages shall meet the following requirements.

(2) For pit disposal
(a) Radioactive waste to be disposed shall be from a plant or site with a reactor facility..
(b) Radioactive waste to be disposed shall be waste package or solidified concrete waste.
(c) The waste package or solidified concrete waste shall meet the following requirement or the requirements described in paragraph 3.

(3) For trench disposal
(a) Radioactive waste to be disposed shall be from a plant or site with a reactor facility.
(b) Radioactive waste to be disposed shall be solidified concrete waste.
(c) The solidified concrete waste shall meet the requirement described in paragraph3.

2 Technical standards of radioactive waste form for subsurface disposal and for disposal with engineered barrier shall be as described in the following subparagraphs:

(1) For the prevention of radiation hazards, radioactive wastes shall be enclosed or solidified in the container using the methods provided by the Minister of METI;
(2) The radioactivity concentration shall not exceed the maximum radioactivity concentration indicated in the application etc.;
(3) The density of radioactive materials on the surface shall not exceed one tenth of the surface density limit specified in Article 14 Paragraph 1 Item (c);
(4) Any materials with a possibility of spoiling the integrity of radioactive waste materials shall not be contained;
(5) It shall have enough strength to bear the potential load that may be extended during waste repository disposal;
(6) There shall be no marked damage; and
(7)Waste form etc. shall be labelled with tag indicating the radioactive waste with serial number identifying the waste form as provided by the application of the preceding Article. These tag should use the method which does not disappear easily, and be marked at visible spot

3 The technical standards to wastes, such as solidified concrete waste shall be as described in the following subparagraphs:

(1) An explosive material shall not be included;
(2) The measure to compare with items described in the application shall be taken for the solidified concrete waste. and
(3) The radioactivity concentration shall not exceed the maximum radioactivity concentration indicated in the application etc.

Table H6-2 Items that should be described in Operational Safety Program (Article 63 paragraph 1 of the Rule for Disposal of Category 1 Waste Disposal of Nuclear Fuel Material or Material Contaminated with Nuclear Fuel Material)

(1) System of the observance of related laws and operational safety program (including the participation of management persons).
(2) System for safety culture cultivation (including the participation of management persons).
(3) Quality assurance for waste disposal facility (including the methods of root cause analysis and organization for analysis implementation describing the position of working procedure in operational safety program).
(4) Duties and organization of personnel engaged in management of the radioactive waste disposal facility (except for the following Clause).
(5) Scope of duty on chief engineer of radioactive waste and the contents as well as authority of chief engineer of radioactive waste to supervise operational safety and positioning in the organization.
(6) Safety education for personnel engaged in radiation work at the disposal facility concerning :
  (a) Safety education policy (including its implementation plan);
  (b) Details of safety education concerning:
    1) related laws, regulations and the Operational Safety Program;
    2) structure, performance and operation of disposal facility;
    3) radiation control;
    4) handling of nuclear fuel material ; and
    5) emergency preparedness;.
  (c) Other necessary matters concerning safety education concerning waste disposal facilities.
(7) Operation of systems to be specially controlled for safety reasons
(8) Establishment of a controlled area, a peripheral monitoring area and preservation area of a disposal

facility, and restriction of access to these areas;
(9) Gaseous and liquid discharge monitoring equipment;
(10) Monitoring of dose, dose equivalent, radioactive material concentration and surface contamination density by radioactive materials, and decontamination;
(11) Management of radiation measurement equipment and measuring method;
(12) Patrol and inspection of disposal facility and measures to be taken after patrol and inspection;
(13) Self-imposed periodic facility inspection of waste disposal facility
(14) Receipt, transport, storage and handling of radioactive waste;
(15) Emergency preparedness;
(16) Adequate records and reports (including the report on the occurrences of accidents, failures and equivalents complied with Article 89 each Clause to managements.) of the safe operation of disposal facility (including compliance with the Operational Safety Program)
(17). Periodic assessment of waste disposal facility
(18) Shearing technical information by an operator who conducted maintenance works with other licensee of Category 1 and 2 waste disposal activities.
(19) Disclosure of the nonconformity information in occurrence of nonconformity.
(20) Other matters necessary for the safe operation of disposal facility.

Table H6-3 Methods for Disposal (summary of Article 61 of the Rule for Disposal of Category 1 Waste Disposal of Nuclear Fuel Material or Material Contaminated with Nuclear Fuel Material)

1. Gaseous waste disposal

Gaseous wastes shall be disposed of by any of the following methods:

(1) Discharge through ventilation facilities;

The concentration of radioactive materials under ventilation shall be controlled as low as possible by filtering, decay radioactivity, dilution with a lot of air, etc. at the ventilation facilities. In this case, the concentration of radioactive materials in the air at the ventilation port, or at the exhaust monitoring equipment shall be monitored, so as not to exceed the concentration limits provided by the Minister of METI at outside boundary of peripheral monitoring area;

(2) Retain and store in a gaseous waste storage tank that is effective for the prevention of radiation hazards.

2.Liquid waste disposal

Liquid wastes shall be disposed of by any of the following methods:

(1) Discharge through discharge facilities;

The concentration of radioactive materials under discharge shall be made as low as possible by filtering, evaporation, adsorption by an ion exchange resin method etc., decay radioactivity, dilution by plenty of water, and other methods at the discharge facility. In this case, the concentration of radioactive materials in the underwater at the discharge port, or at the discharge water monitoring equipment, shall be monitored so as not to exceed the concentration limits at outside boundary of peripheral monitoring area provided by the Minister of METI;

(2) Retain and store in a liquid waste storage tank that is effective for the prevention of radiation hazards;

(3) Enclose in a container or solidify in a container, and store in a storage facility that is effective for the prevention of radiation hazards;

(a) When enclosing radioactive wastes in a container, the container concerned shall be in conformity with the following standards:

- The structure shall have low permeability, corrosion resistant and low leakage of radioactive wastes;
- There shall be no possibility of crack or damage; and
- The lid of the container shall not be taken off easily.

(b) When solidifying radioactive wastes in a container, the container used for solidifying the radioactive wastes shall be protective against dispersion or leakage of the radioactive waste;

(c) When storing in a storage facility that is capable of prevention of radiation hazards, the following items shall be subjected:

- When radioactive wastes are enclosed in a container, and are stored, the container concerned shall be wrapped with materials which are capable to absorb all of the enclosed radioactive wastes, or provided with a saucer which is capable to accommodate all of the wastes, when a crack or a damage arises to prevent spread of the contamination;
- The container in which radioactive wastes were enclosed or solidified, shall be attached with marks that shows that the content is radioactive wastes, and a serial number corresponding to the radioactive waste whose recorded content based on the provisions of Article 44 shall

be displayed to compare; and

- Post up notes for administration and control of the disposal facility concerned in the place easily visible.

(4) Incinerate by an incineration facility that is effective for the prevention of radiation hazards

(5) Solidify by a solidifying facility that is effective for the prevention of radiation hazards; or

(6) Waste repository disposal in a waste disposal facility in accordance with the technical standards for disposal facility and radioactive waste to be disposed;

The concentration of radioactive materials in the underwater at the boundary of the outside of an peripheral monitoring area shall be controlled not to exceed the concentration limits provided by the Minister of METI by monitoring the concentration of radioactive materials in the underwater of the peripheral monitoring area

3. Solid waste disposal

Solid wastes shall be processed and stored of by any of the following methods:

(1) Incinerate by an incineration facility that is effective for the prevention of radiation hazards;

(2) Enclose in a container or solidify in a container, and store in a storage facility that is effective for the prevention of radiation hazards, and dispose;

(a) When enclosing radioactive wastes in a container, the container concerned shall be in conformity with the following standards:

- The structure shall have low permeability, corrosion resistant and low leakage of radioactive wastes;
- There shall be no possibility of crack or damage; and
- The lid of the container shall not be taken off easily.

(b) When solidifying radioactive wastes in a container, the container used for solidifying the radioactive wastes shall be protective against dispersion or leakage of the radioactive waste;

(c) When storing in a storage facility that is capable of prevention of radiation hazards, the following items shall be subjected:

- The container in which radioactive wastes were enclosed or solidified, shall be attached with marks that shows that the content is radioactive wastes, and a serial number corresponding to the radioactive waste whose recorded content based on the provisions of Article 44 shall be displayed to compare; and
- Post up notes for administration and control of the disposal facility concerned in the place easily visible.

(3) Radioactive waste such as a large machine, which is very difficult to process by the method of Item (2) or any radioactive waste that needs the decay of radio-activities with time, shall be stored in a depository that is effective for the prevention of radiation hazards, and dispose; Post up notes for administration and control of the disposal facility concerned in the place easily visible.

(4) Waste repository disposal in a waste disposal facility in accordance with the technical standards for disposal facility and radioactive waste to be disposed;

The concentration of radioactive materials in the underwater at the boundary of the outside of an peripheral monitoring area shall be controlled not to exceed the concentration limits provided by the Minister of METI by monitoring the concentration of radioactive materials in the underwater of the peripheral monitoring area

Table H6-4 The Incidents Reporting Criteria (Article 89 of the Rule for Disposal of Category 1 Waste Disposal of Nuclear Fuel Material or Material Contaminated with Nuclear Fuel Material)

Upon occurrence of any of the following incidents, the Licensee of a Category 1 Waste Disposal shall immediately give notice to the Minister of METI, and report within ten days on the details of the incidents and corrective measures taken:

(1) Theft or loss of nuclear fuel material;

(2) Failures of a disposal facility that disturb category 1 waste disposal work as special measures are needed for repair of the failure;

(3) Failures of a disposal facility that disturb category 1 waste disposal work as a result of loss or potential loss of confinement function of nuclear fuel materials etc. in the limited area, radiation shielding function to prevent radiation hazards by external radiation, or fire or explosion protection function in a waste disposal facility;

(4) Abnormal condition of discharge of gaseous radioactive wastes at ventilation facility or discharge of liquid radioactive wastes from a discharge facility due to failures of a disposal facility or other unexpected events;

(5) Atmospheric radio-nuclides concentrations by radiation monitoring outside peripheral monitoring

area exceeding limit provided by the Minister of METI because of discharge of gaseous radioactive waste;

(6) By radiation monitoring, radio-nuclides concentrations in discharged water at the outer boundary of peripheral monitoring area exceeding limits provided by the Minister of METI ;

(7) Leakage of nuclear fuel materials, etc. outside the controlled area;

(8) Leakage of nuclear fuel materials, etc. inside the controlled area due to a failure of disposal facility or other unexpected events excluding following cases (excluding the case when the measures such as access control or key control for the area related to the leakage or when the leaked material spreads outside the controlled area);

- When the leaked liquid nuclear fuel materials etc. does not spread outside the curb readily installed around the equipment for prevention of spreading of leakage;
- The function of ventilation related to the area of the leakage of gaseous nuclear fuel materials etc. is maintained appropriately;
- The amount of radioactivity of leaked nuclear fuel materials etc. is very small or the degree of leakage is minor.

(9) Effective dose by radiation exposures of personnel in the controlled area exceeding or likely to exceed dose limits of 5mSv for radiation workers and 0.5mSv for non-radiation workers due to a failure of a disposal facility or other unexpected events;

(10) Radiation exposures of radiation workers exceeding or likely to exceed the dose limits specified by the Minister of METI ;

(11) Any other hazards to personnel occurring or likely to occur at the facility (excluding minor non-radiation hazards).

L5 Illustrations related to spent fuel storage

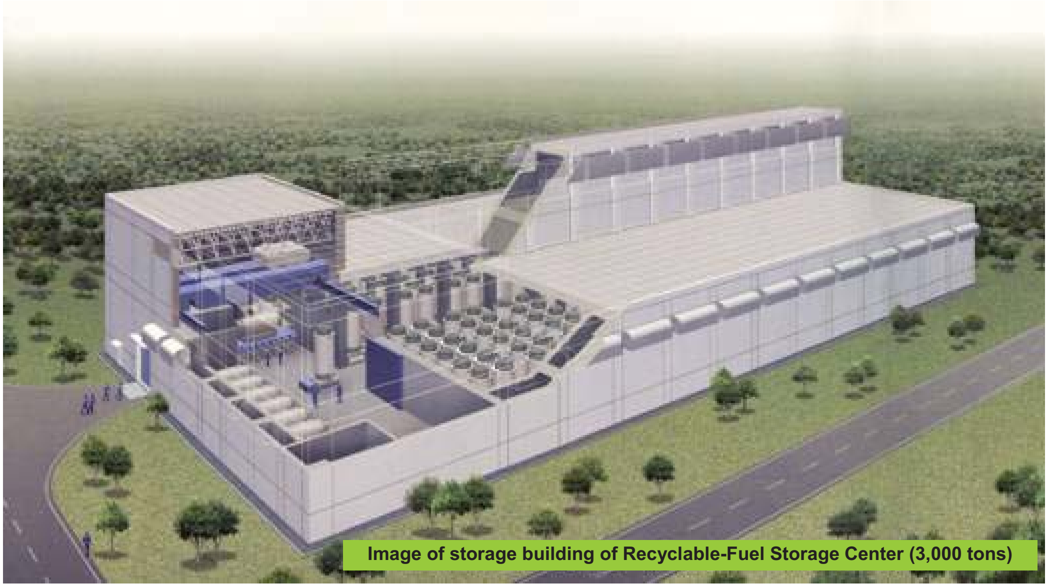


Fig. L5-1 Conceptual Drawing of Recyclable-Fuel Storage Center
(Source: Home page of Recyclable-Fuel Storage Company)

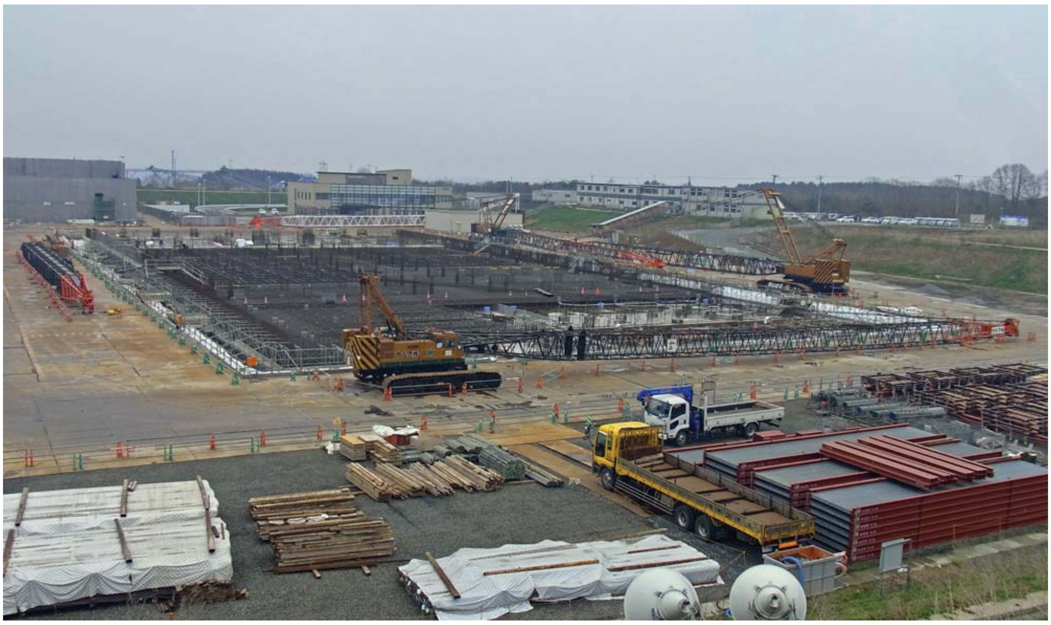


Fig. L5-2 Construction site view of Recyclable-Fuel Storage Center
(Source: Home page of Recyclable-Fuel Storage Company)

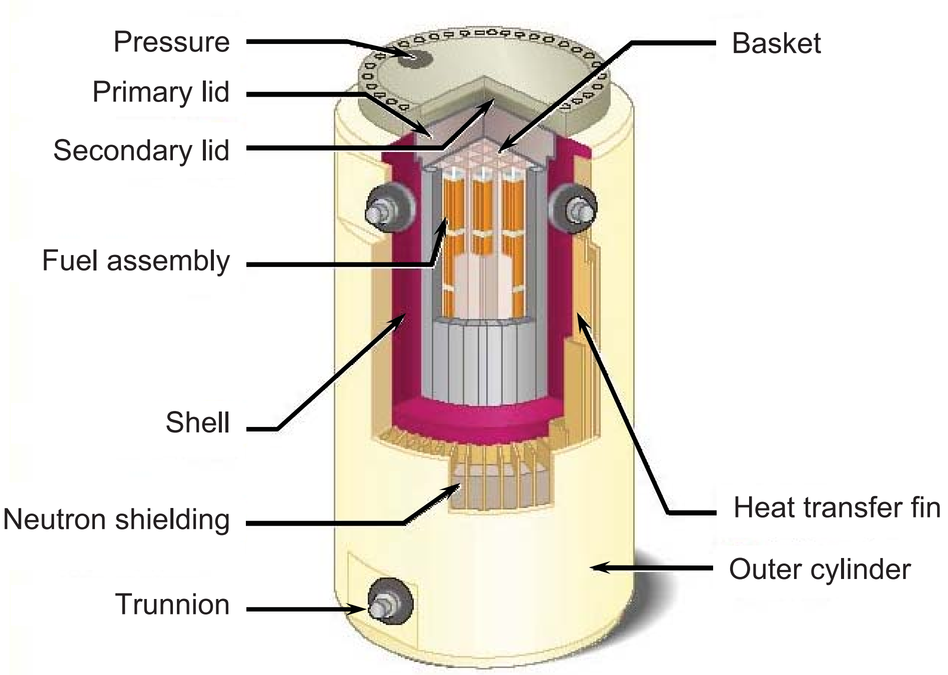


Fig. L5-3 Concept of metallic cask
(Source: Home page of Recyclable-Fuel Storage Company)

L6 Illustrations related to waste disposal

L6.1 Categorization of waste disposal methods

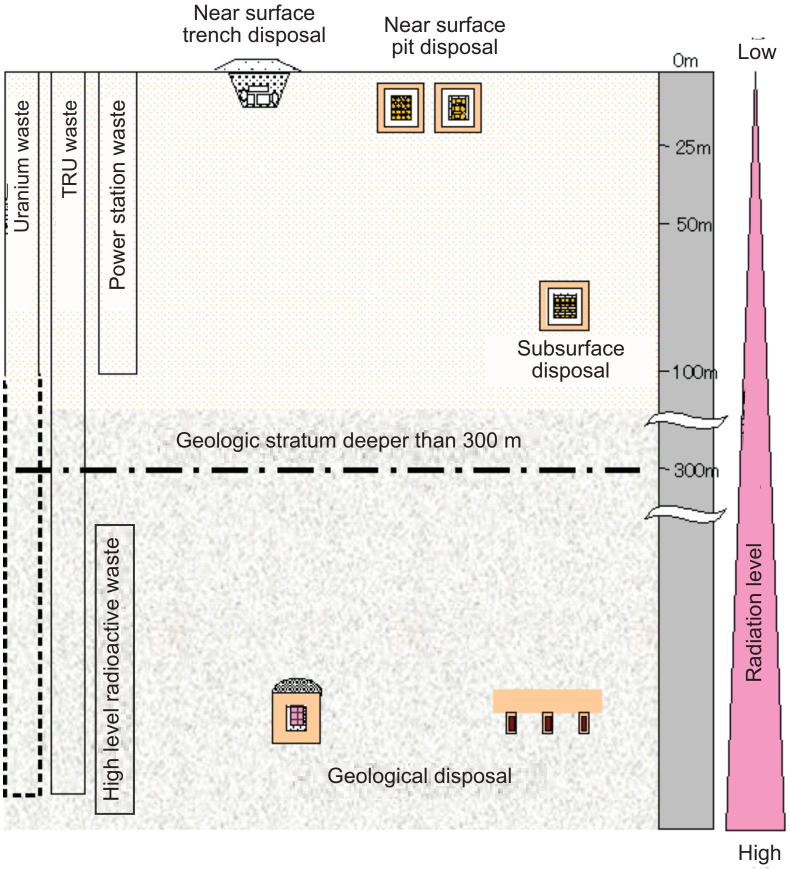


Fig. L6-1 Categorization of radioactive waste disposal methods in Japan
(Source: Home page of ANRE)

L6.2 Near surface pit disposal

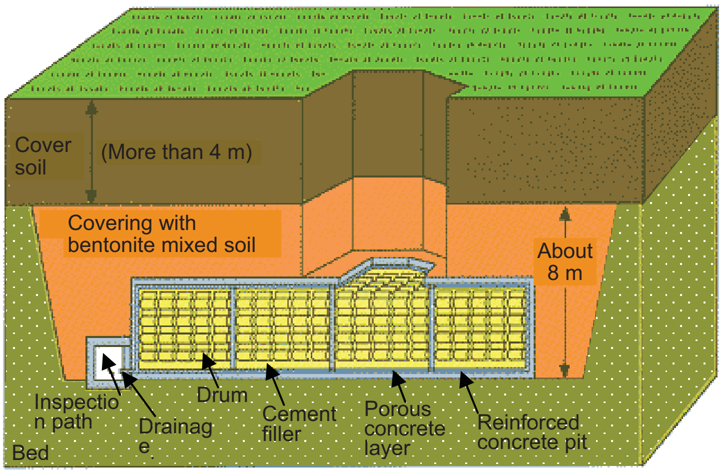


Fig. L6-2 Example of near surface pit disposal
(Source: Home page of ANRE)

L6.3 Subsurface disposal

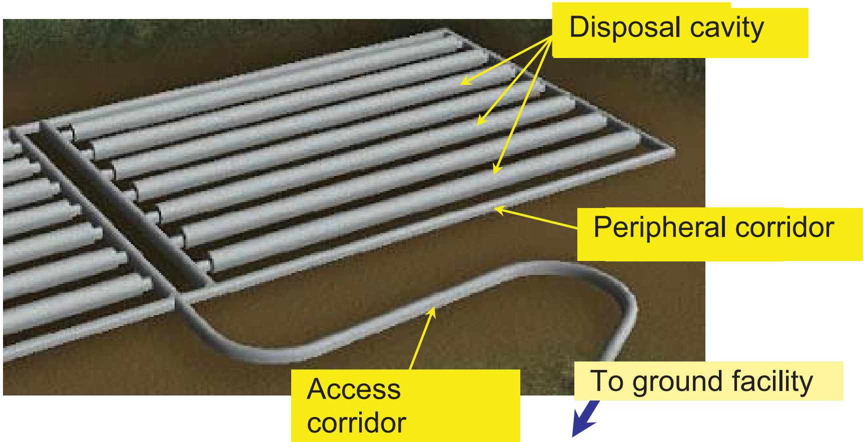


Fig. L6-3-1 Underground structure of waste disposal facility
(Source: "Safety Regulation on subsurface disposal of low level radioactive waste", Waste Safety Subcommittee, NISS/ACNRE, January 2008)

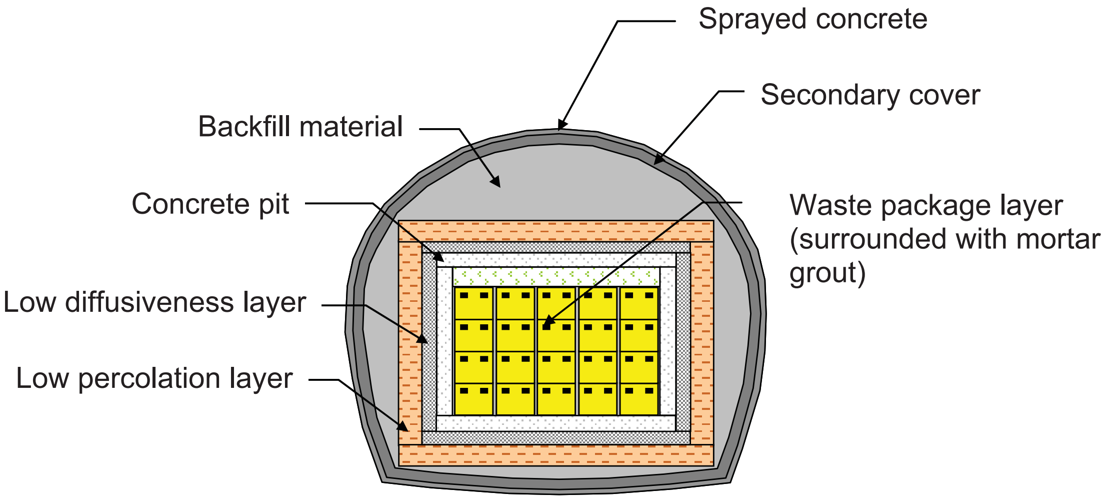


Fig. L6-3-2 Vertical sectional view of disposal cavity
(Source: "Safety Regulation on subsurface disposal of low level radioactive waste", Waste Safety Subcommittee, NISS/ACNRE, January 2008)

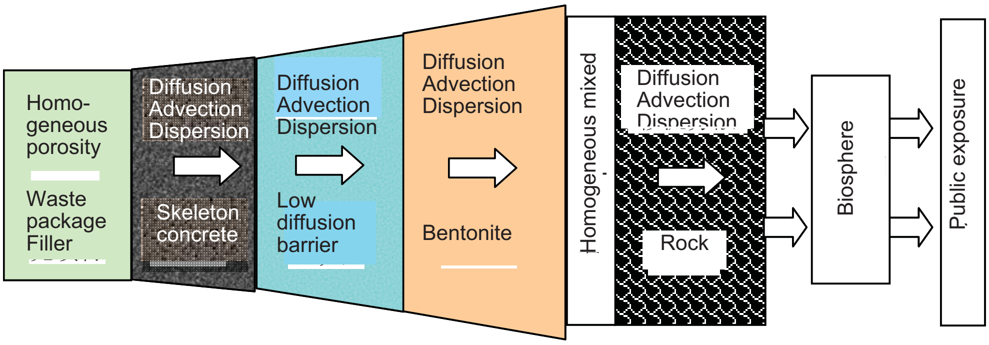


Fig. L6-3-3 Performance evaluation model for safety evaluation
(Source: "Safety Regulation on subsurface disposal of low level radioactive waste",
Waste Safety Subcommittee, NISS/ACNRE, January 2008)

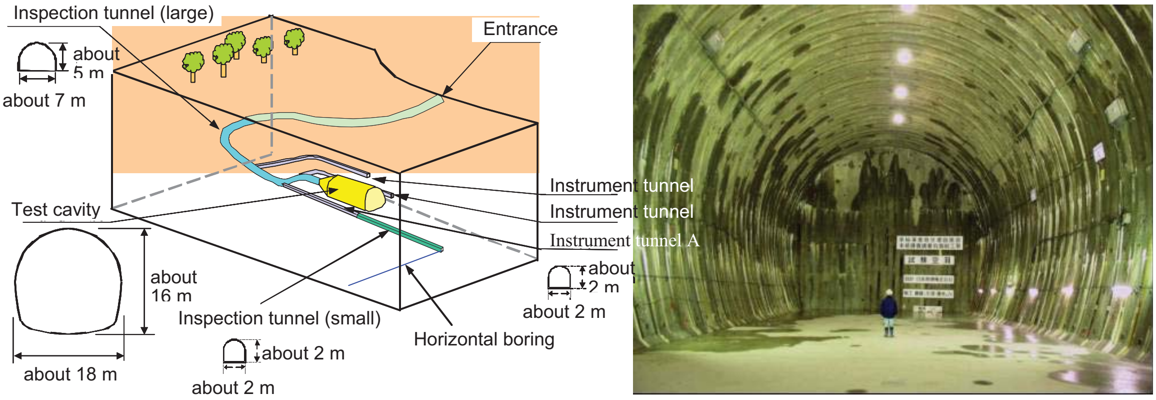


Fig. L6-3-4 Inspection tunnel
(Source: "Safety Regulation on subsurface disposal of low level radioactive waste",
Waste Safety Subcommittee, NISS/ACNRE, January 2008)

L6.4 Geological disposal

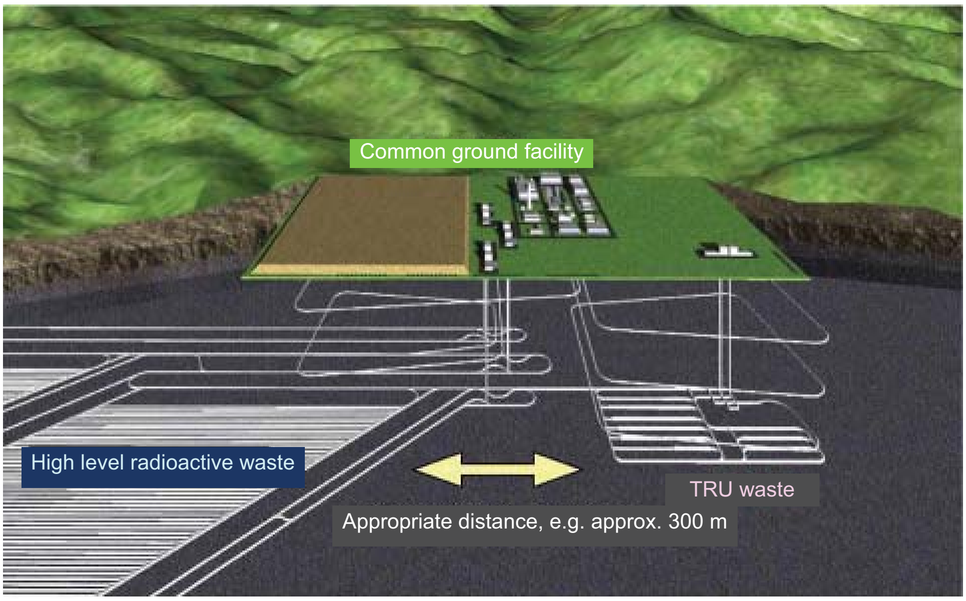


Fig. L6-4 Concept of single-site disposal
(Source: Home page of ANRE)

L7 Reports etc., related to the accident at TEPCO's Fukushima Nuclear Power Stations

- Report of Japanese Government to the IAEA Ministerial Conference on Nuclear Safety - The Accident at TEPCO's Fukushima Nuclear Power Stations – (Contents of summary) (Nuclear Emergency Response Headquarters, June 2011)
  http://www.kantei.go.jp/foreign/kan/topics/201106/iaea_houkokusho_e.html

- Additional report of Japanese Government to the IAEA Mini - The Accident at TEPCO's Fukushima Nuclear Power Stations – (Second Report) (summary) (Nuclear Emergency Response Headquarters, September 2011)
  http://www.kantei.go.jp/foreign/incident/health_and_safety.html

- Points of Progress Status of "Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station, TEPCO" (Nuclear Emergency Response Headquarters, Government-TEPCO Integrated Response Office, October 17, 2011)
  http://www.meti.go.jp/english/earthquake/nuclear/

- The Act on measures for radioactive wastes (August, 2011)

- Basic Policy for Emergency Response on Decontamination Work (Nuclear Emergency Response Headquarters, Government-TEPCO Integrated Response Office, August, 2011)
  http://www.meti.go.jp/english/press/2011/0826_03.html

Attachments

Reports etc., related to the accident at TEPCO’s Fukushima Nuclear Power Stations

Report of the Japanese Government
to the IAEA Ministerial Conference on Nuclear Safety

- The Accident at TEPCO's Fukushima Nuclear Power Stations –

(Summary)

June 2011

Nuclear Emergency Response Headquarters

Government of Japan

Contents of summary

1. Introduction

The Tohoku District - off the Pacific Ocean Earthquake and the resulting tsunamis struck the Fukushima Dai-ichi and Fukushima Dai-ni Nuclear Power Stations (hereinafter, the “Fukushima NPSs”) of Tokyo Electric Power Co. (TEPCO) at 14:46 on March 11, 2011 (all times herein are JST), followed by a nuclear accident unprecedented in both scale and timeframe.

The situation has become extremely trying for Japan, insofar as it has had to execute countermeasures for the nuclear accident whilst also dealing with the broader disaster caused by the earthquake and tsunamis.

This nuclear accident has turned out to be a major challenge for Japan, with numerous relevant domestic organizations working together to respond to the situation while also receiving support from many countries around the world. The fact that this accident has raised concerns around the world about the safety of nuclear power generation is a matter which Japan takes with the utmost seriousness and remorse. Above all, Japan sincerely regrets causing anxiety for people all over the world about the release of radioactive materials.

Currently, Japan is dealing with the issues and working towards settling the situation utilizing accumulated experience and knowledge. It is incumbent upon Japan to share correct and precise information with the world continually in terms of what happened at the Fukushima NPSs, including regarding how events progressed and how Japan has been working to settle the situation. Japan also recognizes a responsibility to share with the world the lessons it has learned from this process.

On the basis of the recognitions stated above, this report has been prepared as the report from Japan for the International Atomic Energy Agency (IAEA) Ministerial Conference on Nuclear Safety, which will convene in June 2011. The Government-TEPCO Integrated Response Office is engaged in working toward settling the situation from the accident under the supervision of Mr. Banri Kaieda, Minister of Economy, Trade and Industry, in conjunction with and joining forces with the Nuclear and Industrial Safety Agency and also with TEPCO. This report was prepared by the Government Nuclear Emergency Response Headquarters, taking into account the approach toward the restoration of stable control taken by the Government-TEPCO Integrated Response Office and hearing the views of outside experts. The work has been managed as a whole by Mr. Goshi Hosono, Special Advisor to the Prime Minister designated by Prime Minister Naoto Kan in his capacity as General Manager of the Government Nuclear Emergency Response Headquarters (GNER HQs).

This report is a preliminary accident report and represents a summary of the evaluation of the accident and the lessons learned to date based on the facts ascertained about the situation so far. In terms of its range, the summary is centered on technical matters related to nuclear safety and nuclear emergency preparedness and responses up to the present moment. Issues related to nuclear damage compensation, the wider societal effects, and so on are not covered.

In addition to preparing this report, the Government has established the “Investigation Committee on the Accidents at the Fukushima Nuclear Power Station of Tokyo Electric Power Company” (hereinafter the “Investigation Committee”) in order to provide an overall investigation of the utility of countermeasures being taken against the accident that has occurred at the Fukushima NPSs. Aspects stressed within this Investigation Committee are independence from Japan’s existing nuclear energy administration, openness to the public and the international community, and comprehensiveness in examining various issues related not only to technical elements but also to institutional aspects. These concepts are used as the basis for strictly investigating all activities undertaken so far, including activities by the Government in terms of countermeasures against the accident. The contents of this report will also be investigated by the Investigation Committee and the progress of the investigation activities will be released to the world.

Japan's basic policy is to release information about this accident with a high degree of transparency. In preparing this report under this policy, attention has been paid to providing as accurately as possible an exact description of the facts of the situation, together with an objective evaluation of countermeasures against the accident, clearly distinguishing between known and unknown matters. Factual descriptions are based on findings current as of May 31, 2011.

Japan intends to exert its full efforts to properly tackle the investigation and analysis of this accident and to continue to provide those outcomes to both to the IAEA and to the world as a whole.

2. Situation regarding Nuclear Safety Regulations and Other Regulatory Frameworks in Japan before the Accident

Safety regulations governing NPSs in Japan are mandated under the "Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors" and "The Electricity Business Act." The Nuclear and Industrial Safety Agency (NISA) within the Ministry of Economy, Trade and Industry is responsible for these regulations. The Nuclear Safety Commission (NSC), established under the Cabinet Office, has the role of supervising and auditing the safety regulation activities implemented by NISA and has the authority to make recommendations through the Prime Minister to the Minister of Economy, Trade and Industry to take necessary measures, as necessary. When the Minister of Economy, Trade and Industry issues a license for the establishment of an NPS, the Minister is required to seek in advance the NSC's views regarding safety issues.

The monitoring and measurement activities for preventing radiation damages and for evaluating radioactivity levels are carried out by related government bodies including the Ministry of Education, Culture, Sports, Science & Technology (MEXT) based on the related laws and regulations.

Responses to nuclear accidents in Japan are supposed to be carried out based on the Act on Special Measures Concerning Nuclear Emergency Preparedness, (hereinafter "ASMCNE"), which was established after the occurrence of a criticality accident in a JCO nuclear fuel fabrication facility in 1999. ASMCNE complements the Disaster Countermeasures Basic Law should a nuclear emergency occur. ASMCNE stipulates that the national and local governments, and the licensee, shall address a nuclear emergency by acting in close coordination with each other, that the Prime Minister shall declare a nuclear emergency situation in response to the occurrence of a nuclear emergency situation and give instructions to evacuate area(s) or to take shelter as appropriate, that the GNER HQs headed by the Prime Minister shall be established to respond to the situations, and so on.

Emergency environmental monitoring, which is one of the responses to be taken at the time of a nuclear disaster, shall be implemented by local governments and supported by MEXT.

3. Disaster Damage in Japan from the Tohoku District - off the Pacific Ocean Earthquake and Resulting Tsunamis

The Pacific coast area of eastern Japan was struck by the Tohoku District - off the Pacific Ocean Earthquake, which occurred at 14:46 on March 11, 2011. This earthquake occurred in an area where the Pacific plate sinks beneath the North American plate and the magnitude of this earthquake was 9.0, the largest in Japan's recorded history. The seismic source was at latitude 38.1 north, longitude 142.9 east and at a depth of 23.7km.

The crustal movement induced by this earthquake extended over a wide range, from the Tohoku District to the Kanto District. Afterwards, tsunamis struck the Tohoku District in a series of seven waves, resulting in the inundation of an area as large as 561km^2. As of the date that this report was issued, approximately 25,000 people are reported dead or missing.

In terms of the earthquake observed at the Fukushima NPSs, the acceleration response spectra of the earthquake movement observed on the basic board of reactor buildings exceeded the acceleration response spectra of the response acceleration to the standard seismic ground motion Ss for partial periodic bands at the Fukushima Dai-ichi NPS. As for the Fukushima Dai-ni NPS, the acceleration response spectra of the earthquake movement observed on the basic board of the reactor buildings was below the acceleration response spectra of the response acceleration to the standard seismic ground motion Ss. The earthquake damaged the external power supply.

Thus far, major damage to the reactor facilities which are important for safety functions has yet to be recognized. Further investigation is needed because the details of the situation remain unknown.

In terms of the damage to the external power supply at the Fukushima NPSs, a total of six external power supply sources had been connected to the Dai-ichi Power Station on the day the earthquake hit. However, all power supplied from these six lines stopped due to damage to the breakers, etc. and the collapse of the power transmission line tower due to the earthquake. Furthermore, at the Fukushima Dai-ni NPS, while a total of four external power supply sources had been connected as of the day of the earthquake, only one of them remained to supply electricity after the quake struck, as one line was under maintenance, one stopped due to the earthquake, and yet another also stopped. (After the completion of restoration works at 13:38 the following day, March 12, one power supply line was restored, resulting in two sources supplying the electricity thereafter.)

With respect to the strike of the tsunamis, the Fukushima Dai-ichi NPS was hit by the first enormous wave at 15:27 on March 11 (41 minutes after the earthquake), and the next enormous wave around 15:35, while the Fukushima Dai-ni NPS was hit by the first enormous wave at around 15:23 (37 minutes after the earthquake) and by the next enormous wave at around 15:35 (as stated in TEPCO's announcement). The license for the establishment of nuclear reactors at the Fukushima Dai-ichi NPS was based on the assumption that the maximum design basis tsunami height expected was 3.1m. The assessment in 2002 based on the "Tsunami Assessment Method for Nuclear Power Plants in Japan" proposed by the Japan Society of Civil Engineers (JSCE) indicated a maximum water level of 5.7m, and TEPCO raised the height of its Unit 6 seawater pump installation in response to that assessment. However, the inundation height due to the tsunami this time was 14 to 15m, and in all units, the seawater pump facilities for cooling auxiliary systems were submerged and stopped functioning. In addition to that, all the emergency diesel power generators and the distribution boards installed in the basements of the reactor buildings and turbine buildings except for Unit 6 were inundated and stopped functioning.

For the Fukushima Dai-ni NPS, the maximum design basis tsunami height was expected to be 3.1 to 3.7m. Further, the said assessment by JSCE in 2002 indicated a maximum water level of 5.1 to 5.2m. Because of the tsunamis, most of the seawater pump facilities for cooling auxiliary systems, except for some, were submerged and stopped functioning, and the emergency diesel power generators installed in the basement of the reactor buildings stopped.

Thus, the assumption of, and the preparedness for, the onslaught of enormous tsunamis were not sufficient.

4. Occurrence and Development of the Accident at the Fukushima Nuclear Power Stations

(1) Outline of the Fukushima Nuclear Power Stations

The Fukushima Dai-ichi NPS is located in the towns of Okuma and Futaba, which are in the county of Futaba in Fukushima Prefecture. This NPS consists of six Boiling Water Reactors (BWR) installed-- Units 1 to 6-- with a total generating capacity of 4,696MW.

The Fukushima Dai-ni NPS is located in the towns of Tomioka and Naraha of Futaba county in Fukushima Prefecture, and consists of 4 BWRs whose total generating capacity is 4,400MW.

(2) Status of safety assurance for the Fukushima NPSs

In facilities with nuclear reactors, the occurrence of failures must be prevented even if natural phenomenon, etc. should occur. However, assuming that failures may nevertheless happen, protective measures are provided to ensure safety even when the unusual situation of design basis event should happen. In addition, Japan started undertaking accident management measures in 1992, designed to minimize to the greatest possible extent the possibility of reaching a state of a severe accident should these protective measures not be enough and mitigate the effects even if the situation were to reach the state of a severe accident. Implementation of these accident management measures is not required by law under the safety regulations. The accident management measures are implemented by nuclear operators voluntarily, and the government requires them to make reports on their implementation.

The accident management measures at the Fukushima NPSs have been implemented for the following four functions: functions to shutdown the nuclear reactor, functions to inject water into the nuclear reactors and the PCVs, functions to remove heat from the PCVs, and functions to support the safety functions. For example, measures to maintain functions to inject water into the nuclear reactors include that the connection to the piping be secured for water injection functions to nuclear reactors through PCV cooling systems and that, as alternative water-injection equipment, the core spray system from the existing Make Up Water Condensate (MUWC) system and the fire extinguishing system be utilized.

(*Severe Accident: An event that significantly exceeds the design basis event, and a situation where appropriate cooling for the reactor core or control of reactivity is rendered inoperable by the postulated measures under the evaluation for safety design, resulting in serious damage to the reactor core.)

(**Accident Management: Measures taken to prevent an event leading to a severe accident, or to mitigate its influence in the event of a severe accident, by utilizing a) functions other than the anticipated primary ones under the safety margin and safety design included in the current design or b) newly installed equipment in preparation for a severe accident, etc.)

(3) Operating status of the Fukushima NPSs before the earthquake

In terms of the operating status at the Fukushima NPSs before the earthquake on March 11, Unit 1 was under operation at its rated electric power, Units 2 and 3 were under operation at their rated thermal power, and Units 4, 5 and 6 were under periodic inspection. Among these Units, Unit 4 was undergoing a major construction for renovations, with all the nuclear fuel in the RPV having already been transferred to the spent fuel pool. Moreover, 6,375 units of spent fuel were stored in the common spent fuel pool.

At the Fukushima Dai-ni NPS, all the nuclear reactors from Units 1 to 4 were under operation at their rated thermal power.

(4) The incidence and development of the accident at the Fukushima NPSs

At the Fukushima Dai-ichi NPS, Units 1 to 3 which were under operation automatically shut down at 14:46 on March 11. All six external power supply sources were lost because of the earthquake. This caused the emergency diesel power generators to start up. However, seawater pumps, emergency diesel generators and distribution boards were submerged because of the tsunami strike, and all emergency diesel power generators stopped except for one generator in Unit 6. For that reason, all AC power supplies were lost except at Unit 6. One emergency diesel power generator (an air-cooled type) and the distribution board escaped submersion and continued operation at Unit 6. In addition, since the seawater pumps were submerged by the tsunami, residual heat removal systems to release the residual heat inside the reactor to the seawater and the auxiliary cooling systems to release the heat of various equipment to the seawater lost their functions..

TEPCO's operators followed TEPCO's manuals for severe accidents and urgently attempted to secure power supplies in cooperation with the government, in order to recover various kinds of equipment within the safety systems while the core cooling equipment and the water-injection equipment, which had automatically started up, were operating. However, ultimately power supplies could not be secured.

Since the core cooling functions using AC power were lost in Units 1 to 3, core cooling functions not utilizing AC power were put into operation, or, alternately, attempts were made to put them into operation. These were operation of the isolation condenser*** in Unit 1, the operation of the reactor core isolation cooling system**** (RCIC) in Unit 2 and the operation of the RCIC and the high pressure injection system***** (HPCI) in Unit 3.

These core cooling systems that do not utilize AC power supplies stopped functioning thereafter, and were switched to alternative injections of freshwater or sea water by fire extinguishing lines, using fire engine pumps.

Concerning Units 1 to 3 of the Fukushima Dai-ichi NPS, as the situation where water injection to each RPV was impossible to continue for a certain period of time, the nuclear fuel in each reactor core was not covered by water but was exposed, leading to a core melt. Part of the melted fuel stayed at the bottom of the RPV.

A large amount of hydrogen was generated by chemical reactions between the zirconium of the fuel cladding tubes, etc. and water vapor. In addition, the fuel cladding tubes were damaged and radioactive materials therein were discharged into the RPV. Further, these hydrogen and radioactive materials were discharged into the PCV during the depressurization process of the RPV.

Injected water vaporizes after absorbing heat from the nuclear fuel in the RPV. Accordingly, the inner pressure rose in the RPVs which had lost their core cooling functions, and this water vapor leaked through the safety valves into the PCV. Due to this, the inner pressure within the PCVs in Units 1 to 3 rose gradually, with PCV wet well vent operations carried out a number of times, in which the gases in the PCVs are released from the gas phase area in the suppression chamber into the atmosphere, through the ventilation stack, for the purpose of preventing damage to the PCV caused by the pressure therein.

(***Isolation condenser: Equipment with the function of returning water condensed from water vapor in the RPV by natural circulation (that is, with no driving by pumps required) to cool the RPV, when the RPV is isolated due to the loss of external power supply, etc. (when reactor cooling cannot be done by the main condenser). An isolation condenser has a structure to cool the water vapor that was led into the heat transfer tube with the water stored in the condenser (body side).

(****Reactor core isolation cooling system (RCIC): A system that cools the reactor cores when reactors are isolated from feed water and condenser systems due to loss of external power, etc. Either the condensate storage tank or the pressure suppression pool water can be used as a water source. The driving system for the pump is a turbine which uses some of the steam in the reactors.)

(*****High pressure injection system (HPCI): One of the emergency core cooling systems that injects water, with the pump driven by providing the water vapor generated by the decay heat to the turbine.)

After the wet well venting of the PCVs, explosions presumably caused by hydrogen which had leaked from the PCV occurred in the upper area of the reactor buildings, ruining the operation floor in the reactor buildings of Units 1 and 3. As a result of these incidents, a lot of radioactive materials were discharged to the atmosphere. Following the ruination of the Unit 3 building, an explosion probably caused by hydrogen occurred in the reactor building of Unit 4, ruining its upper area. In Unit 4, all core fuels had been transferred to the spent fuel pool for periodic inspection before the earthquake. During this time, it seems that in Unit 2 a hydrogen explosion occurred and caused damage at a point presumed to be near the suppression chamber.

The most urgent task at the site, along with recovery of the power supply and the continuation of water injection to reactor vessels, was water injection to the spent fuel pools. In the spent fuel pool in each unit, the water level continued to drop on account of the evaporation of water caused by the heat of the spent fuel in the absence of the pool water cooling system, due to the loss of power supply. Water injection to the spent fuel pool was carried out by the Self-Defense Forces, the Fire and Disaster Management Agency and the National Police Agency, using helicopters and water cannon trucks. Concrete pump trucks were ultimately secured, which led to stable water injection using freshwater from nearby reservoirs after the initial seawater injection.

(5) Status of each Unit at the Fukushima NPSs

1) Fukushima Dai-ichi NPS Unit 1

· *Loss of power supply*

The reactor was scrammed by the earthquake that occurred at 14:46 on March 11. The external power supply was lost due to the earthquake and two emergency diesel generators started up. The two emergency diesel generators stopped functioning as a result of the tsunami at 15:37 on the same day and all AC power was lost.

· *Cooling of the reactor*

The emergency isolation condenser* (IC) automatically started up at 14:52 on March 11 and started cooling the reactor. Subsequently, the IC stopped functioning at 15:03 on the same day. According to the operation procedure document, the cooling speed is to be adjusted to 55 degrees Celsius/hour. The pressure in the reactor rose and fell three times afterwards, which indicates that the IC had been operated manually. According to TEPCO, fresh water injection from a fire extinguishing line started at 05:46 on March 12, using a fire engine pump, and 80,000 liters of water were injected by 14:53 on the same day, but they claim that it is unknown when water injection stopped. Seawater injection started at 19:04 by means of a fire extinguishing line. There was some confusion between the government and the main office of TEPCO in communications and in the chain of command on seawater injection, but seawater injection continued following the decision by the director of the Fukushima Dai-ichi NPS. Injection of freshwater resumed on March 25 with the injection of water stored in a pure water tank. For at least one hour after the earthquake, the water level in the reactor was not low enough to trigger an automatic start-up (L-L: 148cm below the bottom of the separator) of the High Pressure Coolant Injection system (HPCI), and there has been no record of a start-up.

· *Status of the reactor core*

Water injection seemed to have stopped for 14 hours and 9 minutes, after the total loss of AC power at 15:37 on March 11 until the start of freshwater injections at 5:46 on March 12. From the results of the evaluation by NISA (on the assumption that the HPCI was not operating), it seems that the fuel was exposed due to a drop in the water level around 17:00 on March 11, and that the core melt started afterwards. A considerable amount of melted fuel seems to have moved to and accumulated at the bottom of the RPV. There is a possibility that the bottom of the RPV was damaged and some of the fuel might have dropped and accumulated on the D/W floor (lower pedestal).

· *Hydrogen explosion*

Wet well venting of the PCV was carried out at 14:30 on March 12. Afterwards, a hydrogen explosion occurred in the reactor building at 15:36 on the same day. Zirconium appears to have reacted with water as the temperature rose in the RPV, generating hydrogen. It appears that the gas containing the hydrogen accumulating in the upper area of the reactor buildings due to leakage, etc. from the PCV triggered the hydrogen explosion. Injecting nitrogen into the PCV started on April 7.

· *Leakage of cooling water*

The cooling water that has been injected into the RPV appears to be leaking from the bottom of the RPV. The total amount of water injected into the RPV was approximately 13,700 metric tons (information from TEPCO; current as of May 31), and total amount of steam generated is estimated at 5,100 metric tons. Therefore the amount of leakage seems to be the difference between these two, approximately 8600 metric tons, minus the amount inside the RPV (approximately 350m^3).

2) Fukushima Dai-ichi NPS Unit 2

· *Loss of power supply*

The reactor was scrammed by the earthquake at 14:47 on March 11 and the external power supply was lost and two emergency diesel generators started up. The two emergency diesel generators were stopped by the tsunami and all AC power supply was lost at 15:41 on the same day.

· *Cooling of the reactor*

TEPCO started up the Reactor Core Isolation Cooling System (RCIC) manually around 14:50 on March 11. The RCIC automatically stopped because of the high water level in the reactor at around 14:51 on the same day. Afterwards, TEPCO manually started it up at 15:02 and it stopped again at 15:28 on the same day. TEPCO started it up again manually at 15:39 on the same day. The RCIC stopped at 13:25 on March 14. Seawater injection using a firefighting pump started at 19:54 on the same day.

· *Status of the reactor core*

Water injection appears to have stopped for 6 hours and 29 minutes, from 13:25 on March 14 when the RCIC stopped, until seawater injection resumed at 19:54 on the same day. According to the results of NISA's analysis, it seems that the fuel was exposed due to a drop in the water level at around 18:00 on March 14 and that the core started melting afterwards. A considerable part of melted fuel seems to have moved to and accumulated at the bottom of the RPV. There is a possibility that the bottom of the RPV was damaged and some of the fuel might have dropped and accumulated on the D/W floor (lower pedestal).

· *Explosion noise*

A PCV wet vent operation, which included that of small valves, was carried out from around 11:00 on March 13. Noise of an explosion occurred at around 6:00 on March 15 around the suppression chamber of the containment vessel. There is a possibility that the explosion occurred in the torus room, as the gas, including hydrogen, was generated by a reaction between the zirconium and water along with a temperature rise in the RPV, invading the suppression chamber by such means as the opening of the main steam safety relief valve.

· *Leakage of cooling water*

As of now, injected cooling water is thought to be leaking at the bottom of the RPV. The total amount of injected water to the RPV was approximately 21,000 metric tons (information by TEPCO; current as of May 31), and the total amount of steam generated is estimated at 7,900 metric tons. Therefore, the amount of leakage appears to be the difference between these two, approximately 13,100 metric tons minus the amount inside the RPV (approximately 500 m^3).

3) Fukushima Dai-ichi NPS Unit 3

· *Loss of Power supply*

The reactor was scrammed by the earthquake at 14:47 on March 11, and the external power supply was lost and two emergency diesel generators started up. The two emergency diesel generators were stopped by the tsunami and all AC power was lost at 15:41 on the same day.

· *Cooling of the reactor*

The Reactor Core Isolation Cooling System (RCIC) was manually started at 15:05 on March 11. It stopped automatically at 15:25 on the same day due to a rise in the reactor water level. It was started manually at 16:03 on the same day, and the RCIC stopped at 11:36 on March 12. The High Pressure Core Injection System (HPCI) automatically started due to the reactor low water level (L-2) at 12:35 on the same day, and the HPCI stopped at 2:42 on March 13. The reason for that appears to have been a drop in pressure in the reactor. Another probable cause could be water vapor outflow from the HPCI system.

· *Status of the reactor core*

The operation to inject water containing boric acid commenced using a fire extinguishing line at around 9:25 on March 13. However, the water could not be injected sufficiently due to the high pressure in the reactor, and the water level in the reactor lowered. As a result, water injection was halted for at least 6 hours and 43 minutes after the HPCI stopped at 02:42 on March 13 until water injection using the fire extinguishing line started at 09:25 on the same day. According to the results of NISA's analysis, the fuel appears to have been exposed due to a drop in the reactor water level at around 08:00 on March 13, with the core starting to melt afterwards. A considerable part of melted fuel seems to have moved to and accumulated at the bottom of the RPV. However, there is a possibility that the bottom part of the RPV was damaged and some of the fuel might have dropped and accumulated on the dry well floor (lower pedestal).

· *Hydrogen explosion*

A wet well vent operation of the PCV was carried out at 05:20 on March 14. A hydrogen explosion occurred at the reactor building at 11:01 on the same day. It seems that zirconium and water reacted along with a rise in temperature in the PCV, and that gas containing hydrogen by such means as leakage from the PCV accumulated in the upper area of the reactor buildings, triggering a hydrogen explosion.

· *Leakage of cooling water*

It is assumed at the moment that injected cooling water is leaking at the bottom of the RPV. The total amount of water injected into the RPV was approximately 20,700 metric tons (information by TEPCO; current as of May 31) and the total amount of steam is estimated to be approximately 8,300 metric tons. A substantial amount equivalent to the difference between these two, approximately 12,400 metric tons minus the amount in the RPV (approximately 500m^3), appears to have been leaked.

4) Fukushima Dai-ichi NPS Unit 4

· *Cooling of the spent fuel pool*

The reactor had been shut down for periodic inspection, with the nuclear fuel having been transferred to the spent fuel pool. External power supply was lost by the earthquake on March

11 and one emergency diesel generator started up. (The other one was under inspection and did not start up.) The emergency diesel generator stopped due to tsunami at 15:38 on the same day, and all AC power was lost. Both the cooling and feed water functions were thus lost. The spraying of water over the spent fuel pool started from March 20.

· *Explosion in the reactor building*

At around 6:00 on March 15, an explosion in the reactor building occurred, resulting in all the walls above the bottom of the operation floor and the walls on the west side and along the stairs collapsing. A fire broke out near the northwest corner on the 4th floor of the reactor building at 09:38 on the same day. With regard to the explosion in the reactor building, an inflow of hydrogen from Unit 3 may be possible, as the exhaust pipe for venting the PCV joins the exhaust pipe from unit 4 before the exhaust stack. However, the cause of the explosion has not yet been determined.

5) Fukushima Dai-ichi NPS Unit 5

· *Securing a power supply*

This reactor had already been shut down for periodic inspection. Upon the loss of the external power supply due to the earthquake at 14:46 on March 11, two emergency diesel generators started up. However, the two emergency diesel generators stopped at 15:40 on the same day due to the tsunamis, causing all AC power to be lost. An alternate power supply was taken from the emergency diesel generator of Unit 6 on March 13, 2011.

· *Cooling of the reactor and the spent fuel pool*

Although an RPV pressure reduction operation was carried out at 06:06 on March 12, the reactor pressure slowly increased due to the effects of decay heat. The alternate power supply was taken from the emergency diesel generator of Unit 6 on March 13, and water injection into the reactor became possible, using the transfer pump for the condenser of Unit 5. Reduction of pressure through a safety relief valve had been carried out since 05:00 on March 14, and there was repeated replenishment of the water from the condensate storage tank to the reactor through the transfer pump in order to control the pressure and water level of the reactor. To carry out cooling by the residual heat removal system, a temporary seawater pump was installed and started up, and cooling of the reactor and of the spent fuel pool were carried out in turn by switching the system constitution for the Residual Heat Removal (RHR) system on March 19. As a result, the reactor reached cold shutdown status at 14:30 on March 20.

6) Fukushima Dai-ichi NPS Unit 6

· *Securing of power supply*

This reactor had already been shut down for periodic inspection. Three emergency diesel generators started up upon the loss of external power supply due to the earthquake at 14:46 on March 11. Two emergency diesel generators stopped running due to the tsunami at 15:40 on the same day, and the power supply was maintained by making use of the remaining emergency diesel generator.

· *Cooling of the reactor and the spent fuel pool*

Reactor pressure rose slowly due to the effect of decay heat. Water injection into the reactor became possible on March 13, using the transfer pump for the condenser with the emergency diesel generator. Reduction of the pressure by means of a safety relief valve has been carried out since March 14, with repeated replenishment of the water from the condensate storage tank to the reactor through the transfer pump, in order to control the pressure and the water level of the reactor. To carry out cooling through the residual heat removal system, a temporary seawater pump was installed and started up, and cooling of the reactor and the spent fuel pool was carried out in turn by switching the system constitution for the residual heat removal system on March 19. The reactor reached cold shutdown status at 19:27 on March 20.

7) Fukushima Dai-ni NPS

· *Overall*

Reactors from Units 1 to 4 at the Fukushima Dai-ni NPS which had been in operation were scrammed at 14:48 on March 11. A total of four external power supply lines had been connected to this NPS. One line was undergoing maintenance, another stopped due to the earthquake and yet another stopped one hour after the earthquake, which resulted in electric supply being provided by a single line. (Restoration work was completed at 13:38 on March 12, thereby making two lines available.) The RHR systems of Unit 1, Unit 2 and Unit 4, etc. were damaged upon the reactors being hit by the tsunami at around 15:34 on the same day.

· *Unit 1*

In terms of the reactor, cooling and water level maintenance were carried out by means of the reactor core isolation cooling system and the Make Up Water Condensate (MUWC) system.

However, the temperature of the suppression pool water exceeded 100 degrees Celsius because not all the heat could be removed. Cooling through dry well spraying started at 07:10 on March 12. Cooling of the suppression pool started with the operation of the RHR system by connecting a temporary cable from the functioning distribution board at 01:24 on March 14. The temperature of the suppression pool became lower than 100 degrees Celsius at 10:15 on the same day, and the reactor reached cold shutdown status at 17:00 on the same day.

· *Unit 2*

In terms of the reactor, cooling and water level maintenance were carried out by means of the reactor core isolation cooling system and the Make Up Water Condensate (MUWC) system. However, the temperature of the suppression pool water exceeded 100 degrees Celsius because not all the heat could be removed. Cooling through dry well spraying started at 07:11 on March 12. Cooling of the suppression pool started with the operation of the RHR system by connecting a temporary cable, just as happened at Unit 1, at 07:13 on March 14. The temperature of the suppression pool became lower than 100 degrees Celsius at 15:52 on the same day and the reactor reached cold shutdown status at 18:00 on the same day.

· *Unit 3*

The RHR system (A) and low pressure core spray system became unusable as a result of the tsunami. However, the RHR system (B) was not damaged and cooling by this system remained ongoing. Therefore the reactor reached cold shutdown status at 12:15 on March 12.

· *Unit 4*

In terms of the reactor, although cooling and water level maintenance were carried out by the RCIC and the MUWC system, the temperature of the suppression pool water exceeded 100 degrees Celsius because not all the heat could be removed. Cooling of the suppression pool started at 15:42 on March 14 with the operation of the RHR system. The temperature of the suppression pool became lower than 100 degrees Celsius and the reactor reached cold shutdown status at 07:15 on March 15.

(3) Status of the other NPSs

1) Higashidori NPS of Tohoku Electric Power Co.

The Higashidori NPS of Tohoku Electric Power Co. (one BWR) had been shut down for periodic inspection, and all fuels in the core had been transferred to the spent fuel pool. All three external power supply lines stopped due to the earthquake, and power was supplied by an emergency diesel generator.

2) Onagawa NPS of Tohoku Electric Power Co.

At the Onagawa NPS of Tohoku Electric Power Co. (BWR Units 1 to 3) Units 1 and 3 were under operation and Unit 2 was under reactor start-up operation before the earthquake on March 11. All 3 reactors were scrammed by the earthquake. Four of five external power supply lines stopped due to the earthquake, leaving one line remaining. Unit 1 suffered an on-site power loss and power was supplied by emergency diesel generators. Water injection into the reactor was carried out by the reactor core isolation cooling system, etc. and the reactor reached cold shutdown status at 0:57 on March 12. In Unit 2, the external power supply was maintained and the cooling function of the reactor was not affected. In Unit 3, although the external power supply was maintained, the auxiliary equipment cooling seawater pump stopped. After that, water was injected into the reactor by the RCIC, etc. and the reactor reached cold shutdown status at 1:17 on March 12.

3) Tokai Dai-ni NPS of Japan Atomic Power Company

Tokai Dai-ni NPS of the Japan Atomic Power Company (one BWR) was undergoing rated thermal power operation, and the reactor was automatically scrammed due to the earthquake at 14:48 on March 11. Although all three lines of external power supply stopped, three emergency diesel generators started up. One of those emergency diesel generators stopped due to the tsunami, but with the remaining two securing the power supply, the reactor reached cold shutdown status at 0:40 on March 15.

5. Response to the Nuclear Emergency

(1) Emergency response after the accident occurred

At the Fukushima Dai-ichi NPS, all AC power was lost due to the disaster of the earthquake and tsunamis. In accordance with Paragraph 1, Article 10 of the Special Law of Emergency Preparedness for Nuclear Disaster, TEPCO notified the government at 15:42 on March 11, 2011, the day on which the earthquake occurred, that all AC power had been lost in Units 1 to 5.

After that, TEPCO recognized that the injection of water via the emergency core cooling systems was impossible at Units 1 and 2 of the Fukushima Dai-ichi NPS and notified the government at 16:45 on the same day of a State of Nuclear Emergency in accordance with the Article 15 of the Special Law of Emergency Preparedness for Nuclear Disaster.

The Prime Minister declared a state of nuclear emergency at 19:03 on the same day and established the Nuclear Emergency Response Headquarters and the Local Nuclear Emergency Response Headquarters.

On March 15, the Integrated Headquarters for the Response to the Incident at the Fukushima Nuclear Power Stations (later renamed the Government–TEPCO Integrated Response Office on May 9) was established so that the government and the operator could work together in a concerted manner, decide to take necessary measures and promptly respond while sharing information on the state of the disasters at the nuclear facilities and on necessary measures

The Prime Minister, who serves as the Director-General of Nuclear Emergency Response Headquarters, determined the evacuation area and the in-house evacuation area according to the assessment of the possibility of discharging radioactive materials, and instructed Fukushima Prefecture and relevant cities, towns and villages to act in accordance with this determination. Responding to the status of accidents at the Fukushima Dai-ichi NPS, at 21:23, March 11, the evacuation area was set at the area within a 3km radius and the in-house evacuation area was a 3 to 10km radius from the Fukushima Dai-ichi NPS. Afterwards, according to the escalation of events, the evacuation area was expanded to a 20km radius at 18:25, March 12, and the in-house evacuation area was expanded to a 30km radius at around 11:00, March 15. Also, responding to the status of the accidents at the Fukushima Dai-ni NPS, the evacuation area within a 3km radius and the in-house evacuation area of a 3 to 10 km radius were set at the same time a nuclear emergency situation was declared at 7:45, March 12, with the evacuation area expanded to a 10 km radius at 17:39 on the same day. Then, the evacuation area was changed to a 8 km radius on April 21. Evacuation and stay-in-house instructions immediately after the accident were promptly implemented through a concerted effort by residents in the vicinity, local governments, the police and other relevant authorities.

The Prime Minister determined that evacuation areas within a 20km radius of Fukushima Dai-ichi NPS would be a “restricted area,” in accordance with the Basic Act on Disaster Control and instructed the mayors of cities and towns and the heads of villages and concerned local governments to prohibit access to the area on April 21.

The Local Nuclear Emergency Response Headquarters started its activities at an Off-Site Center as designated by the Basic Plan for Emergency Preparedness. However, it was moved to the Fukushima Prefectural Office in Fukushima City due to high-level radiation as the nuclear accident escalated, in addition to a communication blackout and a lack of fuel, food and other necessities caused by logistic congestion around the site.

The longer the accident lasted, the heavier the burden on residents in the vicinity of the NPS became. In particular, many of the residents who were instructed to stay within their houses were voluntarily evacuated and those who remained in the area found it increasingly difficult to sustain their livelihoods due to congestion in the distribution of goods and logistics problems. In response to this situation, the government launched support measures.

The primary functions of the Emergency Response Support System (ERSS), which monitors the status of reactors and forecasts the progress of the accident when a nuclear emergency occurs, could not be utilized because necessary information from the plants could not be obtained. In addition, the primary functions of the System for Prediction of Environmental Emergency Dose Information (SPEEDI), which conducts a quantitative forecast of variations of atmospheric concentrations of radioactive materials and air dose rates, could not be utilized because source term information could not be obtained. Although they were used in alternative ways, their operation processes and the disclosure of their results have remained as an issue.

(2) Implementation of environmental monitoring

In the Basic Plan for Emergency Preparedness, local governments are in charge of environmental monitoring when a nuclear emergency occurs. However, most of the monitoring posts became dysfunctional at first when the accident occurred. From March 16, it was decided that the Ministry of Education, Culture, Sports, Science and Technology (MEXT) would take charge of summarizing the environmental monitoring carried out by MEXT, local governments and cooperating U.S. organizations.

As for the land areas outside the premises of the NPS, MEXT measures the air dose rate, radioactive concentrations in the soil, and concentrations of radioactive materials in the air and takes environmental samples in cooperation with the Japan Atomic Energy Agency, Fukushima Prefecture, the Ministry of Defense, and electric companies. MEXT also carries out monitoring by aircraft in cooperation with the Ministry of Defense, TEPCO, the U.S. Department of Energy, etc. TEPCO carries out environmental monitoring at NPS sites and their vicinities, etc.

In terms of the sea areas near the NPS, MEXT, the Fisheries Agency, the Japan Agency for Marine-Earth Science and Technology, the Japan Atomic Energy Agency, TEPCO, and others cooperate with each other to carry out the monitoring of radioactive concentrations, etc. in the seawater and in the seabed, while the Japan Agency for Marine-Earth Science and Technology simulates the distribution and spread of radioactive concentrations.

The Nuclear Safety Commission evaluates and announces the results of these environmental monitoring efforts as they become available.

Environmental monitoring of the air, sea and soil of the premises and the surrounding areas of the Fukushima NPSs is conducted by TEPCO.

(3) Measures regarding agricultural products, drinking water, etc.

The Ministry of Health, Labour and Welfare decided that the "Indices relating to limits on food and drink ingestion" indicated by the Nuclear Safety Commission of Japan shall be adopted for the time being as provisional regulation values, and foods which exceed these levels shall not be supplied to the public for consumption, pursuant to the Food Sanitation Act. The Prime Minister, as the Director-General of Government Nuclear Emergency Response Headquarters, has instructed relevant municipalities to restrict shipments of foods that exceed the provisional regulation level.

As for tap water, the Ministry of Health, Labour and Welfare notified departments and agencies concerned in the local governments of the necessity to avoid drinking tap water if the radioactive concentration of tap water exceeds the level indicated by the Nuclear Safety Commission from March 19 onward, and released the monitoring results by the local governments concerned, as well.

(4) Measures for additional protected area

The environmental monitoring data have revealed that there were areas where radioactive materials were accumulated at high levels even outside of the 20 km radius. Therefore, the Prime Minister as Director-General of NERHQs instructed the heads of relevant local governments on April 22 that deliberate evacuation areas needed to be established for specific areas beyond the 20 km radius, and area between the 20 km and 30 km radius which had been set as in-house evacuation areas, excluding the areas within it qualifying as deliberate evacuation areas, was renamed an "evacuation-prepared area in case of emergency," since the residents there could possibly be instructed to stay in-house or evacuate in the case of future emergencies. In this way, residents inside the deliberate evacuation area were directed to evacuate in a planned manner, and residents inside of the area prepared for evacuation in case of emergency were directed to prepare for evacuation or for in-house evacuation in case of an emergency.

6. Discharge of Radioactive Materials to the Environment

(1) Amount of radioactive materials discharged to the atmosphere

On April 12, NISA and the Nuclear Safety Commission each announced the total discharged amount of radioactive materials to the atmosphere so far.

NISA estimated the total discharged amount from reactors at the Fukushima Dai-ichi NPSs according to the results analyzing reactor status, etc. by JNES and presumed that approximately 1.3x 10^{17} Bq of iodine-131 and approximately 6.1x 10^{15} Bq of cesium-137 were discharged. Subsequently, JNES re-analyzed the status of the reactors based on the report which NISA collected on May 16 from TEPCO on the plant data immediately after the accident occurred. Based on this analysis of reactor status and others by JNES, NISA estimated that the total discharged amount of iodine-131 and cesium-137 were approximately 1.6 x 10^{17} Bq and 1.5 x 10^{16} Bq, respectively. The Nuclear Safety Commission estimated the amount of certain nuclides discharged into the atmosphere (discharged between March 11 to April 5) with assistance from the Japan Atomic Energy Agency (JAEA) through back calculations, based on the data of environmental monitoring and air diffusion calculation; the estimations are 1.5 x 10^{17} Bq for iodine-131 and 1.2 x 10^{16} Bq for cesium-137. The discharged amount since early April has been declining and is about 10^{11} Bq/h to 10^{12} Bq/h in iodine-131 equivalent.

(2) Discharged amount of radioactive materials to seawater

Water containing radioactive materials diffused from the RPV leaked into the PCV at the Fukushima Dai-ichi NPS. Also, because of water injections into the reactors from the outside for cooling, some injected water leaked from the PCVs and accumulated in reactor buildings and turbine buildings. The management of contaminated water in reactor buildings and turbine buildings became a critical issue from the standpoint of workability in the buildings, and the management of contaminated water outside of the buildings became a critical issue from the standpoint of preventing the diffusion of radioactive materials into the environment.

On April 2, it was discovered that highly contaminated water with a radiation level of over 1000mSv/h had accumulated in the pit of power cables near the water intake of Unit 2 of the Fukushima Dai-ichi NPS and it was flowing into the seawater. Despite that, the outflow was halted by stopping work on April 6, and the total discharged amount of radioactive materials was assumed to be approximately 4.7x 10^{15} Bq. As an emergency measure, it was decided that this highly contaminated water would be stored in tanks. However, as no tanks were available at the time, low-level radioactive water was discharged into the seawater from April 4 to April 10 in order to secure storage capacity for the contaminated water. The total amount of discharged radioactive materials was presumed to be approximately 1.5x 10^{11} Bq.

7. Situation regarding radiation exposure

The government has changed the dose limit for personnel engaged in radiation work from 100mSv to 250mSv in light of the present situation of the accident in order to prevent escalation of the accident. This was decided based on the information that a 1990 recommendation by the International Commission on Radiological Protection provided for 500mSv as the dose limit to avoid deterministic effects that has been set for personnel engaged in emergency rescue work.

With regard to the activities by personnel engaged in radiation work in TEPCO, there was no alternative but for the chief workers to carry personal dosimeters and observe radioactivity for their entire work group unit, because a lot of personal dosimeters had been soaked by seawater, rendering them unusable. Afterwards, as personal dosimeters became available, all workers have been able to carry personal dosimeters since April 1.

The status of exposure doses of personnel engaged in radiation work is as follows. As of May 23, the total number of workers that had entered the area was 7,800, with an average exposure dose of 7.7mSv. Thirty of these workers had exposure doses above 100mSv. The internal exposure measurement of the radiation workers has been delayed and the exposure dose, including internal exposure of a certain number of workers, could exceed 250mSv in the future. On March 24, two workers stepped into accumulated water and their exposure doses have been estimated at less than 2 or 3Sv.

As for radiation exposure to residents in the vicinity, no cases of harm to health were found in 195,345 (the number as of May 31) residents who received screening in Fukushima Prefecture. All 1,080 children who went through thyroid gland exposure evaluation received results lower than the screening level.

The estimation and the evaluation of exposure doses of residents in the vicinity, etc. are planned to be carried out through the use of the results of environmental monitoring, in a prompt manner after the survey of evacuation routes and activities conducted mainly by Fukushima Prefecture, with the assistance of relevant ministries, agencies and the National Institute of Radiological Science, etc.

8. Cooperation with the International Community

Since the occurrence of this nuclear accident, experts have visited Japan from the United States, France, Russia, the Republic of Korea, China and the United Kingdom, exchanged views with relevant organizations in Japan, and given significant amounts of advice regarding stabilizing the nuclear reactors and the spent fuel pools, preventing the diffusion of radioactive materials, and implementing countermeasures against radioactive contaminated water. Japan has also received support from these countries and accepted materials necessary to undertake measures against the nuclear accident.

Experts from international organizations specializing in nuclear power such as the IAEA and the OECD Nuclear Energy Agency (OECD/NEA) visited Japan, providing advice and so on. Also, international organizations such as the IAEA, the World Health Organization (WHO), the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO), and the International Commission on Radiological Protection (ICRP) have provided necessary information to the international community from their own technical standpoints.

9. Communication regarding the Accident

Initially after the occurrence of the accident, accurate and timely information was not sufficiently provided, typically demonstrated in delays in notifying local governments and municipalities, a situation which has been identified as a challenge in the field of communication regarding the accident. Transparency, accuracy and rapidity are important in domestic and international communication about accidents. The Japanese Government has utilized various levels and occasions such as press conferences at the Prime Minister's Office as well as press conferences held jointly by relevant parties. While these have been improved as needed, in reflection of what and how information should be provided, efforts to improve communication must be ongoing.

Briefings on important issues regarding the accident have been provided at press conferences by the Chief Cabinet Secretary to explain to the citizens the status of the accident as well as the views of the Japanese Government. TEPCO as a nuclear operator and NISA as a regulatory authority have also held press conferences on the status, details and development of the accident. The NSC has provided important technical advice and explained the evaluation of environmental monitoring results and other matters at press conferences.

Joint press conferences with the participation of relevant organizations have been held since April 25 in order to share information in an integrated manner. The Special Advisor to the Prime Minister, NISA, MEXT, the Secretariat of the NSC, TEPCO and other relevant organizations have participated in these joint press conferences.

As for inquiries from the general public, NISA has opened a counseling hotline on the nuclear accident, etc., and MEXT has also opened a counseling hotline on the impact of radiation on health, etc. Experts in academia, including members of the Atomic Energy Society of Japan, have actively explained and provided information to citizens.

Regarding the provision of information to the international community, the Japanese Government reported the accident status to the IAEA promptly pursuant to the Convention on Early Notification of a Nuclear Accident, beginning with the first report on 16:45 on March 11, immediately after the accident occurred. The Japanese Government has also reported the provisional evaluations of the International Nuclear and Radiological Event Scale (INES) when the government made its announcement regarding each evaluation.

As for opportunities for communication with countries across the world including neighboring countries, briefings to diplomats in Tokyo and press conferences for the foreign media have been conducted.

Notification to other countries including neighboring countries about the deliberate discharge of accumulated water of low-level radioactivity to the sea on April 4 was not satisfactory. This is a matter of sincere regret and every effort has been made to ensure sufficient communication with the international community and to reinforce the notification system.

Provisional evaluations based on the INES have been as follows:

(1) The first report

A provisional evaluation of Level 3 was issued, based on the determination by NISA at 16:36 on March 11 that the emergency core cooling system for water injection had become unusable. This situation occurred because motor-operated pumps lost function due to all-around losses of power at Units 1 and 2 of the Fukushima Dai-ichi NPS.

(2) The second report

On March 12, the PCV venting of Unit 1 of the Fukushima Dai-ichi NPS was conducted, and an explosion at its reactor building occurred. Based on environmental monitoring, NISA confirmed the emission of radioactive iodine, cesium and other radioactive materials, and made an announcement on a provisional evaluation of Level 4, because NISA determined that over approximately 0.1% of the radioactive materials in the reactor core inventory had been emitted.

(3) The third report

On March 18, as some incidents causing fuel damage had been identified at Units 2 and 3 of the Fukushima Dai-ichi NPS, NISA announced a provisional evaluation of Level 5 because the release of several percentages of the radioactive materials in the core inventory was determined to have occurred, based on the information ascertained at that moment, including that of the status of Unit 1.

(4) The fourth report

On April 12, regarding the accumulated amount of the radioactive materials released in the atmosphere, NISA announced its estimates from analytical results of the reactor status, etc., while NSC announced its estimates from dust monitoring data. (Please refer to VI. 1.) The estimation by NISA was 370,000TBq of radioactivity in iodine equivalent, while the calculated value based on the estimate of NSC was 630,000TBq. Based on these results, NISA announced a provisional evaluation of Level 7 the same day. One month had passed between the third and fourth reports, and the provisional INES evaluation should have been made more promptly and appropriately.

10. Future Efforts to Settle the Situation regarding the Accident

Regarding the current status of the Fukushima Dai-ichi NPS, freshwater has been injected to the RPVs through feed water systems at Units 1, 2 and 3 and has been continuously cooling the fuel in the RPVs. This has helped the temperature around the RPVs stay around 100 to 120 degrees Celsius at the lower part of RPVs. Review and preparation for circulation cooling systems, including the process of transferring and treating accumulated water, have been underway. Although the RPV and PCV of Unit 1 have been pressurized to some extent, steam generated in some units such as Units 2 and 3 seems to have leaked from the RPV and PCV, which appears to have condensed to form accumulations of water found in many places, including the reactor buildings, and some steam seems to have been released into the atmosphere. To respond to this issue, the status has been checked by dust sampling in the upper part of the reactor buildings, and discussion and preparation for covering the reactor buildings has been underway.

Cold shutdown of Units 5 and 6 has been maintained using residual heat removal systems with temporary seawater pumps and their reactor pressure has been stable, ranging from 0.01 ~ 0.02 MPa (Gauge pressure).

Details of the current status of each unit are listed in the following chart.

(Megapascal: Unit of pressure 1MPa = 9.9 atmosphere. Gauge pressure is absolute pressure minus atmospheric pressure.)

TEPCO announced the “Roadmap towards Restoration from the Accident in Fukushima Daiichi Nuclear Power Station” on April 17, with the following 2 steps as targets: "Radiation dose in steady decline" as "Step 1" and "Release of radioactive materials is under control and radiation dose is being significantly held down" as "Step 2." The timeline for achieving targets is tentatively set as follows: "Step 1" is set at around 3 months and "Step 2" is set at around 3 to 6 months after achieving Step 1.

Subsequently, coolant leakage from the PCVs was found in Units 1 and 2. Since the same risk was found in Unit 3, TEPCO announced a revised roadmap on May 17. In the new roadmap, basically no changes were made to the schedule, but new efforts were added, including reviewing and improving cooling reactors, adding measures against tsunamis and aftershocks, and improving the work environment for workers.

In particular, in the review of the issues regarding the "Reactors," the establishment of a "circulation cooling system" in which contaminated water accumulated in buildings (accumulated water), etc. is processed and reused for water injection into reactors, was prioritized for "cold shutdown" in Step 2.

The NERHQs also presented an approach toward settling the situation and that related to the evacuation area in the announcement, "Temporary approach policy for measures for nuclear sufferers," of May 17.

11. Responses at Other Nuclear Power Stations

On March 30, NISA instructed all electric power companies and related organizations to implement emergency safety measures at all NPSs, in order to prevent the occurrence of nuclear disasters and core damage, etc. caused by tsunami-triggered total AC power loss, on the basis of the latest knowledge gained from the accident at the Fukushima NPSs. On May 6, NISA carried out on-site inspections at all NPSs (except the Onagawa NPS, Fukushima Dai-ichi and Fukushima Dai-ni NPS), and confirmed that emergency safety measures were appropriately implemented at these NPSs. On May 18, NISA received an implementation status report from the Onagawa NPS, where work to prepare against tsunamis was delayed after it was hit by the tsunamis. Regarding the Fukushima Dai-ni NPS, which achieved a stable condition after cold shutdown on April 21, NISA also instructed the NPS to implement emergency safety measures, and received an implementation status report from it on May 20. NISA confirmed that all the nuclear power stations in Japan have appropriately arranged measures against total AC power loss, etc. which are expected to be implemented immediately as emergency safety measures.

Based on the presumed causes of the accident and the additional knowledge gained from the accident, which are stated in this report, and the lessons learned from the accident, which are mentioned in Section 12, NISA and other relevant ministries are to improve and strengthen the emergency safety measures that have been put in place. NISA will strictly verify the implementation status of enhanced measures by the nuclear operators and promptly come up with mid- and long-term measures.

The Headquarters for Earthquake Research Promotion of MEXT has estimated that within the next 30 years there is an 87% percent chance of an imminent magnitude 8 earthquake in the Tokai region near the Hamaoka Nuclear Power Station of Chubu Electric Power Co., Inc. As this is accompanied by increasing concerns over the high possibility of a large-scale tsunami resulting from the envisioned earthquake, the government has placed its highest priority on public safety above all else, and, determining that the operation of all Units at the Hamaoka NPS should be halted until mid- to long-term countermeasures such as the construction of an embankment that can sufficiently withstand a tsunami resulting from the envisioned Tokai Earthquake are implemented, requested on May 6 that Chubu Electric Power Co., Inc., halt all reactors at the NPS. Chubu Electric Power Co., Inc. accepted this request and stopped operation of all the Units by May 14.

12. Lessons Learned from the Accident Thus Far

The Fukushima NPS accident has the following aspects: it was triggered by a natural disaster; it led to a severe accident with damage to nuclear fuel, Reactor Pressure Vessels and Primary Containment Vessels; and accidents involving multiple reactors arose at the same time. Moreover, as nearly three months have passed since the occurrence of the accident, a mid- to long-term initiative is needed to settle the situation imposing a large burden on society, such as a long-term evacuation of many residents in the vicinity, as well as having a major impact on industrial activities, including the farming and livestock industries in the related area. There are thus many aspects different from the accidents in the past at the Three Mile Island Nuclear Power Plant and the Chernobyl Nuclear Power Plant.

The accident is also characterized by the following aspects. Emergency response activities had to be performed in a situation where the earthquake and tsunami destroyed the social infrastructure such as electricity supply, communication and transportation systems across a wide area in the vicinity. The occurrence of aftershocks frequently impeded various accident response activities.

This accident led to a severe accident, shook the trust of the public, and warned those engaged in nuclear energy of their overconfidence in nuclear safety. It is therefore important to learn lessons thoroughly from this accident. The lessons are being presented classified into five categories at this moment, bearing in mind that the most important basic principle in securing nuclear safety is having defenses in depth.

Thus the lessons that have been learned to date are presented as classified in five categories. We consider it inevitable to carry out a fundamental review on nuclear safety measures in Japan based on these lessons. While some of them are specific to Japan, these specific lessons have been included regardless, from the standpoint of showing the overall structure of the lessons.

The lessons in category 1 are those learned based on the fact that this accident has been a severe accident, and from reviewing the sufficiency of preventive measures against a severe accident.

The lessons in category 2 are those learned from reviewing the adequacy of the responses to this severe accident.

The lessons in category 3 are those learned from reviewing the adequacy of the emergency responses to the nuclear disaster in this accident.

The lessons in category 4 are those learned from reviewing the robustness of the safety infrastructure established at nuclear power stations.

The lessons in category 5 are those learned from reviewing the thoroughness in safety culture while summing up all the lessons.

Lessons in category 1
Strengthen preventive measures against a severe accident

(1) Strengthen measures against earthquakes and tsunamis

The earthquake was an extremely massive one caused by plurally linked seismic centers. As a result, at the Fukushima Dai-ichi Nuclear Power Station, the acceleration response spectra of seismic ground motion observed on the base mat exceeded the acceleration response spectra of the design basis seismic ground motion in a part of the periodic band. Although damage to the external power supply was caused by the earthquake, no damage caused by the earthquake to systems, equipment or devices important for nuclear reactor safety at nuclear reactors has been confirmed. However, further investigation should be conducted as the details regarding this situation remain unknown.

The tsunamis which hit the Fukushima Dai-ichi Nuclear Power Station were 14-15m high, substantially exceeding the height assumed under the design of construction permit or the subsequent evaluation. The tsunamis severely damaged seawater pumps, etc., causing the failure to secure the emergency diesel power supply and reactor cooling function. The procedural manual did not assume flooding from a tsunami, but rather only stipulated measures against a backrush. The assumption on the frequency and height of tsunamis was insufficient, and therefore, measures against large-scale tsunamis were not prepared adequately.

From the viewpoint of design, the range of an active period for a capable fault which needs to be considered in the seismic design for a nuclear power plant is considered within 120,000-130,000 years (50,000 years in the old guideline). The recurrence of large-scale earthquakes is expected to be appropriately considered. Moreover, residual risks must be considered. Compared with the design against earthquake, the design against tsunamis has been performed based on tsunami folklore and indelible traces of tsunami, not on adequate consideration of the recurrence of large-scale earthquakes in relation to a safety goal to be attained.

Reflecting on the above issues, we will consider the handling of plurally linked seismic centers as well as the strengthening of the quake resistance of external power supplies. Regarding tsunamis, from the viewpoint of preventing a severe accident, we will assume appropriate frequency and adequate height of tsunamis in consideration of a sufficient recurrence period for attaining a safety goal. Then, we will perform a safety design of structures, etc. to prevent the impact of flooding of the site caused by tsunamis of adequately assumed heights, in consideration of the destructive power of tsunamis. While fully recognizing a possible risk caused by the flooding into buildings of tsunamis exceeding the ones assumed in design, we will take measures from the viewpoint of having defenses in depth, to sustain the important safety functions by considering flooded sites and the huge destructive power of run-up waves.

(2) Ensure power supplies

A major cause of this accident was the failure to secure the necessary power supply. This was caused by the facts that power supply sources were not diversified from the viewpoint of overcoming vulnerability related to failures derived from a common cause arising from an external event, and that the installed equipment such as a switchboard did not meet the specifications that could withstand a severe environment such as flooding. Moreover, it was caused by the facts that battery life was short compared with the time required for restoration of the AC power supply and that a time goal required for the recovery of the external power supply was not clear.

Reflecting on the above facts, Japan will secure a power supply at sites for a longer time set forth as a goal, even in severe circumstances of emergencies, through the diversification of power supply sources by preparing various emergency power supply sources such as air-cooled diesel generators, gas turbine generators, etc., deploying power-supply vehicles and so on, as well as equipping switchboards, etc. with high environmental tolerance and generators for battery charging, and so on.

(3) Ensure robust cooling functions of reactors and PCVs

In this accident, the final place for release of heat (the final heat sink) was lost due to the loss of function of the seawater pumps. Although the reactor cooling function of water injection was activated, core damage could not be prevented due to the drain of the water source for injection, the loss of power supplies, etc., and furthermore, the PCV cooling functions also failed to run well. Thereafter, difficulties remained in reducing the reactor pressure and, moreover, in injecting water after the pressure was reduced, because the water injection line into a reactor through the use of heavy machinery such as fire engines, etc. had not been developed as measures for accident management. In this manner, the loss of cooling functions of the reactors and PCVs aggravated the accident.

Reflecting on the above issues, Japan will secure robust alternative cooling functions for its reactors and PCVs by securing alternative final heat sinks for a durable time. This will be pursued through such means as diversifying alternative water injection functions, diversifying and increasing sources for injection water, and introducing air-cooling systems.

(4) Ensure robust cooling functions of spent fuel pools

In the accident, the loss of power supplies caused the failure to cool the spent fuel pools, requiring actions to prevent a severe accident due to the loss of cooling functions of the spent fuel pools concurrently with responses to the accident of the reactors. Until now, a risk of a major accident of a spent fuel pool had been deemed small compared with that of a core event and measures such as alternative means of water injection into spent fuel pools, etc. had not been considered.

Reflecting on the above issues, Japan will secure robust cooling measures by introducing alternative cooling functions such as a natural circulation cooling system or an air-cooling system, as well as alternative water injection functions, in order to maintain the cooling of spent fuel pools even in case of the loss of power supplies.

(5) Thorough accident management (AM) measures

The accident reached the level of a so-called “severe accident.” Accident management measures had been introduced to the Fukushima NPSs to minimize the possibilities of severe accidents and to mitigate consequences in the case of severe accidents. However, looking at the situation of the accident, although some portion of the measures functioned, such as the alternative water injection from the fire extinguishing water system to the reactor, the rest did not fulfill their roles within various responses, including ensuring the power supplies and the reactor cooling function, with the measures turning out to be inadequate. In addition, accident management measures are basically regarded as voluntary efforts by operators, not legal requirements, and so the development of these measures lacked strictness. Moreover, the guideline for accident management has not been reviewed since their development in 1992 and has not been strengthened or improved.

Reflecting on the above issues, we will change the accident management measures from voluntary safety efforts by operators to legal requirements, and develop accident management measures to prevent severe accidents, including a review of design requirements as well, by utilizing a probabilistic safety assessment approach.

(6) Response to issues concerning the siting with more than one reactor

The accident occurred at more than one reactor at the same time, and the resources needed for accident response had to be dispersed. Moreover, as two reactors shared the facilities, the physical distance between the reactors was small and so on. The development of an accident occurring at one reactor affected the emergency responses at nearby reactors.

Reflecting on the above issues, Japan will take measures to ensure that emergency operations at a reactor where an accident occurs can be conducted independently from operation at other reactors if one power station has more than one reactor. Also, Japan will assure the engineering independence of each reactor to prevent an accident at one reactor from affecting nearby reactors. In addition, Japan will promote the development of a structure that enables each unit to carry out accident responses independently, by choosing a responsible person for ensuring the nuclear safety of each unit.

(7) Consideration of NPS arrangement in basic designs

Response to the accident became difficult since the spent fuel storage pools were located at a higher part of the reactor buildings. In addition, contaminated water from the reactor buildings reached the turbine buildings, meaning that the spread of contaminated water to other buildings has not been prevented.

Reflecting on the above issues, Japan will promote the adequate placement of facilities and buildings at the stage of basic design of NPS arrangement, etc. in order to further ensure the conducting of robust cooling, etc. and prevent an expansion of impacts from the accident, in consideration of the occurrence of serious accidents. In this regard, as for existing facilities, additional response measures will be taken to add equivalent levels of functionality to them.

(8) Ensuring the water tightness of essential equipment facilities

One of the causes of the accidents is that the tsunami flooded many essential equipment facilities including the component cooling seawater pump facilities, the emergency diesel generators, the switchboards, etc., impairing power supply and making it difficult to ensure cooling systems.

Reflecting on the above issues, in terms of achieving the target safety level, Japan will ensure the important safety functions even in the case of tsunamis greater than ones expected by the design or floods hitting facilities located near rivers. In concrete terms, Japan will ensure the water-tightness of important equipment facilities by installing watertight doors in consideration of the destructive power of tsunamis and floods, blocking flooding routes such as pipes, and installing drain pumps, etc.

Lessons in Category 2
Enhancement of response measures against severe accidents

(9) Enhancement of measures to prevent hydrogen explosions

In the accident, an explosion probably caused by hydrogen occurred at the reactor building in Unit 1 at 15:36 on March 12, 2011, as well as at the reactor in Unit 3 at 11:01 on March 14. In addition, an explosion that was probably caused by hydrogen occurred at the reactor building in Unit 4 around 06:00 on March 15, 2011. Consecutive explosions occurred as effective measures could not be taken beginning from the first explosion. These hydrogen explosions aggravated the accident. A BWR inactivates a PCV and has a flammability control system in order to maintain the soundness of the PCV against design basis accidents. However, it was not assumed that an explosion in reactor buildings would be caused by hydrogen leakage, and as a matter of course, hydrogen measures for reactor buildings were not taken.

Reflecting on the above issues, we will enhance measures to prevent hydrogen explosions, such as by installing flammability control systems that would function in the event of a severe accident in reactor buildings, for the purpose of discharging or reducing hydrogen in the reactor buildings, in addition to measures to address hydrogen within the PCVs.

(10) Enhancement of containment venting system

In the accident, there were problems in the operability of the containment venting system. Also, as the function of removing released radioactive materials in the containment venting system was insufficient, the system was not effective as an accident management countermeasure. In addition, the independence of the vent line was insufficient and it may have had an adverse effect on other parts through connecting pipes, etc.

Reflecting on the above issues, we will enhance the containment venting system by improving its operability, ensuring its independence, and strengthening its function of removing released radioactive materials.

(11) Improvements to the accident response environment

In the accident, the radiation dosage increased in the main control room and operators could not enter the room temporarily, and the habitability in the main control room has decreased, as it still remains difficult to work in that room for an extended period. Moreover, at the on-site emergency station, which serves as a control tower for all emergency measures at the site, the accident response activities were affected by increases in the radiation dosage as well as by the worsening of the communication environment and lighting.

Reflecting on the above issues, we will enhance the accident response environment that enables continued accident response activities even in case of severe accidents through measures such as strengthening radiation shielding in the control rooms and the emergency centers, enhancing the exclusive ventilation and air conditioning systems on site, as well as strengthening related equipment, including communication and lightening systems, without use of AC power supply.

(12) Enhancement of the radiation exposure management system at the time of the accident

As these accidents occurred, although adequate radiation management became difficult as many of the personal dosimeters and dose reading devices became unusable due to their submergence in seawater, personnel engaged in radiation work had to work on site. In addition, measurements of concentration of radioactive materials in the air were delayed, and as a result the risk of internal exposure increased.

Reflecting on the above issues, we will enhance the radiation exposure management system at the time an accident occurs by storing the adequate amount of personal dosimeters and protection suits and gears for accidents, developing a system in which radioactive management personnel can be expanded at the time of the accident and improving the structures and equipment by which the radiation doses of radiation workers are measured promptly.

(13) Enhancement of training responding to severe accidents

Effective training to respond to accident restoration at nuclear power plants and adequately work and communicate with relevant organizations in the wake of severe accidents was not sufficiently implemented up to now. For example, it took time to establish communication between the emergency office inside the power station, the Nuclear Emergency Response Headquarters and the Local Headquarters and also to build a collaborative structure with the Self-Defense Forces, the Police, Fire Authorities and other organizations which played important roles in responding to the accident. Adequate training could have prevented these problems.

Reflecting on the above issues, we will enhance training to respond to severe accidents by promptly building a structure for responding to accident restoration, identifying situations within and outside power plants, facilitating the gathering of human resources needed for securing the safety of residents and collaborating effectively with relevant organizations.

(14) Enhancement of instrumentation to identify the status of the reactors and PCVs

Because the instrumentation of the reactors and PCVs did not function sufficiently during the severe accident, it was difficult to promptly and adequately obtain important information to identify how the accident was developing, such as the water levels and the pressure of reactors, and the sources and amounts of released radioactive materials.

In respond to the above issues, we will enhance the instrumentation of reactors and PCVs, etc. to enable them to function effectively even in the wake of severe accidents.

(15) Central control of emergency supplies and equipment and setting up rescue teams

Logistic support has been provided diligently by those responding to the accident and supporting affected people with supplies and equipment gathered mainly at J Village. However, because of the damage from the earthquake and tsunami in the surrounding areas shortly after the accident, we could not promptly or sufficiently mobilize rescue teams to help provide emergency supplies and equipment or support accident control activities. This is why the on-site accident response did not sufficiently function.

Reflecting on the above issues, we will introduce systems for centrally controlling emergency supplies and equipment and setting up rescue teams for operating such systems in order to provide emergency support smoothly even under harsh circumstances.

Lessons in Category 3
Enhancement of nuclear emergency responses

(16) Responses to combined emergencies of both large-scale natural disasters and prolonged nuclear accident

There was tremendous difficulty in communication and telecommunications, mobilizing human resources, and procuring supplies among other areas when addressing the nuclear accident that coincided with a massive natural disaster. As the nuclear accident has been prolonged, some measures such as the evacuation of residents, which was originally assumed to be a short-term measure, have been forced to be extended.

Reflecting on the above issues, we will prepare the structures and environments where appropriate communication tools and devices and channels to procure supplies and equipment will be ensured in the case of concurrent emergencies of both a massive natural disaster and a prolonged nuclear accident. Also, assuming a prolonged nuclear accident, we will enhance emergency response preparedness including effective mobilization plans to gather human resources in various fields who are involved with accident response and support for affected persons.

(17) Reinforcement of environmental monitoring

Currently, local governments are responsible for environmental monitoring in an emergency. However, appropriate environmental monitoring was not possible immediately after the accident because the equipment and facilities for environmental monitoring owned by local governments were damaged by the earthquake and tsunami and the relevant individuals had to evacuate from the Off-site Center Emergency Response Center. To bridge these gaps, MEXT has conducted environmental monitoring in cooperation with relevant organizations.

Reflecting on the above issues, the Government will develop a structure through which the Government will implement environmental monitoring in a reliable and well-planned manner during emergencies.

(18) Establishment of a clear division of labor between relevant central and local organizations

Communication between local and central offices, as well as with other organizations, was not achieved to a sufficient degree, due to the lack of communication tools immediately after the accident and also due to the fact that the roles and responsibilities of each side were not clearly defined. Specifically, responsibility and authority were not clearly defined in the relationship between the NERHQs Nuclear Emergency Response Headquarters and Local NERHQs Headquarters, between the Government and TEPCO, between the Head Office of TEPCO and the NPS on site, or among the relevant organizations in the Government. Especially, communication was not sufficient between the government and the main office of TEPCO as the accident initially began to unfold.

Reflecting on the above issues, we will review and define roles and responsibilities of relevant organizations including the NERHQs, clearly specify roles, responsibilities and tools for communication while also improving institutional mechanisms.

(19) Enhancement of communication relevant to the accident

Communication to residents in the surrounding area was difficult because communication tools were damaged by the large-scale earthquake. The subsequent information to residents in the surrounding area and local governments was not always provided in a timely manner. The impact of radioactive materials on health and the radiological protection guidelines of the ICRP, which are the most important information for residents in the surrounding area and others, were not sufficiently explained. Japan focused mainly on making accurate facts publicly available to its citizens and has not sufficiently presented future outlooks on risk factors, which sometimes gave rise to concerns about future prospects.

Reflecting on the above issues, we will reinforce the adequate provision of information on the accident status and response, along with appropriate explanations of the effects of radiation to the residents in the vicinity. Also, we will keep in mind having the future outlook on risk factors included in the information delivered while incidents are still ongoing.

(20) Enhancement of responses to assistance from other countries and communication to the international community

The Japanese Government could not appropriately respond to the assistance offered by countries around the world because no specific structure existed within the Government to link such assistance offered by other countries to domestic needs. Also, communication with the international community including prior notification to neighboring countries and areas on the discharge of water with low-level radioactivity to the sea was not always sufficient.

Reflecting on the above-mentioned issues, the Japanese Government will contribute to developing a global structure for effective responses by cooperating with the international community, for example, developing a list of supplies and equipment for effective responses to any accident, specifying contact points for each country in advance in case of an accident, enhancing the information sharing framework through improvements to the international notification system, and providing faster and more accurate information to enable the implementation of measures that are based upon scientific evidence.

(21) Adequate identification and forecasting of the effect of released radioactive materials

The System for Prediction of Environmental Emergency Dose Information (SPEEDI) could not make proper predictions on the effect of radioactive materials as originally designed, due to the lack of information on release sources. Nevertheless, the Ministry of Education, Culture, Sports, Science and Technology (MEXT), the Nuclear and Industrial Safety Agency (NISA) and the Nuclear Safety Commission (NSC) Japan used SPEEDI to calculate the estimation with various assumptions for the internal examination of the situation. Even under such restricted conditions without adequate information on release sources, it should have been utilized as a reference of evacuation activities and other purposes by presuming diffusion trends of radioactive materials under certain assumptions, but it could not. Although the results generated by SPEEDI are now being disclosed, disclosure should have been conducted from the initial stage.

The Japanese Government will improve its instrumentation and facilities to ensure that release source information can be securely obtained. Also, it will develop a plan to effectively utilize SPEEDI and other systems to address various emergent cases and disclose the data and results from SPEEDI, etc. from the earliest stages of such cases.

(22) Clear definition of widespread evacuation areas and radiological protection guidelines in nuclear emergency

Immediately after the accident, an Evacuation Area and In-house Evacuation Area were established, and cooperation of residents in the vicinity, local governments, police and relevant organizations facilitated the fast implementation of evacuation and “stay-in-house” instruction. As the accident became prolonged, the residents had to be evacuated or stay within their houses for long periods. Subsequently, however, it was decided that guidelines of the ICRP and IAEA, which have not been used before the accident, would be used when establishing Deliberate Evacuation Area and Emergency Evacuation Prepared Area. The size of the protected area defined after the accident was considerably larger than a 8 to 10km radius from the NPS, which had been defined as the area where focused protection measures should be taken.

Based on the experiences gained from the accident, the Japanese Government will make much greater efforts to clearly define evacuation areas and guidelines for radiological protection in nuclear emergencies.

Lessons in Category 4

Reinforcement of safety infrastructure

(23) Reinforcement of safety regulatory bodies

Governmental organizations have different responsibilities for securing nuclear safety. For example, NISA of METI is responsible for safety regulation as a primary regulatory body, while the Nuclear Safety Commission of the Cabinet Office is responsible for regulation monitoring of the primary governmental body, and relevant local governments and ministries are in charge of emergency environmental monitoring. This is why it was not clear where the primary responsibility lies in ensuring citizens' safety in an emergency. Also, we cannot deny that the existing organizations and structures hindered the mobilization of capabilities in promptly responding to such a large-scale nuclear accident.

Reflecting on the above issues, the Japanese Government will separate NISA from METI and start to review implementing frameworks, including the NSC and relevant ministries, for the administration of nuclear safety regulations and for environmental monitoring.

(24) Establishment and reinforcement of legal structures, criteria and guidelines

Reflecting on this accident, various challenges have been identified regarding the establishment and reinforcement of legal structures on nuclear safety and nuclear emergency preparedness and response, and related criteria and guidelines. Also, based on the experiences of this nuclear accident, many issues will be identified as ones to be reflected in the standards and guidelines of the IAEA.

Therefore, the Japanese Government will review and improve the legal structures governing nuclear safety and nuclear emergency preparedness and response, along with related criteria and guidelines. During this process, it will reevaluate measures taken against age-related degradation of existing facilities, from the viewpoint of structural reliability as well as the necessity of responding to new knowledge and expertise, including progress in system concepts. Also, the Japanese Government will clarify technical requirements based on new laws and regulations or on new findings and knowledge for facilities that have already been approved and licensed-- in other words, it will clarify the status of retrofitting in the context of the legal and regulatory framework. The Japanese Government will make every effort to contribute to improving safety standards and guidelines of the IAEA by providing related data.

(25) Human resources for nuclear safety and nuclear emergency preparedness and responses

All the experts on severe accidents, nuclear safety, nuclear emergency preparedness and response, risk management and radiation medicine should get together to address such an accident by making use of the latest and best knowledge and experience. Also, it is extremely important to develop human resources in the fields of nuclear safety and nuclear emergency preparedness and response in order to ensure mid- and long-term efforts on nuclear safety as well as to bring restoration to the current accident.

Reflecting on the above-mentioned issues, the Japanese Government will enhance human resource development within the activities of nuclear operators and regulatory organizations along with focusing on nuclear safety education, nuclear emergency preparedness and response, crisis management and radiation medicine at educational organizations.

(26) Ensuring the independence and diversity of safety systems

Although multiplicity has been valued until now in order to ensure the reliability of safety systems, avoidance of common cause failures has not been carefully considered, and independence and diversity have not been sufficiently secured.

Therefore, the Japanese Government will ensure the independence and diversity of safety systems so that common cause failures can be adequately addressed and the reliability of safety functions can be further improved.

(27) Effective use of probabilistic safety assessment (PSA) in risk management

PSA has not always been effectively utilized in the overall reviewing processes or in risk reduction efforts at nuclear power plants. While a quantitative evaluation of risks of quite rare events such as a large-scale tsunami is difficult and may be associated with uncertainty even within PSA, Japan has not made sufficient efforts to improve the reliability of the assessments by explicitly identifying the uncertainty of these risks.

Considering knowledge and experiences regarding uncertainties, the Japanese Government will further actively and swiftly utilize PSA while developing improvements to safety measures, including effective accident management measures, based on PSA.

Lessons in Category 5
Thoroughly instill a safety culture

(28) Thoroughly instill a safety culture

All those involved with nuclear energy should be equipped with a safety culture. “Nuclear safety culture” is stated as, “A safety culture that governs the attitudes and behavior in relation to safety of all organizations and individuals concerned must be integrated in the management system” (IAEA, Fundamental Safety Principles, SF-1, 3.13). Learning this message and putting it into practice is the starting point, the duty and the responsibility of those who are involved with nuclear energy. Without a safety culture, there will be no continual improvement of nuclear safety.

Reflecting on the current accident, the nuclear operators whose organization and individuals have primary responsibility for securing safety should look at every item of knowledge and every finding and confirm whether or not they indicate a vulnerability of a plant. They should reflect as to whether they have been serious in introducing appropriate measures for improving safety, when they are not confident that risks concerning the public safety of the plant remain low.

Also, organizations or individuals involved in national nuclear regulations, as those who responsible for ensuring the nuclear safety of the public, should reflect whether they have been serious in addressing new knowledge in a responsive and prompt manner, not leaving any doubts in terms of safety.

Reflecting on this viewpoint, Japan will establish a safety culture by going back to the basics, namely that pursuing defenses in depth is essential for ensuring nuclear safety, by constantly learning professional knowledge on safety, and by maintaining an attitude of trying to identify weaknesses as well as room for improvement in the area of safety.

13. Conclusion

The nuclear accident that occurred at the Fukushima Nuclear Power Station (NPS) on March 11, 2011 was caused by an extremely massive earthquake and tsunami rarely seen in history and resulted in an unprecedented serious accident that extended over multiple reactors simultaneously. Japan is extending its utmost efforts to confront and overcome this difficult accident.

In particular, at the accident site, people engaged in the work have been making every effort under severe conditions to settle the situation. It is impossible to resolve the situation without these contributions. The Japanese Government is determined to make its utmost efforts to support the people engaged in this work.

We take very seriously the fact that the accident, triggered by a natural disaster of an earthquake and tsunamis, became a severe accident due to such causes as the losses of power and cooling functions, and that consistent preparation for severe accidents was insufficient. In light of the lessons learned from the accident, Japan has recognized that a fundamental revision of its nuclear safety preparedness and response is inevitable.

As a part of this effort, Japan will promote the “Plan to Enhance the Research on Nuclear Safety Infrastructure” while watching the status of the process of settling the situation. This plan is intended to promote, among other things, research to enhance preparedness and responses against severe accidents through international cooperation, and to work to lead the results achieved for the improvement of global nuclear safety.

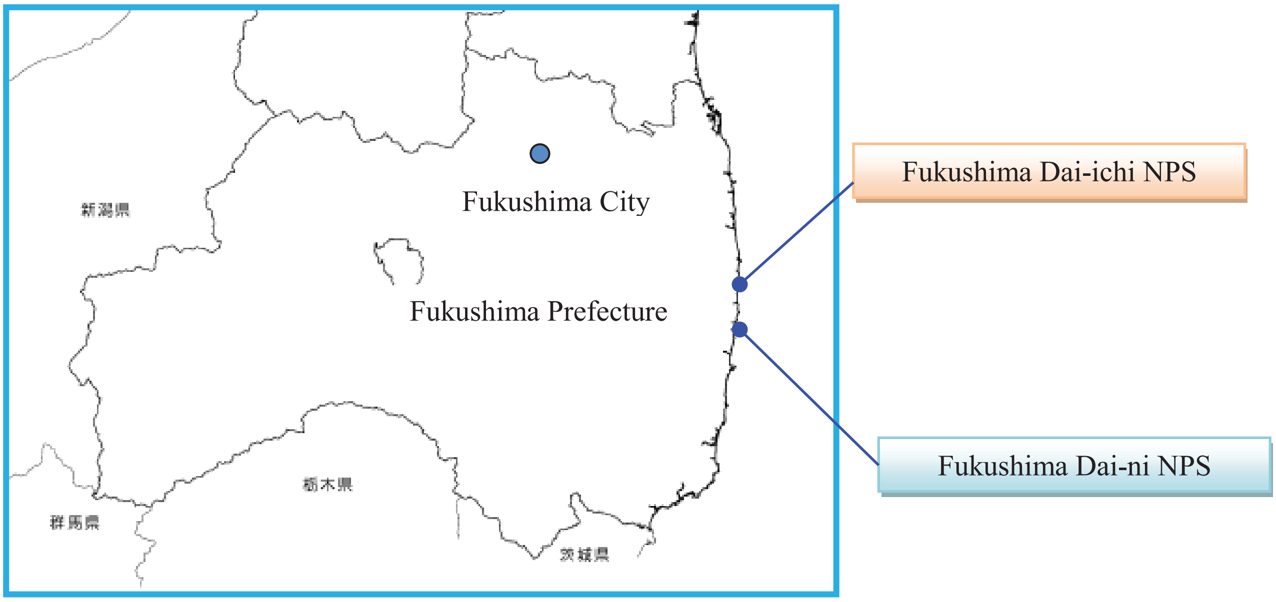
At the same time, it is necessary for Japan to conduct national discussions on the proper course for nuclear power generation while disclosing the actual costs of nuclear power generation, including the costs involved in ensuring safety.

Japan will update information on the accident and lessons learned from it in line with the future process of restoration of stable control and also further clarification of its investigations. Moreover, it will continue to provide such information and lessons learned to the International Atomic Energy Agency as well as to countries around the world.

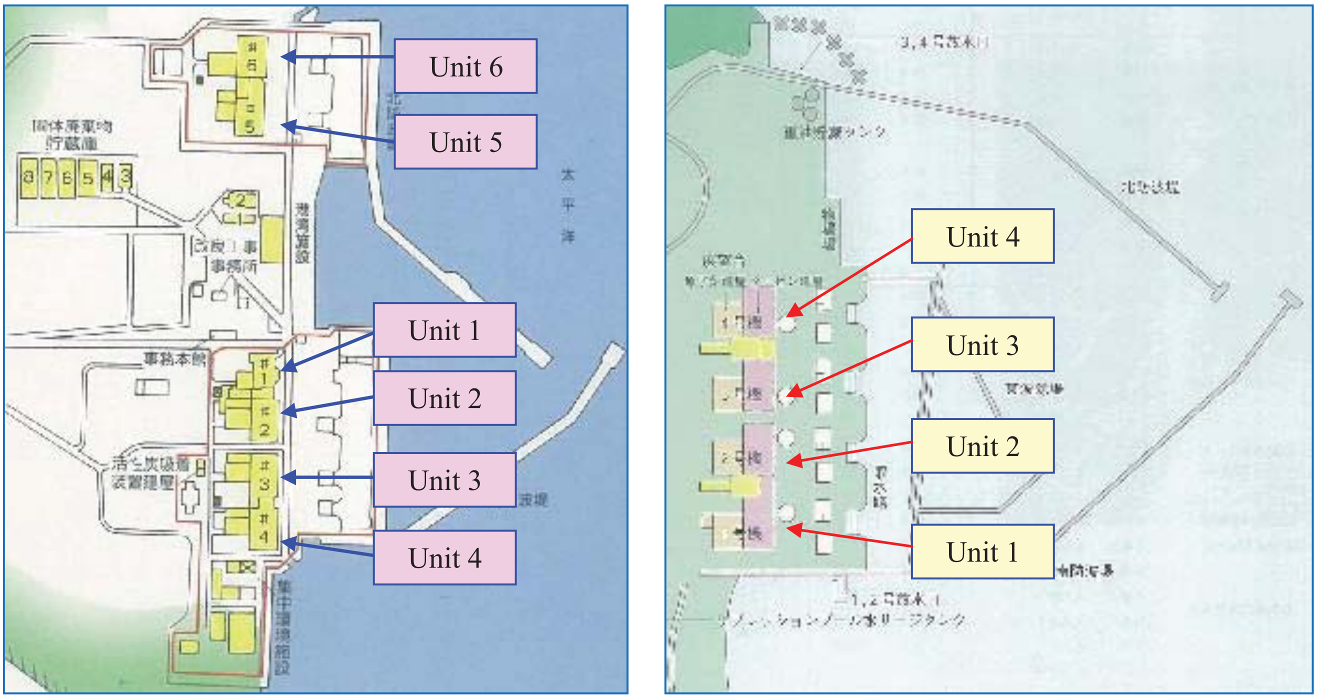
Moreover, we feel encouraged by the support towards restoration from the accident received from many countries around the world, to which we express our deepest gratitude, and we would sincerely appreciate continued support from the IAEA and countries around the world.

We are prepared to confront much difficulty towards restoration from the accident and also confident that we will be able to overcome this accident by uniting the wisdom and efforts of not only Japan but also the world.

Location of NPSs in the Tohoku District



Location of NPSs within Fukushima



Layouts of Fukushima Dai-ichi NPS and Fukushima Dai-ni NPS

Generation Facilities at the Fukushima Dai-ichi NPS

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Electric output (MWe)	460	784	784	784	784	1100
Commercial operation	1971/3	1974/7	1976/3	1978/10	1978/4	1979/10
Reactor model	BWR3	BWR4			BWR5	
PCV model	Mark-1					Mark-2
Number of fuel assemblies in the core	400	548	548	548	548	764

Generation Facilities at the Fukushima Dai-ni NPS

	Unit 1	Unit 2	Unit 3	Unit 4
Electric output (MWe)	1100	1100	1100	1100
Commercial operation	1982/4	1984/2	1985/6	1987/8
Reactor model	BWR5			
PCV model	Mark-2	Mark-2 Advance		
Number of fuel assemblies in the core	764	764	764	764

Status of Each Unit at the Fukushima Dai-ichi NPS (As of May 31)

Unit No.	Unit 1	Unit 2	Unit 3	Unit 5	Unit 6
Situation of water injection into reactor	Injecting fresh water via a water supply line. Flow rate of injected water : 6.0 m^3/h	Injecting fresh water via a fire extinguishing and water supply line. Flow rate of injected water: 7.0m^3/h(via the fire protection line), 5.0m^3/h(via the feedwater line)	Injecting fresh water via the water supply line. Flow rate of injected water : 13.5 m^3/h	Water injection is unnecessary as the cooling function of the reactor cores are in normal operation.	
Reactor water level	Fuel range A : Off scale Fuel range B : -1,600mm	Fuel range A : -1,500mm Fuel range B : -2,150mm	Fuel range A:-1,850mm Fuel range B:-1,950mm	Shut down range measure ment 2,164mm	Shut down range measure ment 1,904mm
Reactor pressure	0.555MPa g(A) 1.508MPa g(B)	-0.011MPa g (A) -0.016MPa g (B)	-0.132MPa g (A) -0.108MPa g (B)	0.023 MPa g	0.010 MPa g
Reactor water temperature	(Collection impossible due to low system flow rate)			83.0°C	24.6 °C
Temperatures related to Reactor Pressure Vessel (RPV)	Feedwater nozzle temperature: 114.1 °C Temperature at the bottom head of RPV: 96.8 °C	Feedwater nozzle temperature: 111.5 °C Temperature at the bottom head of RPV: 110.6 °C	Feedwater nozzle temperature: 120.9 °C Temperature at the bottom head of RPV: 123.2 °C	(Monitoring water temperature in the reactors.)	
D/W Pressure, S/C Pressure	D/W: 0.1317 MPa abs S/C: 0.100 MPa abs	D/W: 0.030 MPa abs S/C: Off scale	D/W: 0.0999 Mpa abs S/C: 0.1855 MPa abs	-	
Status	We are working on ensuring the reliability of the cooling function by installing temporary emergency diesel generators and sea water pumps as well as receiving electricity from external power supplies at each plant.				

Additional Report of the Japanese Government to the IAEA

- The Accident at TEPCO's Fukushima Nuclear Power Stations -

(Second Report)

(Summary)

September 2011

Nuclear Emergency Response Headquarters

Government of Japan

SUMMARY

Contents of Summary

1.Introduction

The Nuclear Emergency Response Headquarters of the Government of Japan prepared for the International Atomic Energy Agency (IAEA) Ministerial Conference on Nuclear Safety convened in June 2011 a report (hereinafter referred to as the “June Report”) addressing the situation of the accident at the Tokyo Electric Power Company' (TEPCO) Fukushima Nuclear Power Stations which occurred on March 11 of this year. This report covered the occurrence and development of the accident, responses to the nuclear emergency, lessons learned from the accident until that time, and other such matters. The Headquarters submitted the report to the IAEA and made presentations of the report at the Conference.

The Ministerial Declaration and the Chair’s Summary of the Conference’s plenary session state expectations towards Japan for the continued provision of information. The government recognizes that it is incumbent upon Japan to continue to provide accurate information regarding the accident to the international community, including lessons learned through the accident. In accordance with this approach the Government of Japan decided to compile information on the state of affairs subsequent to the June report in the form of an additional report and submit it to the IAEA on the occasions of the Board of Governors meeting and the General Conference.

Summary

Restoration from the accident has been steadily proceeding with Step 2 after completing Step 1, including among other matters the achievement of stable cooling of the nuclear reactors and the spent fuel pools in Fukushima NPS. That said, the situation is such that several more months are expected to be required to bring about more stable cooling. Against such a backdrop, the following three points have been noted in preparation of this additional report.

(1) This report compiles additional information on the accident obtained as well as efforts being made to bring about restoration from the accident after the June Report.
(2) The report compiles the current state of efforts to make full use of lessons learned.
(3) The report indicates of the state of affairs regarding the response to those who have suffered as a result of the nuclear accident (an off-site response) and the state of examination of a mid- to long-term plan for the site after restoration from the accident is completed (an on-site plan).

Particularly with regard to (3) above, the Government of Japan not only naturally advances its own initiatives but also considers it to be of paramount importance in the context of steadily advancing the initiatives to undertake matters through obtaining information, such as the related experiences and research results of other nations around the world and international organizations, as well as through receiving technical cooperation from them. Japan hopes this report will serve to engender such partnerships.

This additional report records in considerable detail what has been ascertained up until the present time regarding the situation of the responses at not only the Fukushima NPS but also other NPSs affected by the Tohoku District - Off the Pacific Coast Earthquake and the subsequent tsunamis. Moreover, the report gives an account of developments in terms of the response to those suffering as a result of the nuclear accident, including decontamination efforts. On the other hand, efforts regarding nuclear damage compensation are not covered, as was also the case with the June Report.

Preparation of this additional report has been carried out in the Government Nuclear Emergency Response Headquarters, taking into consideration efforts for restoration from the accident conducted by the Government-TEPCO Integrated Response Office, while also listening to opinions from outside eminent persons. The work in preparing this report has been managed as a whole by Mr. Goshi Hosono, Minister for the Restoration from and Prevention of Nuclear Accidents, and compiled with Mr. Yasuhiro Sonoda, Parliamentary Secretary of the Cabinet Office, playing a central role.

Japan's basic policy is to maintain a high degree of transparency as it releases information about the accident. Consequently in this report as well, it has paid attention to providing accurate descriptions of the facts of the situation while also evaluating as stringently and objectively as possible its countermeasures to address the accident. Hearings were also conducted with related parties as necessary in order to confirm various situations. The descriptions of factual situations are based on what had been ascertained as of August 31.

Japan will continue to make full use of appropriate opportunities to disseminate additional reports to the world about the accident, using a similar format. In addition, with the activities of the "Investigation Committee on the Accidents at the Fukushima Nuclear Power Station of Tokyo Electric Power Company" established by the government now fully underway, the results of the Committee's investigation will also be publicly disclosed to the world in the course of time.

Japan intends to engage in efforts for restoration from this accident in partnership with the world. It will at the same time firmly uphold the principle of transparency as it continues to provide information about the state of affairs regarding the accident to the world through the IAEA.

2. Further Developments regarding the Nuclear Accident

(1) The Tohoku District-Off the Pacific Ocean Earthquake and the resulting tsunamis

A seismic source rupture process (a seismic source model) and a tsunami source rupture process (a tsunami source model) were obtained through an analysis that used observed ground motion data and observed tsunami waveform data, respectively. The results of this analysis indicated that slips, which are one of the major factors in mechanisms that give rise to seismic and tsunami sources, were between 55 m and not quite 70 m in the shallow area along the Japan Trench.

There is a high probability that the recent earthquake was an earthquake of M9 in terms of long-period ground motions, yet had at the same time characteristics of an earthquake of M8 in terms of short-period ground motions.

It is likely that those factors that had a great impact on the tsunami water level include the large slip noted above and the overlap effects of the tsunami water level due to a delay in rupture start time associated with consecutive rupturing of multiple seismic source areas.

(2) Status of the accident at the Fukushima NPSs, etc.

TEPCO has reported that, in an effort to ascertain the inundation height and inundation area of the premises of the Fukushima Dai-ichi NPS on the basis of tsunami source models estimated through figure simulation, it was successful in reproducing the actual behavior for the most part. TEPCO also reported investigation results which included that the direct main bus panels of Units 1, 2 and 4 were inundated due to the tsunamis while those of Units 3, 5 and 6 were spared, and that the inundation pathway leading to the main buildings was mainly the opening on the ground on the sea side of the turbine building and the opening connecting to the trench duct under the ground.

TEPCO has also reported the results of an evaluation analyzing the impacts of earthquakes on buildings and structures as well as equipment and piping critical to safety, stating that it can be estimated that the major facilities and equipment that had key functions with regard to safety were, at the time of the earthquake and immediately afterwards, at a status at which safety functions could be maintained. Insofar as many aspects regarding the detailed status of impacts caused by the earthquake remain unclear, the Nuclear and Industrial Safety Agency intends to conduct further investigations and examination, such as through a substantial on-site investigation, and also carry out evaluations.

The Nuclear and Industrial Safety Agency has received reports from TEPCO regarding the accident and has been moving forward with investigations making use of hearings with the employees of TEPCO and others. Based on these, the major additional information regarding the status of the initial response at the power stations after the accident occurred with regard to such matters as cooling, alternative water injection, the

PCV venting, and so on, as well as the current state of affairs including the state of the spent fuel pools, the state of the RPV, and the like were determined to be as follows.

1) The status of the Fukushima Dai-ichi NPS in overall terms

In the Fukushima Dai-ichi NPS after the earthquake struck, while the staff designated for emergency responses was able to be secured, these persons were required to carry out various responses to the situation of concurrent disasters at multiple Units. As a result of the lost of all AC power supply due to the tsunami striking, the means of communication within the power station were extremely limited, including the loss of function of the site-specific PHS system. The Safety Parameter Display System (SPDS), which is the system to figure out the status of each plant, lost its ability to function, negatively impacting the formulation of response measures within the power station's emergency response headquarters.

On the basis of the state of damage of its power supply facilities, TEPCO had power supply vehicles from all of its branches head to the Fukushima Dai-ichi NPS beginning on the evening on March 11, but due to road damage and traffic jams, they were not able to proceed as intended. The transportation by air of power supply vehicles by the Self-Defense Forces was also considered but this could not be realized due to the great weight of the vehicles. It was against such a backdrop that, utilizing power supply vehicles secured before dawn on March 12, the staff of the stations undertook work to lay electricity cables with a view to restoring power supply amidst extremely poor working surroundings, such as darkness, strong aftershocks occurring intermittently, an ongoing major tsunami alert, pools of water left by the tsunamis, obstacles strewn about, the high air dose, etc.

2) Unit 1 of Fukushima Dai-ichi NPS

- *Initial cooling*

Although cooling by isolation condenser (IC) (two lines) was begun after the automatic shutdown of the nuclear rector, it was manually stopped by following the operation procedure documents because of a rapid decrease in the temperature of the RPV. After that, using only one system of IC, start-up and shutdown was repeated manually. The loss of power supplies due to the following tsunami made it impossible to confirm the operating status of the IC.

- Alternate water injection

Since it was unclear whether the IC functions at the plant were able to be maintained and since it was impossible to confirm the water level of the reactors, at 17:12 on March 11, with the aim of implementing cooling by means of alternative water injection, TEPCO started to consider adopting alternative water injection actions (the fire protection system, the make-up water condensate system) set up as accident management (AM) measures and fire engines using fire cisterns, which had been set up in response to the lessons learned from the Niigata-ken Chuetsu-oki Earthquake. Regarding the utilization of the fire protection system, staff manually opened valves of the core spray system and so on in the dark, making it possible for water injection to occur after the depressurization of the RPV.

Also, although the deployment of an available fire engine near Unit 1 became necessary, tsunami-induced driftage interrupted the flow of road traffic on site. A fire engine was deployed near Unit 1 only after securing an access route by breaking the lock of a gate that was closed. It was through such difficult work that at 05:46, March 12, fresh water injection was started using the fire engine, by means of the fire protection system line.

- PCV venting

Because the means to transfer heat to the ultimate heat sink was lost as a result of the tsunami, TEPCO started to review from the very earliest stages of the accident the possibility of conducting PCV venting. When station employees connected a small generator at around 23:50 on March 11 to the instrument to confirm PCV drywell pressure, it was 0.600 MPa abs (maximum operating pressure is 0.427 MPa gage (= 0.528 MPa abs)). Therefore the NPS started work in concrete terms to perform venting. The evacuation of residents in the vicinity was being confirmed prior to performing the venting, and at 9:03 on March 12 the evacuation of Okuma Town (Kuma district) was confirmed as having been completed. At around 9:15 station employees performed the operation to open a PCV venting valve (open 25% of the stipulated procedure) using the light of a flashlight in the darkness. Subsequently station employees went to operate the small valve of the suppression chamber (S/C); but, it was impossible to do so due to a high dose in the environment of that spot. Due to this, the opening operation of the S/C small valve in the Main Control Room was performed with expectations of residual pressure of air in the S/C small valve, and the operation to open the S/C large valve through the use of a temporary compressor was performed at around 14:00 that day. The result was that at 14:30 the PCV drywell pressure was confirmed to have decreased, and consequently it was judged that venting had been performed.

- *Situation of the spent fuel pool*

Due to the loss of all AC power and the consequent loss of seawater pump function due to the earthquake and tsunamis on March 11, the functions of cooling and of make-up water were lost. The reactor buildings were damaged by hydrogen explosions on March 12 and portions of the ceilings fell down on the upper side of the pool. There is a high probability that exposed fuel was avoided by maintaining the water level at the spent fuel pool through the spraying of water by concrete pump truck and injections of water taken from the piping of the fuel pool cooling and cleanup systems and freshwater sources. An alternative cooling system has been organized and operated since August 10 and at present the water temperature has been stabilized at approximately 30^{o}C.

- *Current status of the RPV*

As of August 31, water injection was being undertaken at a flow rate of approximately 3.6m^3/h, which exceeds the flow rate equivalent to decay heat. The temperature of the bottom of the RPV is below 100^{o}C and has been trending in a stable manner without showing any continuous increasing trend for the past month, a fact indicating that sufficient cooling has been secured through the circulating water injection cooling system. The injection of nitrogen into the PCV has been underway since starting the injection on April 7.

3) Unit 2 of Fukushima Dai-ichi NPS

- *Initial cooling*

Although the loss of power supplies due to the tsunamis made the operating status of the reactor core isolation cooling system (RCIC) unidentifiable, at 02:55, March 12, it was confirmed that the RCIC was in operation, and thereafter, the monitoring of the reactor continued for a little while as an alternative water injection system was prepared.

- *Alternative water injection*

Since it was impossible to determine whether or not the RCIC function was being maintained immediately after the tsunamis struck, just as with Unit 1, TEPCO began to consider adopting alternative water injection actions (the fire protection system, the make-up water condensate system) which had been set up as AM measures, as well as fire engines using the fire cistern. Thereafter, upon confirming the operation of the RCIC, monitoring of the reactor condition continued for some time, and in parallel, a water injection line which took its water from the Unit 3 backwash valve pit was developed in case the RCIC stopped, and hoses were connected the fire engines deployed. At 11:01, March 14, an explosion occurred in the rector building of Unit 3, resulting in the water injection line which had been ready for operation becoming unusable due to damages to the fire engines and hoses. At 13:25 on the same day, since it was judged that the operation of RCIC was not available, it was decided that due to the fact that debris lay scattered on the site direct seawater injection from the landing area would be implemented. After that, while the work was forced to stop due to aftershock, the subsequent arrangements including, among others, reconnecting hoses, depressurizing the RPV using main steam safety relief valves (SRV), and refueling fire engines which had stopped operations after running out of fuel, were completed, although some interruption by aftershocks were unavoidable. At 19:54 on the same day, TEPCO began seawater injections via fire engines.

- *PCV venting*

In order to create a situation in which PCV venting can be performed, operations to open a PCV vent valve (MO valve (motor operated valve)) (open 25% of the stipulated procedure) was performed at 8:10 on the 13th, and the operation of opening the large valve of the S/C vent (AO valve (air operated valve)) was performed at 11:00 of the same day to complete the vent line configuration and await the blowout of a rupture disk. However, after that, the S/C large valve was closed and unable to be re-opened, affected by the explosion of the reactor building of Unit 3 at 11:01 on the 14th; nevertheless, efforts were continued to form a line. At around 21:00 on that day the small valve of the S/C vent (AO valve) was opened slightly, making the vent line configuration successful again. However, a policy of drywell venting was adopted because the pressure on the S/C side was lower than the working pressure of the rupture disk and the pressure on the drywell side was increasing, and an operation to open the small valve of the drywell vent valve (AO valve) was performed once at 0:02 on the 15th; however, it was confirmed several minutes later that the small valve was closed. After that, drywell pressure maintained a high level of values; large sounds of impact occurred between around 6:00 and 6:10 of the 15th, while S/C pressure indicated 0 MPa abs. Lower drywell pressure was also confirmed at around 11:25 on that day.

- *Situation of the spent fuel pool*

Due to the loss of all AC power and the consequent loss of the seawater pump function due to the earthquake and tsunamis on March 11, the functions of cooling and of make-up water was lost. A blow-out panel of the reactor building at Unit 2 was thrown open by a hydrogen explosion at the reactor building of Unit 1 on March 12. Water injections using seawater as the source water and which made use of the piping of the fuel pool cooling and cleanup system had started since March 20. (This was switched to a freshwater source as of March 29.) There is high probability that exposed fuel has been avoided by maintaining the water level of the spent fuel pool through this method of water injection. An alternative cooling system was begun on May 31 and the water temperature has been stabilized at approximately 30^{o}C at present.

- *Current status of the RPV*

As of August 31, water injection was being undertaken at a flow rate of approximately 3.8m^3/h, which exceeds the flow rate equivalent to decay heat. The temperature at the bottom of the RPV is below 130^{o}C and trending in a stable manner without showing any continuous increasing trends for the past month, which indicates that sufficient cooling has been secured via the circulating water injection cooling system. The injection of nitrogen into the PCV has been underway since starting the injection on June 28.

4) Unit 3 of Fukushima Dai-ichi NPS

- *Initial cooling*

Regarding Unit 3, even after the loss of all AC power on March 11, the RCIC was functioning for some time and cooling of the rector was maintained. However, at 11:36, March 12, the RCIC was tripped. HPCI, whose operation was begun immediately following that, which means at 12:35 on the same day, stopped at 02:42, March 13. In light of this situation, TEPCO attempted to restart the injection of water using existing cooling facilities (HPCI, RCIC, diesel-powered fire pumps), but the HPCI failed to operate due to battery depletion. An injection of water into the RPV was also attempted upon confirming the site conditions, but the RCIC failed to begin operating.

- *Alternative water injection*

After the restoration of roads within the site located to the side of units 5/ 6, including the removal of debris and other efforts, the recovery of the fire engines which were parked to the side of units 5/6, and the transfer to Fukushima Dai-ichi NPS of a fire engine which had been positioned as a backup for emergencies at Fukushima Dai-ni NPS, in the early morning of March 13, a line for an injection of water was developed by which freshwater was taken from the fire cistern. In order to depressurize the RPV, it became necessary to operate the main steam safety relief valves (SRV), but due to a lack of working batteries, batteries were removed from cars employees used for commuting and collected. Rapid depressurization of the RPV was implemented using these batteries as a power supply. Following this, at 09:25 on the same day, alternative water injection with fire engines was launched. When freshwater from the fire cistern, the water source, was depleted, at 13:12 on the same day, a seawater injection was begun by developing the line which injects seawater of the backwash valve pit. The explosion of the reactor building on March 14 caused the backwash valve pit to become unusable. Having attempted other sea water injections, around 16:30, March 14, seawater injections were developed that directly took in seawater, and seawater injection via fire engines resumed.

- *PCV venting*

At around 4:50 on March 13 the operation to open the vent valve was started for the PCV vent, and the S/C large valve (AO valve) was not able to be opened despite the forcible energization of the electromagnetic valve for activating the large valve using a small generator, so it was made to open by changing cylinders. Also, the operation to open another vent valve was performed manually (open 15% of the stipulated procedure), the vent lineup was complete at around 8:41 on March 13, and TEPCO awaited the blowout of a rupture disk. At 9:24 on March 13 it was confirmed that drywell pressure had decreased from 0.637 MPa abs (at 9:10 on the 13th) to 0.540 MPa abs (at 9:24 on the 13th), so that TEPCO judged that venting had been conducted. However, after that, there was the repeated closure of a vent valve due to decreased air pressure, so that the operation to open the valve was performed each time by changing cylinders, etc.

- *Situation of the spent fuel pool*

Due to the loss of all AC power and the consequent loss of the seawater pump function due to the earthquake and tsunamis on March 11, the functions of cooling and of make-up water were lost. The entire upper side exterior-wall of the operating floor at the reactor building was damaged by an explosion assumed to have been a hydrogen gas explosion on March 14, and a large amount of rubble fell down onto the spent fuel pool. A large amount of steam emissions from the exposed operating floor was confirmed because of the damage to the building. On March 17, the spraying of seawater to the upper side of the reactor building by helicopter of the Self-Defence Force began. Spraying toward the spent fuel pool through the use of a water spraying truck also started on the same day. Water injection by a concrete pump truck began on March 27, and water injection from the piping of the existing fuel pool cooling and cleanup system was started on April 26. Through this effort, it is highly likely that exposed fuel has been avoided by maintaining the water level at the spent fuel pool. An alternative cooling system has been in place since June 30 and the water temperature is presently stabilized at approximately 30°C.

- *Current status of the RPV*

As of August 31, water injection was being undertaken at a flow rate of approximately 7.0m^3/h, which exceeds the flow rate equivalent to decay heat. The temperature of the bottom of the RPV is below 120°C and trending in a stable manner without showing any continuous increasing trend for the past month, which indicates that sufficient cooling has been secured by means of the circulating water injection cooling system. The injection of nitrogen into the PCV has been underway since starting the injection on July 14.

5) Unit 4 of Fukushima Dai-ichi NPS

- *Situation of the spent fuel pool*

Due to the loss of all AC power and the consequent loss of the seawater pump function due to the earthquake and tsunamis on March 11, the functions of cooling and of make-up water were lost. The upper wall side and other portions of the operating floor were damaged by an explosion assumed to have been a hydrogen gas explosion on March 15. The spraying of freshwater by Self-Defence Forces water spraying trucks began on March 20 and has been conducted periodically ever since. Injections using a temporary fuel pool injection facility were also launched on June 16. After analyzing the results, etc. of nuclide analysis of the pool water sample, most of the fuel inside of the pool appears to be in sound condition and it is presumed that systematic mass-damage has not occurred. In this respect, due to damage at the reactor building at Unit 4, the possibility that part of the fuel was damaged by rubble falling into pool cannot be ruled out. An alternative cooling system has been in place since July 31 and the water temperature is presently stabilized at approximately 40°C.

In addition, the installation of a supportive structure at the bottom of spent fuel pool was completed on July 30 and seismic safety has been enhanced.

6) Fukushima Dai-ni NPS

In Fukushima Dai-ni NPS (BWR of Units 1~4), before the earthquake on March 11, all four units were in operation. One external power supply line was secured for the entire Fukushima Dai-ni NPS, and therefore the securing of an AC power supply was successfully achieved. Regarding Units 1 and 2, the turbine-driven injection system was ensured, and, in the case of the motor-driven injection system, despite the entirety of the emergency core cooling system (ECCS) becoming unusable, all other injection systems except the ECCS were ensured. Thus, core cooling was successfully achieved. Regarding Units 3 and 4, the turbine-driven injection system was ensured, and insofar as motor-driven injection system, part of ECCS and other injection systems were ensured, so that core cooling was successfully achieved. Regarding the removal of decay heat from the PCV, as for Unit 3, since the residual heat removal system (RHR) was ensured, continuous cooling was implemented which led to a cold shutdown. Regarding Units 1, 2 and 4, though the heat removal function was lost due to tsunamis, one RHR system was restored by replacing motors, installing temporary cables, receiving power from temporary cables, and receiving power from high voltage power supply vehicles, and in this way, a cold shutdown was achieved.

7) Other NPSs affected by the earth quake and tsunami

- *Onagawa NPS*

In Tohoku Electric Power Company Onagawa NPS (BWR of Units 1~3), Units 1 and 3 were operating, and Unit 2 was in the process of starting reactor operation. Even after the earthquake and tsunami, one external power supply line was secured for the entire NPS. Due to a fire at the normal distribution panel, Unit 1 could not supply power to the emergency distribution panel, thus it could not use an external power supply. However, by activating the emergency diesel generator, it could secure an AC power supply. As for core cooling, the turbine-driven water injection system and motor-driven water supply system were secured in Units 1 and 3, and core cooling was successful. Regarding Unit 2, the operation of pulling out the control rods for starting up the reactor was carried out, and the water temperature in the reactor was 100ºC or less and immediately resulted in cold shutdown. Regarding removal of decay heat from the PCV, all Residual Heat Removal Systems (RHR) could be secured in Units 1 and 3, and were kept cool and resulted in a cold shutdown. As for Unit 2, the water temperature was 100 ºC or less, and it shifted directly to cold shutdown. One RHR system became dysfunctional due to the following tsunami, but one other system was available, and this was successful in securing the removal of decay heat.

- *Tokai Dai-ni NPS*

The Japan Atomic Power Company Tokai Dai-ni NPS (BWR of 1 Unit) was in operation before the earthquake on March 11.Due to the earthquake, three external power supply lines were stopped and thus external power supply was lost. All emergency diesel generators started operating. After that, although one system became unusable due to the tsunamis, through the use of another emergency diesel generator and a high-pressure core spray system (HPCS), AC power supply from diesel generators was successfully achieved. Regarding core cooling, one motor-driven water supply system could be secured, and core cooling was successful. As for the removal of decay heat from the PCVs, since one system of power supply was secured by an emergency diesel generator, and one system of power supply was secured by Residual Heat Removal System (RHR) as well, it required some time, but cooling was maintained and it resulted in a cold shutdown.

(3) Response regarding Evacuation Areas, etc

The Japanese government has established Evacuation Areas, etc. as necessary in order to avoid the accident impacting the residents in the surrounding areas. As was described in the June Report, the Director-general of the Nuclear Emergency Response Headquarters instructed the mayors concerned of the cities, towns and villages to establish the area within 20 km radius of the Fukushima Dai-ichi NPS as a restricted area from April 22 and residents have in principle been prohibited from access to the area. At the same time, it permits both residents to temporarily access their own residences (residents' temporary access) and public organizations and enterprises, etc. , whose public interest are badly damaged without temporally access to the area, to temporarily access the area (public temporary access). The first round of residents' temporary access for all the cities, towns and villages in the area was almost complete by August 31, with 19,683 households (33,181) people having been granted temporary access by August 31.

On April 22, the government established as the Deliberate Evacuation Area the area in which the cumulative dose might reach 20 mSv within a year from the occurrence of the accident. The residents in this area have almost completed evacuation to date. Regarding the Evacuation-Prepared Area in Case of Emergency which was established on the day as the Deliberate Evacuation Area, in which a response of "stay in-house" and/or evacuation was required in case of emergency, efforts are currently being made to lift the designation (cf. 4.(2) below).

In addition, since June particular spots have been found, which have no areal spread but of which cumulative dose might reach 20 mSv within a year from the accident occurrence depending on a life style, the government has identified their residences as Specific Spots Recommended for Evacuation, and it was decided for the residents living at the spots first to draw attention to these spots and then support and promote evacuation. To date, 227 spots have been established as Specific Spots Recommended for Evacuation, covering 245 households.

(4) Situation regarding the release of radioactive materials

The Japan Atomic Energy Agency (JAEA) reported on May 12 to the Nuclear Safety Commission (NSC) about its trial calculation of the amount of release to the atmosphere of iodine-131 and cesium after the accident occurred, and, as the result of emergency monitoring from March 12 to 15 was thus newly confirmed, the JAEA reevaluated and reported the result to the NSC on August 22.

For the current release amount of radioactive materials at the site, TEPCO, using a graph of the concentration distribution which had been made in advance by means of observed data of concentration measurements of radioactive materials in the atmosphere near the site and a diffusion model (a diffusion model based on the "Regulatory Guide for Meteorological Observation for Safety Analysis of Nuclear Power Reactor Facilities" of the NSC), estimated the current release amount of radioactive materials to the atmosphere. As a result, at a time in early August, the release amount including the total of both cesium-137 and cesium-134 per unit time was estimated to be approximately 2.0×10^8 Becquerel/hour (Bq/h).

The government, to assess the impact of radioactive materials released from the Fukushima Dai-ichi NPS, has actively continued environmental monitoring. In July, the government established the "Monitoring Coordination Meeting" to promote precise implementation and evaluation of monitoring based on the overall results of wide-range environmental monitoring performed by related ministries and agencies, municipalities and the operators. The Coordination Meeting determined the "Comprehensive Monitoring Plan" on August 2 to perform careful monitoring without omissions regarding 1) general environmental monitoring, 2) harbors, airports, etc., 3) the water environment, etc., 4) agricultural soil, forests and fields, etc., 5) food, 6) the water supply, in cooperation with related organizations.

For the outflow of radioactive materials to the sea from the Fukushima Dai-ichi NPS, TEPCO implemented measures to prevent outflow and mitigate diffusion, including the closure of the seawater piping trench located in the upper part of outflow routes as well as blocking pits having outflow risk. The concentration of radioactive materials in seawater near the NPS' water intake and water discharge locations has now decreased to a level near the regulatory concentration value defined by law. However, in the future, there is the possibility that accumulated water might leak under ground and increase contamination of the sea. In light of this situation, the installation of a water shielding wall (at the seaside) made of steel pipe sheet pile with an adequate water shielding function in front of the existing seawall of Units 1 to 4 is planned. Beyond this, the installation of a water shielding wall (at the land side) surrounding the reactor buildings of Units 1 to 4 is also being investigated and examined.

The Ministry of Education, Culture, Sports, Science and Technology (MEXT), on the basis of "Sea Area Monitoring in Wider Areas" published on May 6, has been continuously implementing monitoring of radioactivity concentrations in refuse on the sea surface, in the seawater and in the marine soil in the sea beds off the coast of Miyagi, Fukushima and Ibaraki Prefectures, etc. in cooperation with related organizations.

(5) Situation regarding radiation exposure

Regarding the total value of the external and internal exposure of the workers, while the average value of 3,715 people was as high as 22.4 mSv in March, there is a declining tendency, with 3.9 mSv as the average value of 3,463 people in April and 3.1 mSv as the average value of 2,721 people in May.

Particularly in March, it was confirmed that six people exceeded 250 mSv, which is the dose limit for an emergency worker. All of these were TEPCO employees who were operators and engineers in electricity and instrumentation engaged in monitoring of instruments in the main control rooms immediately after the occurrence of the accident. TEPCO has made it a rule not to allow workers who have exceeded 200 mSv to work at the Fukushima Dai-ichi NPS.

For residents, Fukushima Prefecture intends to implement the “Health Management Survey for the Residents in Fukushima Prefecture” directed at all its residents, who number about two million. In concrete terms, a basic survey based on behavioral records, etc., is scheduled and a detailed survey will be implemented for the residents living in Evacuation Areas, etc. Moreover, supersonic thyroid examinations will be implemented for all residents who are 18 years old or younger. As part of the previous survey of the basic survey, a survey of internal exposure by using a whole body counter, etc. was implemented for 122 residents in areas where the possibility of internal exposure might be relatively high. The internal exposure to the total of cesium-134 and cesium-137 by these subjects was assessed as less than 1 mSv.

(6) Situation regarding measures to address agricultural products, etc.

From viewpoints of securing health, security, and safety of the citizens as well as international community, the government is promoting enhanced efforts on inspection of agricultural products and distribution restriction as necessary, etc., based on provisional regulation values of radiation dose comparable to those of major countries. Regarding agricultural products, etc., on June 27, the Government Nuclear Emergency Response Headquarters (GNER HQ) re-summarized the policy for restricting distribution and intake and also for lifting such orders, on the basis that radioactive cesium exceeding the provisional regulation values has been detected in some food even as the level of radioactive iodine detected in food has been decreasing. Based on this, relevant municipalities are carrying out distribution restrictions and also lifting these restrictions in accordance with the monitoring results of radioactive materials.

As for the specific handling by the government regarding tea in tea fields where the concentration of radioactive cesium of dried tea leaves exceeds provisional regulation values (500 Bq/kg or less) or has a risk of it, Ministry of Agriculture, Forestry and Fisheries (MAFF) provides guidance towards planning to decrease the amount of radioactive cesium by carrying out “deep-skiffing,” which is to prune 10 to 20 cm from the top to the degree that no leaf layers remain. Also, radioactive cesium exceeding the provisional regulation values was detected in beef, and, since it is believed that cattle consumed rice straw collected after the accident and containing radioactive cesium, in conjunction with calling for attention to the handling of rice straw, distribution restrictions of cattle were established. Regarding rice, in cities, towns and villages where radioactive cesium concentration in soil is high, preliminary investigations were carried out in advance in order to figure out the tendency towards concentrations of radioactive materials at a stage before harvesting, and measurement at the post-harvest stage as the main investigation will be carried out, measuring radioactive materials to decide whether or not a restriction on distribution is necessary. On the basis of this concept of the government, the inspection of rice for radioactive materials has been conducted by relevant municipalities, and radioactive materials exceeding provisional regulation values have not been detected to date (August 31). Also, regarding fertilizer, soil amendments, nursery soil, and feed, provisional acceptable values regarding the concentration of radioactive cesium were defined and inspection methods, etc. were established.

3． Efforts to Settle the Accident

On July 19, the Nuclear Emergency Response Headquarters confirmed that the roadmap to settle the situation regarding the accident will transition from Step 1 to Step 2. This was the result of a comprehensive assessment of the situations including that the radiation doses indicated by monitoring posts, etc. were steadily on the decrease, efforts to cool the reactors and spent fuel pools have progressed, the treatment of stagnant water has progressed, etc.

Under Step 2, from October of 2011 to January of 2012, efforts will be made to achieve a situation in which the release of radioactive materials is under control, and the radiation exposure dose is being significantly held down through the realization of the cold shutdown of the rectors etc. The Nuclear Emergency Response Headquarters positioned Step 2 as an effort to be undertaken by the Government-TEPCO Integrated Response Office, and that the government will be sufficiently engaged to settle the accident, including efforts to improve the life and work environment for workers, the enhancement of radiation control and the medical system, and the training of staff. The government will make its utmost efforts to surely achieve the goals of Step 2 and settle the accident as soon as possible.

As the specific situation so far, regarding stable cooling of reactors, in Step 1, in consideration of the achievement of treating stagnant water and stable water injection using it (circulation water cooling), the securing of reliable water injection (actions to address an abnormal event, more than one measure for water injection, etc.), and the avoidance of the risk of a hydrogen explosion accompanying the nitrogen injection into the PCV, the targeted "stable cooling" in Step 1 was realized.

Currently, the actual amount of injected water exceeds the amount of water equivalent to the decay heat, and the temperature of RPV has been stable. Hereafter, regarding Units 2 and 3, where the temperature at the bottom of the PRV exceeds 100^{o}C, the amount of water injection will be modified on a trial base in order to change the temperature inside the reactor and the amount of water necessary to be injected to achieve a cold shutdown condition will be evaluated.

Regarding the cooling of the spent fuel pools, by August 10, "more stable cooling" (a target in Step 2) was achieved before others, as circulating cooling with heat exchangers has been implemented in all Units (1, 2, 3 and 4).

In order to implement the treatment of stagnant water and more stable and efficient injection of treated water into the reactor, as second-line treatment facilities, on August 7, treatment began with evaporative concentration equipment, which reinforces the desalination process. The current accumulated amount of the treated stagnant water is approximately 66,980 tons (as of August 31) and the cesium decontamination factor achieved by the treatment facilities is 10^{6}. (Note: The "decontamination factor" is the ratio of the concentration of cesium in the sample before treatment to the concentration of cesium in the sample after treatment.)

In order to improve the life and work environment for workers, TEPCO installed provisional dormitories as well as rest facilities in the NPS in sequence. Also, in order to improve health control for workers, a medical room has also been installed in the NPS, and the medical systems have been improving by deploying multiple doctors in a seismic isolation building to provide a 24-hour care system etc.

4. Responses to people suffering as a result of the nuclear accident (Off-site)

(1) Off-site measures

The Nuclear Emergency Response Headquarters established the "Roadmap for Immediate Actions for the Assistance of Residents Affected by the Nuclear Incidents" on May 17. Currently it is promoting efforts targeting the Evacuation Areas, the reinforcement and continued implementation of monitoring, and efforts such as decontamination and countermeasures against radioactive waste, etc. with full force in line with the Roadmap. The government will promptly promote such efforts in cooperation with related parties such as local municipalities.

(2) Efforts to lift the designation of Evacuation-Prepared Area in Case of Emergency

The NSC has indicated conditions, etc. for the lifting of each of the designations of Evacuation-Prepared Area in Case of Emergency, Evacuation Area, and Deliberate Evacuation Area, taking into account radiation protection and reactor stability under the "Basic Policy of the Nuclear Safety Commission of Japan on Radiation Protection for Termination of Evacuation and Reconstruction" (July 19) and "Standpoint of the Nuclear Safety Commission for the Termination of Urgent Protective Actions implemented for the Accident at Fukushima Dai-ichi Nuclear Power Plant" (August 4).

Based on the above initiatives, the Nuclear Emergency Response Headquarters indicated the "Concept of Review of Evacuation Area, etc." on August 9. The Japanese government intends to lift the designation of Evacuation-Prepared Area in Case of Emergency in block at the stage when all local municipalities have completed the development of a restoration plan based on their residents' intentions.

Therefore, related organizations are currently promoting environmental monitoring actively with a view to the lifting of the Evacuation-Prepared Area in Case of Emergency. Whole area environmental monitoring of the sites of schools and other public facilities, school zones and parks, etc. and environmental monitoring in response to individual requests of cities, towns and villages, etc. have been performed.

(3) Preparation of maps indicating radiation doses, etc.

The MEXT collected soil at about 2,200 places within a roughly 100 km radius from the TEPCO's Fukushima Dai-ichi NPS while also measuring the air dose rate and the amount of radioactive materials deposited into soil at these locations. It has made it a rule to prepare distribution maps of radiation dose, etc. on the basis of these measurements; so far, it published an air dose rate map on August 2 and a concentration map of radioactive cesium in soil on August 30.

(4) Enactment of the Act on measures for radioactive wastes and the basic policy of decontamination

The Diet enacted the "Act on Special Measures concerning Handling of Radioactive Pollution" on August 26. In light of the fact that contamination of the environment has been occurring on account of radioactive materials discharged by the recent accident, the Act intends to reduce impacts on human health and/or living environment promptly by establishing measures to be taken by the national and local governments and relevant licensees, etc. Specifically, it stipulates that the national government is to establish the basic principles regarding the handling of contamination of the environment by radioactive materials, and, giving due consideration to the degree of significance of the contamination, designate areas where it is necessary to take measures including decontamination by the national government and so on.

As decontamination is an urgent issue to be tackled immediately, the GNER HQ established the "Basic Policy for Emergency Decontamination Work" on August 26 without waiting until the related part of the above-mentioned Act fully comes into force in next January. It summarized specific targets and working principles in carrying out decontamination, including that estimated annual exposure dose of general public in residence areas is to be reduced approximately 50% in the next two years, and so on. In this policy, 1) with a central focus on areas where the estimated annual exposure dose exceeds 20 mSv, the national government directly promotes decontamination with the goal of reducing the estimated annual exposure dose to below 20 mSv, 2) effective decontamination is carried out through the cooperation of municipalities and residents also in areas where the estimated annual exposure dose is below 20 mSv, with a goal of bringing the estimated annual exposure dose to close to 1 mSv, and 3) particularly, by putting high priority on thorough decontamination work in children's living areas (schools, parks, etc.), the goal is to reduce the estimated annual exposure dose of children close to 1 mSv as soon as possible, and then still lower, and so on. The contents of the basic policy are consistent with the above-mentioned Act and will be replaced when this Act fully comes into force. In order to promote these efforts by coordinating with the local areas the government launched "Fukushima Decontamination Promotion Team" and enhanced its on-site system on August 24. Also, on August 25, the Office of Response to Radioactive Materials Contamination was established within the Cabinet Secretariat and a system for comprehensively promoting decontamination, the disposal of radioactive wastes, and the health investigation of residents is to be prepared. In addition, a coordination meeting to facilitate close coordination among relevant ministries and agencies will be launched, as well as a radioactive materials contamination response advisory meeting, to be comprised of persons of knowledge and experience on the establishment of standards regarding radiation. Hereafter, the government intends to appropriate about 220 billion yen for these decontamination activities from reserve fund provided under a secondary supplementary budget for this fiscal year.

(5) Individual efforts concerning decontamination, etc.

\- *Decontamination efforts made by municipalities*

In Date City, Fukushima Prefecture, prior to decontamination works of the whole city, a demonstration experiment targeting swimming pools and private residences was carried out, whereby the radiation dose was successfully lowered to a level that does not cause problems. Other local governments also have started decontamination and remediation activities.

\- *Decontamination of residents' living spaces*

The GNER HQ, since radioactive materials were detected from soil and sand in the gutters as well as fallen leaves, carried out a demonstration experiment on the decontamination of gutters, etc., and compiled and presented instructions for cleaning these.

\- *Decontamination efforts in schools, nursery schools, etc.*

In cases in which the air dose rate of the school yard, kindergarten yard, etc. exceeds 1 μSv/h, MEXT and the Ministry of Health, Labour and Welfare (MHLW), through financial support from the national government, will carry out measures to reduce the dose rate of school soils, etc., with the goal that the exposure dose for pupils and school children not be more than 1 mSv per year in principle after summer vacation.

- Dose reduction of public facilities and school zone, etc.

The national government funded for measures in Fukushima Prefecture for urgently preventing the effects of radiation on children, etc. in schools, parks, school zones, and public facilities, etc. currently used by children, residents, and others.

- Monitoring and decontamination of agricultural soils, etc.

With regard to agricultural land, the Ministry of Agriculture, Forestry and Fisheries (MAFF) collected samples of soil from about 360 points in Fukushima Prefecture and about 220 points in the surrounding 5 prefectures (Miyagi, Tochigi, Gunma, Ibaraki and Chiba Prefectures), promoted investigations into the status of contamination, and compiled a distribution map of radioactive materials concentrations (August 30).

MAFF, in cooperation with the Government Council for Science and Technology Policy, MEXT and the Ministry of Economy, Trade and Industry, has promoted the verification of the effectiveness of physical, chemical and biological decontaminating methods, has been working to develop technologies for decontaminating radioactive materials, and has been reviewing necessary measures for each decontamination status. Also, regarding all forested areas in Fukushima Prefecture, a distribution map of concentrations of radioactive materials is to be prepared similarly, and the future response will be examined accordingly.

- Disposal of disaster wastes, etc.

Ministry of the Environment compiled the “Policy on Disposal of Disaster Wastes in Fukushima Prefecture” on June 23. It stipulated the disposal method, etc. of incinerated ash that burnable waste is to be incinerated at incineration facilities fitted with bag-filter equipment and having exhaust fume absorption functions, and also that bottom ash contaminated with 8,000 Bq/kg or less is to be disposed by landfill. Subsequently, on August 31, the “Policy on Disposal Method of Incinerated Ash, etc. with Contamination that exceeds 8,000 Bq/kg and is less than 100,000 Bq/kg” was compiled.

5. Plans for the NPS site after restoration from the accident (On-site plans)

At the Fukushima Dai-ichi NPS where the recent nuclear accident occurred, there are plans to aim to remove the spent fuel and debris and, ultimately, to take measures for decommissioning. To achieve these objectives, the Mid- and Long-term Response Team of the Government-TEPCO Integrated Response Office is discussing for efforts to address these mid- and long-term challenges at “Advisory Committee on Mid- and Long-term Measures at the Fukushima Dai-ichi NPS of Tokyo Electric Power Co. Inc.,” (hereinafter referred to as “Advisory Committee on Mid- and Long-term Measures”) of the Atomic Energy Commission along with addressing issues by dividing them into mid-term challenges and long-term challenges.

Mid-term challenges include management of the groundwater on the site, integrity management of buildings and equipment, construction of reactor building containers, and the removal of spent fuel from the spent fuel pools. The Mid- and Long-term Response Team is currently discussing and designing the construction of groundwater boundaries on the ocean-side of the NPS site in order to prevent groundwater contamination from expanding, and is evaluating and discussing the safety of the reactor buildings in the event of a possible earthquake in the future in order to ensure safety. For the present, the removing spent fuels from the spent fuel pools, etc. will be tackled for the next three years, with preparations now underway, including the installation of equipment necessary to clear rubble scattered atop the reactor buildings and remove spent fuel, and modifications to the common pool to which spent fuels in the spent fuel pools are to be transferred.

Long-term challenges include the reconstruction of primary containment boundaries, extraction and storage of debris, management and disposal of radioactive waste, and decommissioning.

“Advisory Committee on Mid- and Long-term Measures” of the Atomic Energy Commission is currently discussing and putting together basic policies for efforts to address these mid- and long-term challenges and a set of research and development issues that are expected to be useful and helpful in pursuing those efforts. This Advisory Committee is identifying and sorting out technical challenges to be solved so that debris can be removed from the reactor pressure vessels (RPV) and then put under control, using examples from the activities at Unit 2 of the Three Mile Island nuclear power plant (hereinafter referred to as “TMI-2”) in the United States.

The Fukushima Dai-ichi NPS is in a difficult situation, including the facts that the placement of debris is not known, that debris may have accumulated at the bottom of the primary containment vessels (PCVs) due to damage to the RPV bottoms, unlike in the case of the TMI-2 accident, and the fact that it has been determined that the water injected to cool the RPVs has been flowing out of there into the PCVs, leaking from the PCVs into the bottom part of the reactor buildings, and then further into the turbine buildings from there. With this recognition, it has been decided that attention should be focused on identifying points of leakage of the cooling water and on figuring out the position and nature of the fuel while enabling the circulation pathway for cooling the RPVs to be shortened and debris to be handled, for which an accommodating environment should be put in place. To achieve this, work is now underway to identify technical challenges to be solved and corresponding research and development areas.

For example, the development of engineering and construction methods to locate the leakage points of the PCVs and then repairing them to stop water, thereby enabling the PCVs to be filled with water after the construction of boundaries, has been identified as one of these technical challenges. To achieve this, the development of robots for remote inspection around the PCVs and for repairs, as well as the development of engineering and construction methods for repairing assumed leakage points to prevent water from escaping, etc. have been identified as among the research and development areas.

6. Situation regarding efforts to address lessons learned (28 items)

Japan is making its greatest possible efforts to address the 28 “lessons learned” indicated in the June report. The state of progress among these items is not uniform, with some items already having been fully implemented, others now in the process of being implemented, and still others that are to be newly planned in the future. Japan will prevent the recurrence of such an accident as this by addressing each item steadily and thoroughly based on the idea of “defense in depth,” which is the most important basic principle in securing nuclear safety. In addition, while the NISA has given directions of immediate emergency measures to operators since March 30 based on the findings about this accident as of the time point, it is contemplating that the contents which are supposed to respond to each of the lessons need to be further reviewed based on extensive knowledge in Japan and overseas from now on and be improved and reinforced.

Particularly, Japan aims to establish a new safety regulatory organization and system by establishing Nuclear Safety and Security Agency (tentative name) by around next April. As efforts to establish reinforced safety regulation under the new system and the concrete responses to these "lessons learned" are closely related, they are to be promoted through appropriate coordination.

Lessons in Category 1
Prevention of severe accidents

(1) Strengthen measures against earthquakes and tsunamis
The tsunami damage that caused the recent nuclear accident was brought about because of inadequate preparedness against large tsunamis, including the failure to adequately envisage the frequency of occurrence and the height of tsunamis. This has led preventive measures against tsunamis at nuclear power stations becoming one of the top priorities.

In terms of measures against earthquakes and tsunamis, as noted in this report, those mechanisms, etc. that caused the Tohoku District-Off the Pacific Ocean Earthquake and resulting tsunamis, triggering the Fukushima nuclear accident, are being studied in detail by such research institutes as the Japan Nuclear Energy Safety Organization (JNES). Such recent findings are expected to serve as a basis for future preventive measures against earthquakes and tsunamis at nuclear facilities.

In particular, measures against tsunamis are at the top of the agenda for Japan and on June 26, 2011 the Central Disaster Management Council set out a basic policy for future preventive measures against tsunamis, including those that assume the largest possible tsunami and the most frequent tsunami. The NSC has undertaken and is pursuing discussions on review of the NSC Regulatory Guides regarding earthquake and tsunami considering the Council's suggestions and the progress of discussions by Japan Society of Civil Engineers etc.

In this context, the Nuclear and Industrial Safety Agency (NISA) has undertaken discussions in terms of "defense in-depth," of a design basis that assumes adequate frequency of occurrence, with an adequate recurrence period taken into consideration, and height of tsunami; and of criteria for safety design of structures that allows for the impact force of tsunami waves, etc.

(2) Ensure power supplies

One of the significant factors of the accident was failure to ensure necessary power supplies. Therefore NISA has requested nuclear plant operators to ensure concrete power supplies, and the operators have already implemented the deployment of power-supply vehicles which supply the requisite power for emergency reactor cooling, the securing of emergency diesel generator capacity for a state of cold shutdown (sharing emergency power supplies with other units), countermeasures against flooding for important equipment within a reactor building (sealing of areas of penetration and doors, etc), and assessments of the degree of reliability of power grid.

Currently, nuclear plant operators are also taking measures such as the installation of large-sized air-cooled emergency diesel generators and air-cooled emergency gas turbine generators, measures to improve the reliability of power supply based on the outcome of the assessment of the reliability of the electrical systems (transmission line enforcement, etc.), tsunami protection measures for the switchyard, etc., countermeasures against collapses of transmission line towers and seismic reinforcement of switchyard equipment. In addition, the enhancement of battery capacity and seismic reinforcement of fuel tanks for emergency diesel have been planned as future efforts.

(3) Ensure reliable cooling function of reactors and PCVs

Since the loss of the cooling functions of the reactors and the PCV led to aggravation of the accident, as specific countermeasures, the plant operators, under instructions from NISA, deployed alternative/external water injection devices (pump tucks, fire engines, hoses, coupling parts, etc), ensured the capacity of freshwater tanks, and arranged feedwater lines that take water from the sea.

Currently, in order to bring the reactors to a state of cold shutdown as early as possible, the operators are procuring seawater cooling pumps, spare parts for motors, and temporary pumps which facilitate early restoration, as well as installing large-sized air-cooled emergency generators to drive seawater cooling systems. Also, as future efforts, they plan to make seismic reinforcements of large-sized freshwater tanks and other related efforts.

(4) Ensure reliable cooling functions of spent fuel pools

In the accident, the loss of power supplies led to failure of the cooling for the spent fuel pool. The operators, under instructions from NISA, in order to maintain cooling of the spent fuel pool even when power supplies had been lost, deployed alternative/external cooling water injection devices for the spent fuel pools (pump tucks, fire engines, hoses, coupling parts, etc.), ensured the capacity of freshwater tanks, and arranged feedwater lines that take water from the sea.

Beyond this, they plan to undertake seismic reinforcement of the cooling piping system for the spent fuel pool, etc. as future efforts.

(5) Thorough accident management (AM) measures

Since AM measures were found to be insufficient during the current accident, hereafter efforts shall be implemented to ensure thorough enhancement of AM measures.

The NSC has resumed discussions on upgrading the AM measures which had been discontinued due to the accident of this time. Also, NISA developed an operational safety program and expanded/clarified the interpretation of technical standards regarding emergency response procedures and so on which will enable the stable cooling of the reactor even should all AC power supply and all seawater cooling functions be lost. Hereafter, it plans to implement the work to seek to legislate AM measures based on the result of the examination undertaken by the NSC.

In addition, it plans to adopt a probabilistic safety assessment approach as it develops more effective AM measures.

(6) Responses to multi-unit site issues

The accident revealed issues in the area of responses to accidents at sites having multiple units, since the accidents occurred simultaneously in multiple reactors, and development of the accident at one reactor affected the emergency responses to the accident in neighboring reactors. Thus the plant operators, under instructions from NISA, developed for each reactor independent responsibility systems, systems for accident responses, and procedures.

Hereafter, the measure to ensure the engineering independence of each reactor at sites having more than one reactor are planned to be considered.

(7) Consideration of NPS arrangement in basic design

During the accident, response to the accident became difficult since the spent fuel storage pools were located at a higher part of the reactor building. In addition, situations arose in which contaminated water from the reactor buildings reached the turbine buildings, meaning that the spread of contaminated water to other buildings was not prevented. Accordingly, sufficient consideration of an adequate layout for the facilities and buildings of NPSs is required at the stage of basic design for new construction, and the embodiment of those considerations is being planned.

(8) Ensuring the water tightness of essential equipment and facilities

During the accident, a substantial amount of essential equipment and facilities were flooded due to the tsunamis, impeding the ability to ensure power supply and cooling water. Thus, ensuring the water tightness of essential equipment and facilities even in the case of a massive tsunami is important. The operators, under instructions from NISA, took countermeasures against flood damage to important equipment within the reactor buildings (sealing of penetrations, doors, etc). Currently, the operators are reinforcing the water tightness of the reactor buildings and installing watertight doors and so on.

Lesssons in Category 2

Countermeasures against severe accidents

(9) Enhancement of measures to prevent hydrogen explosions

During this accident, the accident was aggravated by hydrogen explosions. Therefore, enhancement of countermeasures against hydrogen explosions, including measures pertaining to reactor buildings, became an important issue.

For boiling water reactors (BWRs), the operators, under instructions from NISA, as countermeasures against hydrogen leakage into reactor buildings will install exhaust ports by making a hole in the roof of each reactor building, and conducts arrangements for implementing this work. Also, as mid- to long-term efforts, the installation of hydrogen vents atop reactor building and of hydrogen detectors in reactor buildings are planned.

For pressurized water reactors (PWRs), the operators, under instructions from NISA, confirmed that hydrogen leaked from a PCV into the annulus is reliably vented to the outside of the annulus by the already installed annulus exhaust system. Also, as mid- to long-term efforts into the future, the installation of equipment to decrease concentration of hydrogen in PCVs, including passive catalytic hydrogen recombiners requiring no power supply, is planned. For reactors with ice condenser type PCVs, it has been confirmed that hydrogen leaked into the PCV is reliably treated by the already installed igniters (hydrogen burning equipment). This includes confirmation of the operability of the igniter using a power supply from power-supply vehicles, should all AC power supplies be lost.

(10) Enhancement of the containment venting systems

In this accident, problems arose in the operability of the containment venting system for severe accident as well as its functioning in the removal of radioactive materials.

Under instructions from NISA, as initial measures, the plant operators installed standby accumulators for air valves, which enable operation of valves in vent lines even should AC power supplies be lost, as well as transportable compressors and other such equipment.

Also, in addition to these initial measures, further efforts in future will be made towards enhancing the PCV vent system by extensively considering technical expertise in Japan and overseas, including enhancement for the radioactive material removal function.

(11) Improvements to the accident response environment

At the time of this accident, as the radiation dose in the main control room increased, the situations that the operating staffs were unable to enter the main room temporarily, etc. posed problems for accident response activities in various situations.

Under instructions from NISA, the plant operators have taken steps to ensure on-site communication tools (a power supply for on-site PHS communication facilities, transceivers) a portable lighting system, and means of securing a work environment in the main control room (a power supply by power-supply vehicles to the ventilation and air conditioning systems), etc.

Also, along with implementing measures such as the transfer of on-site PHS facilities, etc. to higher ground, there are now plans to enhance functions at emergency stations, seismically reinforce office buildings, and so on.

(12) Enhancement of the radiation exposure management system at the time of the accident

In this accident, adequate radiation management became difficult as the radiation dose increased within the NPS due to the release of radioactive materials. Given this background, under instructions from NISA, the operators deployed the protective clothing against high radiation doses necessary for the early stages of an accident at NPSs, arranged mutual cooperation among operators for protective clothing against high radiation doses, personal dosimeters, full-face masks, and other such equipment, developed a system by which radiation control staff could focus on important operations to ensure radiation control in emergencies, improved employee training for radiation control in emergencies, and other such improvements.

(13) Enhancement of training for responding to severe accidents

Effective training for responding to severe accidents has not sufficiently implemented in the past. Moreover, in this accident, had training been implemented before the accident, more adequate actions could have been conducted.

Therefore, under instructions from NISA, in April the plant operators conducted emergency response training at NPSs witnessed by government staff to prepare workers for a loss of all AC power supplies, a loss of seawater cooling functions, tsunami strikes and other such emergent situations.

The government will also request the operators to implement nuclear emergency drills to prepare for the occurrence of severe accidents and their prolongation and escalation caused by primary coolant pipe breaks or other such accidents. Additionally, the government is also examining hands-on nuclear disaster prevention drills which simulate severe accidents that coincide with complex disasters as happened in this accident, and plans to engage in support and cooperation such as necessary advice for the drills performed by local authorities.

(14) Enhancement of instrumentation for reactors and PCVs

In this accident, under the severe accident conditions, the instrumentation of the reactors and PCVs failed to function sufficiently, and it was difficult to adequately obtain information on the water levels in the reactors and other information that was necessary for responding to the accident.

Consequently plans are being made for the development and preparation of instrumentation of reactors, PCVs, spent fuel pools, etc. to enable adequate functioning even under severe accident conditions.

(15) Central control of emergency supplies and setting up of rescue teams

Shortly after the accident, under the damage conditions caused by the earthquake and tsunamis, the securing of emergency response equipment and the mobilization of rescue teams to support accident control activities were not performed sufficiently.

Therefore, under instructions from NISA, the plant operators have been engaged in the establishment and management of emergency response equipment (power-supply vehicles, pump trucks) and the creation of implementation forces to operate such equipment. They are also arranging and then preparing for common use among plant operators of masks, protective clothing, and the like to provide protection during work with heavy machinery to dispose of rubble or work having high radiation doses, and otherwise developing systems for mutual cooperation.

Plans are also being made for the preparation of emergency response equipment, including robots, unmanned helicopter drones, heavy machinery, decontamination equipment and accident progression prediction systems, as well as for the enhancement of capacity building through training of Self-Defense Forces, police, firefighters, the Japan Coast Guard, and other key personnel.

Additionally, under the new safety regulatory organization, the system for responding to crisis management will be enhanced through the establishment of staff specializing in responding to emergency conditions.

Lessons in Category 3

Responses to nuclear emergencies

(16) Response to a combined situation of massive natural disaster and nuclear emergency

This time a massive natural disaster was followed by a nuclear accident to produce a complex disaster. Also, the prolonged nuclear accident caused difficulties in securing means of communication and of procurement as well as in the mobilization of the full range of support personnel for the accident and disaster response.

Therefore, off-site centers have been reinforced by deploying satellite phones, emergency power supplies and reserves of goods. Deploying alternative materials and equipment is also planned so that alternative facilities may be utilized immediately even if the situation necessitates relocating the function of an off-site center. Moreover, regarding the response to a complex disaster, a review of the full readiness and chain-of-command structure will be made across ministries and agencies.

(17) Reinforcement of environmental monitoring

During the initial stages of this accident, appropriate environmental monitoring became impossible due to damage to local authorities' monitoring equipment and facilities caused by the earthquake and tsunami.

The "Monitoring Coordination Meeting" has therefore been established within the government for the coordination of, and smooth implementation of, environmental monitoring conducted by ministries and agencies, local authorities and TEPCO. The "Comprehensive Monitoring Plan" was developed as an initiative for the immediate future. Based on this Plan, related organizations are engaged in partnership in monitoring by aircraft, monitoring of sea areas and radiation monitoring with a view to facilitating the lifting of restrictions on Emergency Evacuation-Prepared Areas, among other endeavors, and preparation of cumulative dose estimation maps and maps indicating the distribution of radiation doses, etc. Also, in an emergency, the government will take responsibility for establishing the system of performing environmental monitoring surely and deliberately, and it will have the new safety regulation organization play a commanding role in environmental monitoring.

(18) Clarification of the allotment of roles between central and local organizations

In the initial stages of the accident, communication and cooperation between the central and local governments as well as between various relevant organizations were not achieved to a sufficient degree, due to the difficulty in securing means of communication and also due to the fact that the roles and responsibilities of each side were not always clearly defined.

Therefore in responding to the current accident, local bases to respond to the accident were established by utilizing J Village and the Onahama Coal Center. Central organizations to coordinate response activities were also established, including the Government-TEPCO Integrated Response Office, the sufferers' livelihood support team and the Office of Response to Radioactive Materials Contamination.

Hereafter, roles and responsibilities of relevant organizations including the GNER HQ will be reviewed to enable prompt and appropriate responses, and measures will be taken to amend Acts and revise manuals when necessary. Also, communication systems, including communication tools and channels, will be reviewed in order to enable the delivery of information quickly and with certainty. Furthermore, as for the video conference system used at the time of nuclear disaster, it is planned to interconnect relevant governmental organizations, all electric power companies and NPSs to ensure quick and adequate instruction and information collection in emergency situations.

(19) Enhancement of communication regarding the accident

Especially immediately after this accident, actions were not sufficiently taken to provide local residents with information or easily-understood explanations about radiation, radioactive materials, or information on future outlooks on risk factors.

Therefore, a "one-stop counseling service"was established to provide consultation services to local residents, especially residents of Fukushima Prefecture, on the situation regarding the accident, radiation's impact on health and other matters. Also, as for the disclosure of information to the citizens, jointly-held regular press conferences and other opportunities have been conducted by relevant organizations such as NISA and the NSC.

Based on the disclosure of information regarding the Fukushima NPS accident and on the experience of communicating in the contexts of various domestic and foreign disasters as well, it is planned to examine ways of disclosing and providing information during significant NPS accidents, to develop a basic manual, and to provide education and training on that basis to relevant organizations regarding information disclosure and provision.

(20) Enhancement of responses to assistance from other countries and communication to the international community

After the accident, the government could not promptly respond to offers of assistance from other countries around the world (e.g., offers to supply equipment). Initially information was not always fully shared in advance especially with neighboring countries.

In light of this, in order to immediately notify neighboring countries in the case of an accident, contact points for each neighboring country have been specified. The list of contact points will be updated, as appropriate, to ensure the quick and accurate provision of information to the international community.

The system for international responses to an accident will be improved as part of implementing the IAEA Action Plan on Nuclear Safety, including the development of lists of equipment effective for accident responses and methods for international information sharing, including through international notifications. Japan will actively contribute to such international efforts.

(21) Accurate understanding and prediction of the effect of released radioactive materials

In this accident, the use of the System for Prediction of Environmental Emergency Dose Information (SPEEDI) and disclosure of its calculation results, etc. were not properly conducted.

Against this background, since April the government has been disclosing the calculation results of SPEEDI. Since June, the government has also been using SPEEDI for environmental impact assessment after opening the reactor buildings of the Fukushima Dai-ichi NPS as well as for estimating external radiation exposure to residents to supplement the monitoring data that were not sufficiently collected during the early stages of the accident. The results of such evaluations have been disclosed without delay.

In future, the new safety regulation organization will serve as a control center for environmental monitoring, including the operation of SPEEDI, and more effective ways of utilizing SPEEDI will be considered in that context.

(22) Clear definition of the criteria for wide-area evacuations and radiological protection standards in nuclear emergencies

Criteria for specific nuclear emergency response actions, etc. were not well prepared before the accident, especially for wide-area evacuation and radiological protection associated with a prolonged accident.

Moreover, relevant organizations will promote examination the standard of radiological protection, etc. on the basis of this accident. Moreover, the NSC started reviewing "The Regulatory Guide for Emergency Preparedness of Nuclear Facilities", including the definition of the Emergency Planning Zone (EPZ).

Japan will make efforts to reflect the Fukushima experience of accident responses within the review of the standards of International Commission on Radiological Protection (ICRP) and the IAEA standards for nuclear emergency preparedness and radiological protection.

Lessons in Category 4

Enhancement of safety infrastructure

(23) Enhancement of safety regulatory and administrative systems

Due to the unification of administrative organizations over the utilization and regulation of nuclear power and the non-centralized administrative organizations for ensuring nuclear safety, it was unclear until recently which organization has primary responsibility for disaster prevention and the protection of public safety. Reviews of such bodies and the enhancement of nuclear regulatory bodies need to be done promptly.

Therefore, the Japanese Government decided on the "Basic Concept of Structural Reform of Nuclear Safety Regulations" at the Cabinet Meeting of August 15 this year and decided on the launch of a new safety regulatory body. Specifically, considering international discussions in the past, and on the basis of the principle of "separating regulation from utilization," the nuclear safety regulatory divisions of NISA will be separated from the Ministry of Economy, Trade and Industry, with "Nuclear Safety and

Security Agency (tentative name)" aimed to be established by April 2012 as an external agency of the Ministry of Environment by integrating into it the functions of the NSC. For this purpose, the capabilities of this regulatory body will be enhanced by centralizing nuclear safety regulatory activities, a dedicated risk management division will be established to enable this Nuclear Safety and Security Agency to take quick initial responses, and efforts will be made to recruit highly qualified personnel from both the public and private sectors to adequately execute the regulatory activities. In addition, a "Task Force for the Reform of Nuclear Safety Regulations and Organizations" was established on August 26 for the preparation of the bill necessary to establish the new organization.

(24) Establishment and reinforcement of legal frameworks, standards and guidelines

The accident raised a wide range of issues regarding the establishment of legal frameworks and related standards and guidelines regarding nuclear safety and nuclear emergency preparedness. There will also be many issues that should be reflected within the IAEA's standards and guidelines in light of the experiences of the accident.

Reflecting this, a revision of the legal framework, standards, and so on with regard to nuclear safety and nuclear emergency preparedness is scheduled, based on knowledge learned from the accident, including the introduction of a new safety regulatory framework (e.g., backfitting), the enhancement of safety standards and the streamlining of complicated nuclear safety regulatory and legislative systems. Furthermore, a detailed evaluation of the basic designs of nuclear reactors, etc. and review of the relationship between reactor types and the causes of the accident will be carried out, and the safety and reliability of existing reactors will be evaluated on the basis of technological progress in nuclear reactor design and comparisons with the latest technologies.

Furthermore, the Japanese Government will actively provide its experience and knowledge from the accident to contribute to a review of the IAEA's standards and guidelines.

(25) Human resources for nuclear safety and nuclear emergency preparedness and responses

The accident re-emphasized the vital importance of developing human resources in the fields of nuclear safety and nuclear emergency preparedness in order to respond to an accident similar to the Fukushima accident.

Therefore, the new safety regulatory body will have among its basic policies securing personnel who are highly qualified with regard to regulatory matters through reinforced training. This body will also deliberate the establishment of an International Nuclear Safety Training Institute (tentative name), as a research institute that will seek to improve the quality of its human resources and engage in international cooperation. Also, through further promoting activities of "Japan Nuclear Human Resource Development Network" established in cooperation among industry-academic-government related organizations, , etc., this body will work to advance the reinforcement of human resources development in such fields such as nuclear safety, nuclear emergency preparedness, risk management and radiation medicine.

(26) Ensuring the independence and diversity of safety systems

With regards to ensuring the reliability of safety systems, insufficient consideration was given to approaches that would avoid multiple malfunctions all having a common cause in having been triggered by the earthquake and tsunamis, etc. Furthermore, independence and diversity were not achieved to a sufficient degree.

In response to this situation, there are plans to respond appropriately to multiple malfunctions having a common cause, to attain further enhancement of the reliability of safety functions such as in ensuring the independence and diversity of types, storing locations, and other aspects of emergency power generators and seawater cooling systems and to strengthen ensuring the independence and diversity of safety systems.

(27) Effective use of probabilistic safety assessment (PSA) in risk management

PSA has not always been effectively utilized in the overall reviewing risk reduction efforts at nuclear power facilities.

Therefore, NISA and the Japan Nuclear Energy Safety Organization (JNES) are now engaged in deliberations of revisions to legislation and standards, etc., on the premise of the utilization of PSA. Also, regarding the Tsunami PSA, the Japan Atomic Energy Society is preparing to make a guideline.

In addition, there are now plans to formulate improvements to safety measures, including effective accident management measures, based on PSA.

Lessons in Category 5
Thoroughly instill a safety culture

(28) Thoroughly instill a safety culture

Thoroughness in safety culture, which is the foundation of nuclear safety, has been strongly recognized anew through this accident.
Because of this, various responses to this accident will be reviewed carefully and Japan is working to rebuild the attitude in which both nuclear plant operators and individuals involved in safety regulation sincerely pursue new knowledge, both as organizations and individuals.

For those engaged in nuclear safety, it is a starting point, an obligation, and a responsibility for each organization and individual to firmly acquire a culture of nuclear safety. The fact that continuous improvement in nuclear safety is impossible when a safety culture is lacking, is being positioned as the starting point for Japan's ensuring safety in the future. This will be confirmed anew in various forms and will be brought into being.

7. Situation on deliberation to enhance standards etc

The NSC has been presenting various advice and basic policies based on the views indicated by the IAEA and the ICRP. Specifically, "Near-term policy to ensure the safety for treating and disposing contaminated waste around the site of Fukushima Dai-ichi Nuclear Power Station of Tokyo Electric Power Company", "Basic Policy of the Nuclear Safety Commission of Japan on Radiation Protection for Termination of Evacuation and Reconstruction", "Basic Policy on Radiation Monitoring from Now on", and "Standpoint of the Nuclear Safety Commission for the Termination of Urgent Protective Actions implemented for the Accident at Fukushima Dai-ichi Nuclear Power Plant" , etc. have been presented as basic policies and directions related to radiation protection measures to restore from the accident and to facilitate subsequent reconstruction.

In light of the recent accident at the Fukushima Dai-ichi NPS, the NSC has also started reviewing the NSC Regulatory Guides, such as the "Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities" and

"Regulatory Guide for Emergency Preparedness of Nuclear Facilities", and has furthermore resumed to enhance severe accident countermeasures.

The Nuclear and Industrial Safety Agency (NISA) has started deliberating a review of safety standards and other matters. Also, NISA and the Japan Nuclear Energy Safety Organization (JNES) have started analyzing the 28 lessons learned through the June report, have proposed a review of the Guide for Seismic Design of Nuclear Facilities (NS-G-1.6) and Siting Guidelines (DS433) by the IAEA, etc., and also have worked to organize a Safety Report and Technical Document having concrete cases to which those guidelines were applied, etc. with the cooperation of the International Seismic Safety Center of the IAEA.

8. Further Safety Assessment Efforts for NPSs

On July 11, 2011, aiming to further improve safety at NPSs and ensure security and confidence of the public and local residents in terms of nuclear safety, the Japanese government decided to implement safety assessments based on new procedures and rules, basically by making use of international knowledge and experiences of stress tests, particularly those implemented in European countries.

More specifically, those NPSs that have undergone regular inspection and are prepared to start up will sequentially undergo safety assessments in terms of the degree to which safety margins are secured against beyond-design-basis events for facilities and equipment important to safety (preliminary assessments). In addition, all existing nuclear power stations including those in operation and those examined through this preliminary assessment will also undergo comprehensive assessments (secondary assessments), in consideration of the implementation of stress tests in Europe and the progress of the discussions by the Investigation Committee on the Accident at the Fukushima Nuclear Power Stations.

9. Conclusion

Approximately half a year has passed since the accident occurred at the Tokyo Electric Power Co. (TEPCO) Fukushima Nuclear Power Station. This nuclear accident caused by an earthquake and tsunamis is a massive accident unprecedented in Japan or abroad insofar as severe accidents occurred simultaneously at multiple units, that the accident has affected an extensive range in its surrounding area, and that it has been taking a long time to achieve restoration from the accident.

In Japan, related organizations such as the plant operator, the central government and local authorities, including the workers on the site, have been tackling this accident together. While progress has steadily been made with regard to restoration from the accident, such as stable cooling of the reactors and the spent fuel pools, it is far from easy to complete the restoration from the accident, dispose of the radioactive materials and the spent fuel thereafter and proceed with decommissioning of the nuclear reactors. Also, it is necessary to advance the efforts while listening carefully to the voices of the local people when responding to those who suffered as a result of the nuclear accident, including such responses as environmental monitoring and decontamination.

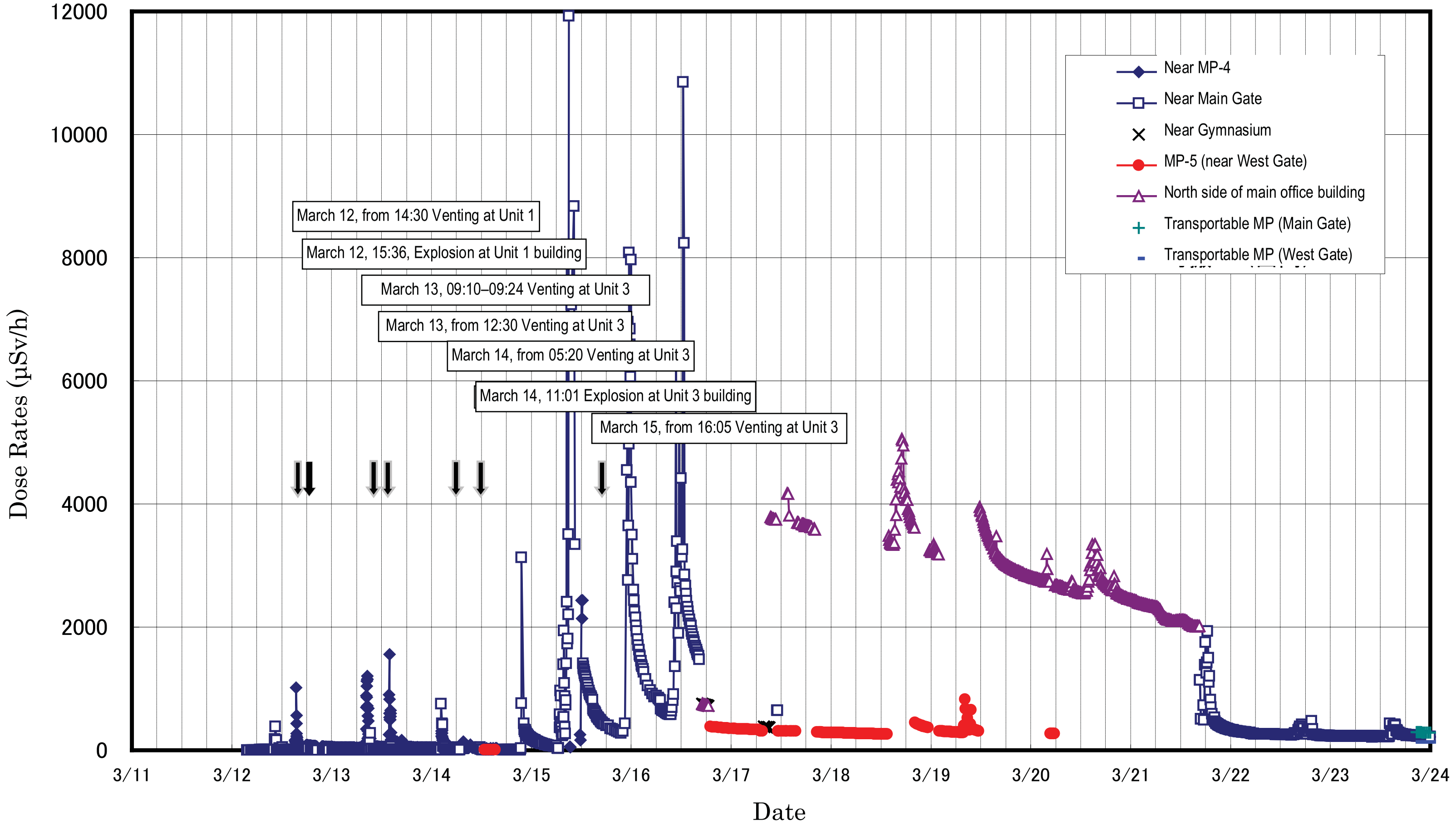
In this second report, the responses taken immediately after the occurrence of the accident at the Fukushima NPS and elsewhere have also been described in greater details. Moreover, it has described a situation in which the station employees and workers at the site, as well as personnel in related organizations, have been working hard in a severe environment that includes damage by an earthquake and by tsunamis, the impact of rubble, and the impact of debris scattered as a result of the hydrogen explosions. The Government of Japan is determined to continue its utmost efforts to support the health management and other aspects of the people engaged in this work.

Japan has received a wide array of support from countries around the world, related international organizations, and others to date. Japan would like to express its deepest gratitude once more while also requesting continued support.

Japan is confident that it will overcome this accident without fail by mobilizing wisdom and efforts from around the world.

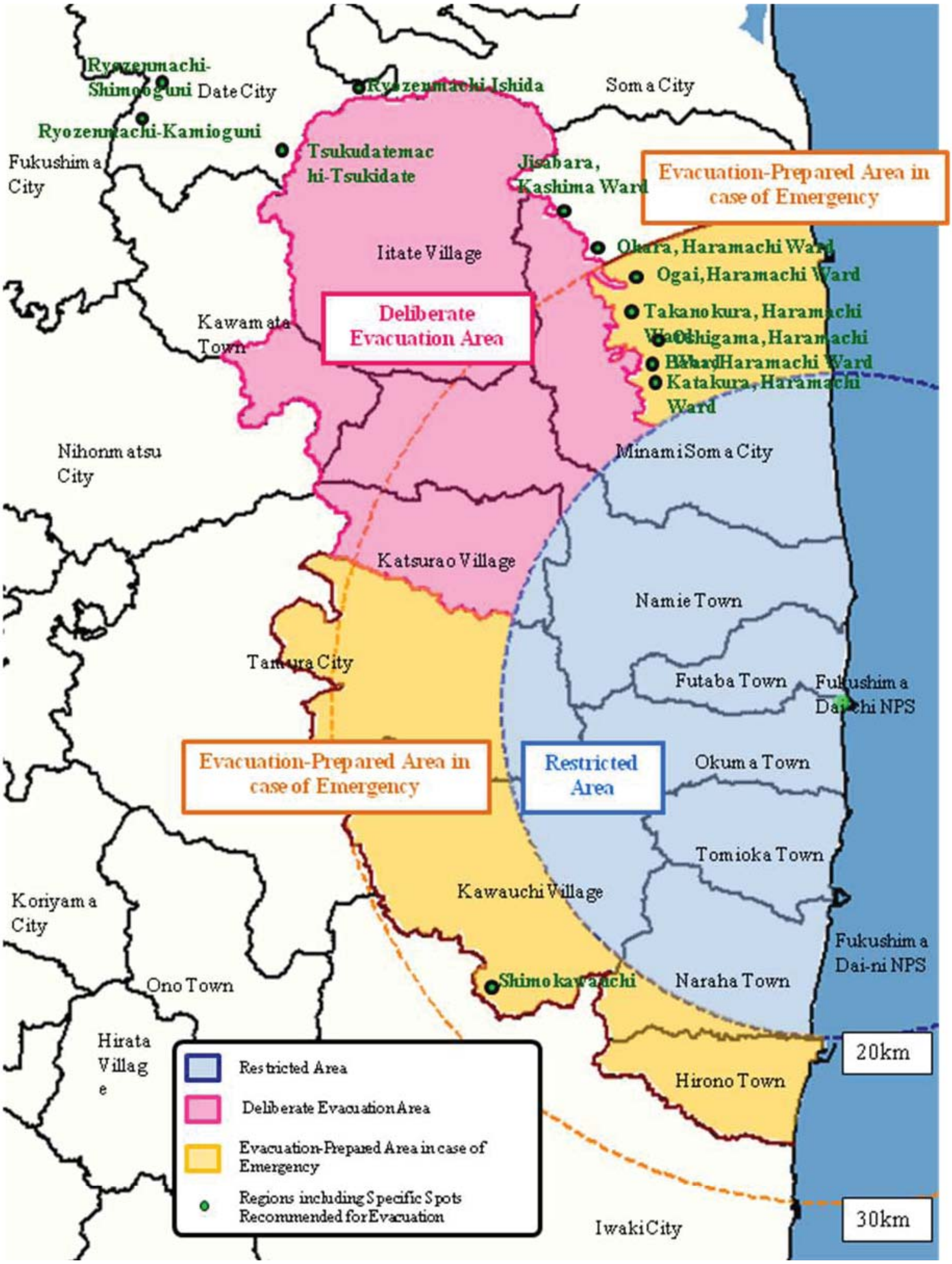
Location of NPSs affected by the Tohoku District - off the Pacific Ocean Earthquake

Changes in Dose Rates at Fukushima Dai-ichi (Monitoring Car)

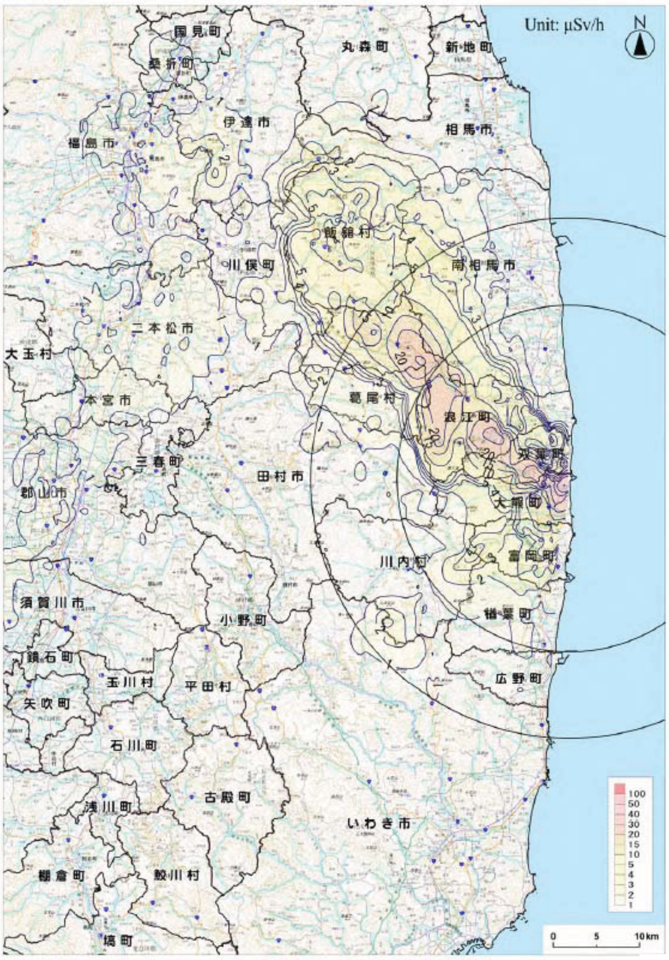


Measurement Results of Dose Rates by Monitoring Car at Fukushima Dai-ichi NPS

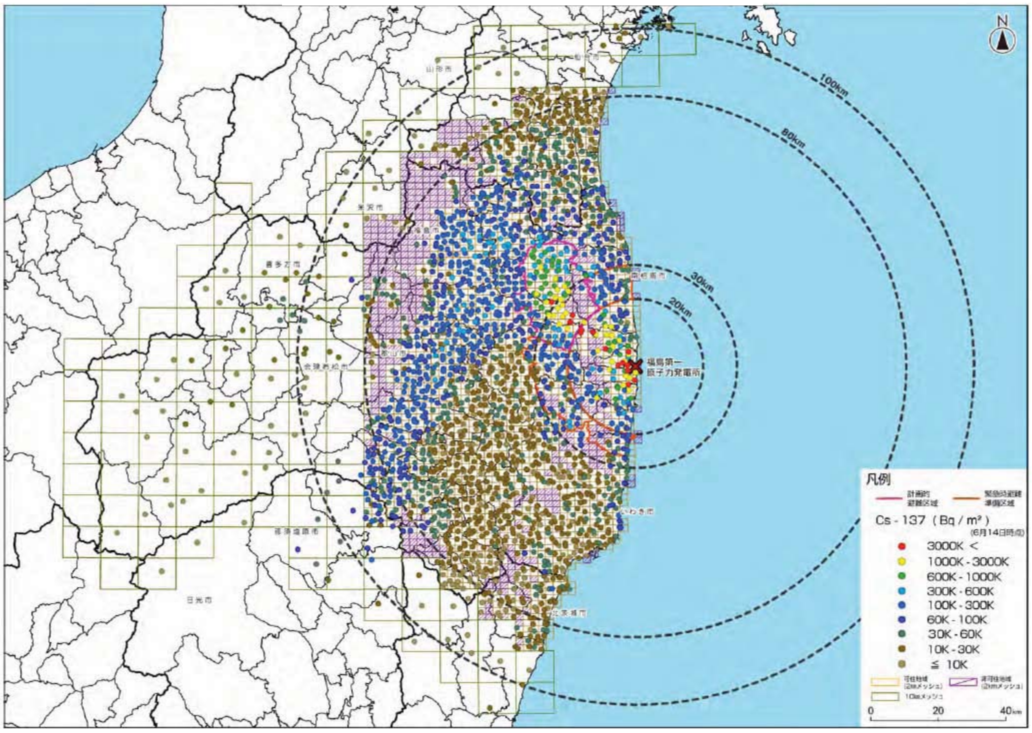
Resricted Area, Deliberate Evacuation Area, Evacuation-Prepared Area in case of Emergency And Evacuation Recommendation Spots (As of August 3, 2011)



Air Dose Rate Map
(As of August 11, 2011)



Soil Concentration Map of Cs-137



Status of Units 1, 2 and 3 of Fukushima Dai-ichi NPS
(As of August 27)

Unit	Unit 1	Unit 2	Unit 3
Status of water injection to the reactor	Fresh water feeding by feed water system Flow rate: 3.7m³/h	Fresh water feeding by feed water system Flow rate: 3.6m³/h	Fresh water feeding by feed water system Flow rate: 7.0m³/h
Reactor Water Level	Fuel range A: Downscale Fuel range B: -1,700mm	Fuel range A: -1,850mm* Fuel range B: -2,200mm*	Fuel range A: -1,550mm* Fuel range B: -2,000mm*
Reactor Pressure	0.017 MPa g(A) - MPa g(B)	0.013 MPa g(A) - MPa g(B)	0.080 MPa g(A) 0.001 MPa g(B)
Temperature around the reactor vessel	Temperature in feed-water nozzle: 92.2 ºC Temperature at reactor vessel bottom: 87.7 ºC	Temperature in feed-water nozzle: 106.9 ºC Temperature at reactor vessel bottom: 115.0 ºC	Temperature in feed-water nozzle: 113.9 ºC Temperature at reactor vessel bottom: 108.8 ºC
Pressure in D/W, S/C	D/W: 0.1275 MPa abs S/C: 0.105 MPa abs	D/W: 0.114 MPa abs S/C: Downscale	D/W: 0.1015 MPa abs S/C: 0.1817 MPa abs
Status	Each plant receives electricity from external power supplies. The process is carried on ensuring reliability of cooling function by installing temporary emergency diesel generators and the seawater pump etc.		

*These data may be modified when TEPCO makes evaluates them.

Appendix 1

October 17, 2011
Nuclear Emergency Response Headquarters
Government-TEPCO Integrated Response Office

Summary of Progress Status of "Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station, TEPCO"

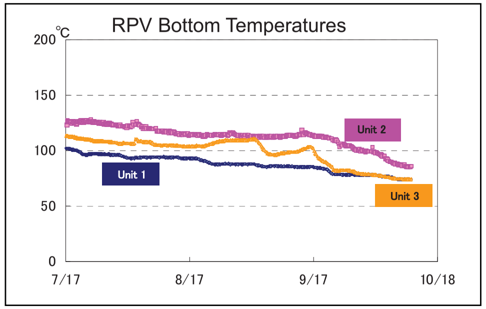
1. Basic policy (no change)

By bringing the reactors and the spent fuel pools to a stable cooling condition and mitigating the release of radioactive materials, we will make every effort to enable evacuees to return to their homes and for all citizens to be able to secure a sound life.

2. Targets and achievement date, etc.

[Step 2: Release of radioactive materials is under control and radiation dose is being significantly held down]

- Aim to achieve within the year. As for [Issue (2) Spent fuel pools], [Issue (3) Accumulated water] and [Issue (7) Tsunami, Reinforcement, etc.], the Step 2 targets have already been achieved.
- The total volume of accumulated water is kept to a level that is able to withstand heavy rains and long-term processing facility outages, and the circulating water cooling is ongoing towards achieving "cold shutdown condition."
- RPV bottom temperature was 74 ℃ for Unit 1, 83 ℃ for Unit 2 and 73 ℃ for Unit 3 (as of Oct. 15), having reached below 100 ℃.
- The current release rate of radioactive materials from the PCVs is estimated to be approx. 0.1 billion Bq/h (provisional figure.) The radiation exposure at the site boundaries due to this release is assessed at 0.2 mSv / year at the maximum (provisional figure.)
- Ensure a "cold shutdown condition" by carefully assessing the RPV bottom temperatures, current release rate of radioactive materials from PCVs together with the radiation exposure due to this release and the securement of the mid-term safety of the circulating cooling system.
- Hereafter, the start of the water shielding wall construction and the completion of the Unit 1 reactor building cover are scheduled.



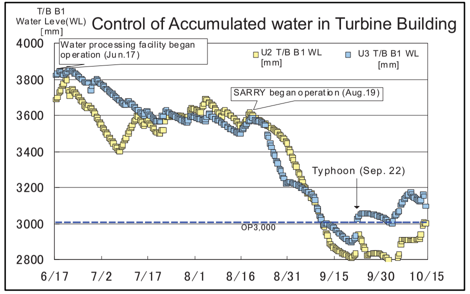
3. Summary of the past one month and future plans (major changes)

[Issue (1) Reactors]: Water injection towards achieving "a cold shutdown condition"

- The RPV bottom temperatures of Units 1 and 3 have stabilized below 100 ℃. By changing the water injection volume on a trial basis, it has been verified that Unit 2's RPV bottom temperature can stabilize below 100 ℃. *Injecting water via Feed Water line and Core Spray line
- Currently, water injection towards achieving cold shutdown is being implemented at the volume of approx.3.7m^3/h for Unit 1, approx. 10.4m^3/h for Unit 2*, approx. 10.2m^3/h for Unit 3*(as of Oct.15).

[Issue (3) Accumulated water]: Processing accumulated water at a level where it is able to withstand heavy rains as well as long-term facility outages

- Approx. 128,140 tons have been processed in total (as of Oct. 13). The accumulated water level is being kept at the present target level of O.P 3,000.
- The desalination processing facility utilizing the evaporation concentration apparatus has been reinforced (Oct. 9), that will enable more stable water injection into the reactors.



[Issue (4) Groundwater]: Beginning soon construction work of the water shielding wall

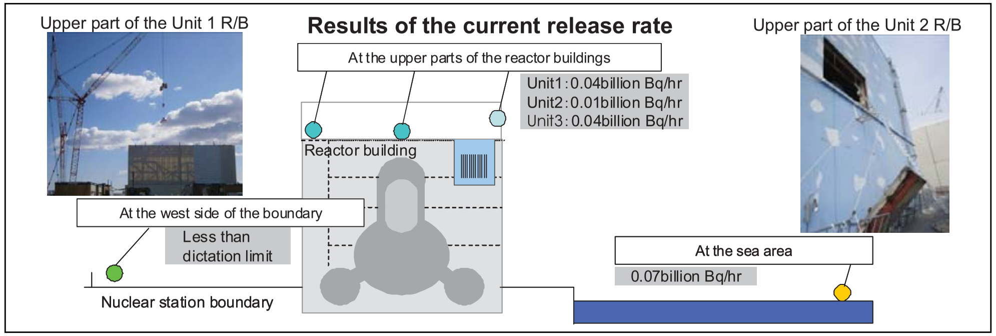
- Basic design of the water shielding wall has been completed (Aug.31) Construction work will begin from around the end of October.

[Issue (5) Atmosphere/Soil]: Completing soon the Unit 1 reactor building cover

- The Unit 1 reactor building cover will be completed by around the end of October.
- Following the Unit 3 (Sep.10), debris removal at the upper part of the Unit 4 reactor building has begun (Sep.21).
- Installation work of the PCV gas control system has begun (Unit 1-Oct. 7, Unit 2-Oct. 10, Unit 3-Sep. 30.)

[Issue (6) Measurement, Reduction and Disclosure]: Estimated the amount of radioactive materials currently released from the PCVs

- Comprehensively estimate the current release rate from the PCVs of Units 1-3 based on the airborne radioactivity concentration (dust concentration) at the upper parts of the reactor buildings and in surrounding area (land and sea).
  - ・The current total release rate from Units 1-3 based on the assessment this time is estimated at approx. 0.1 billion Bq/h at the maximum (provisional figure), which is 1/8,000,000 of that at the time of the accident.
  - ・The radiation exposure per year at the site boundaries is assessed at approx. 0.2 mSv / year at the maximum (provisional figure) based on the aforementioned release rate (The target is 1 mSv / year. Excluding the effect of the radioactive materials already released until now).



- Continuously implement the measurements of airborne radioactivity concentration at the upper parts of the reactor buildings and in the surrounding area (land and sea), thus grasping the reduction tendency of the release rate due to the mitigation countermeasures.
- A decontamination model project focused on the Deliberate Evacuation Area and the Restricted Area is being prepared in a rapid manner. Currently, pre-monitoring is being implemented at a part of the area.

[Issue (9) Radiation control/medical care]: Improved Health Care for workers

- Internal exposures are being measured once a month with the expansion of the Whole Body Counters (twelve units in total).
- Ordinance on Prevention of Ionizing Radiation Hazards has been amended, requiring Utilities to report records of exposure dose for long-term health care. The guideline stating the implementation of the inspection according to the exposure amount has been released (Oct. 11).

[Action plan for mid-term issues] Released "Policy on the mid and long term security"

- NISA released "Policy on the mid and long term security" (Oct. 3).
- The Utility reported on the operating plan as well as safety assessment regarding the circulating water cooling system (Oct. 17). Other systems, etc. shall be reported on as well in a rapid manner.

Appendix 2

“Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station, TEPCO”

October 17th, 2011
Nuclear Emergency Response Headquarters
Government-TEPCO Integrated Response Office

I. Cooling

(1) Reactor

1. Target for Step 2 “Cold Shutdown Condition”

- Circulating water cooling will be continued and enforced, thus bringing the reactors to a “Cold Shutdown Condition” monitoring the RPV temperatures, etc.
- Maintain stable operation of accumulated water processing facility. (Implementation items are stated in II. (3))
- NISA to continue confirming operating status and related matters.

Definition of “Cold Shutdown Condition”

- Temperature of RPV bottom is, in general, below 100℃.
- Release of radioactive materials from PCV is under control and public radiation exposure by additional release is being significantly held down. (Not exceed 1 mSv/y at the site boundary as a target.)

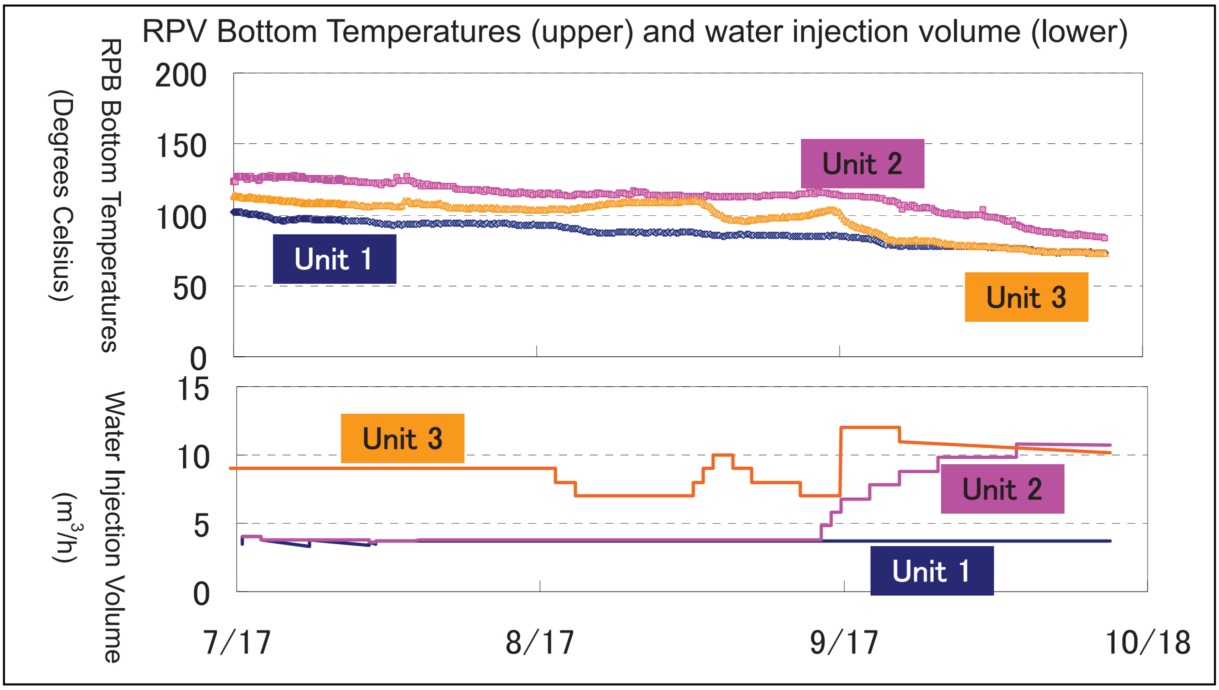
In order to keep satisfying the above two conditions, secure mid-term safety of the circulating water cooling system (reliability of parts and materials, redundancy and independency, assessment of slack time for emergency, detection of failure and trouble, confirmation of restoration measures and recovery time, etc.)

2. Current status and work implemented

① Additional water injection line for more effective cooling [Countermeasures 12, 14, 45]

- RPV bottom temperatures was 74℃ in Unit 1, 83℃ in Unit 2 and 73℃ in Unit 3 (as of Oct.15.) RPV bottom temperatures in Units 1 and 3 have stabilized below 100℃. By changing the water injection volume on a trial basis, it has been verified that Unit 2’s RPV bottom temperature can stabilize below 100℃.
- Currently, water injection towards achieving cold shutdown is being implemented at the volume of approx. 3.7 m^3/h for Unit 1, approx. 10.4 m^3/h for Unit 2* and approx. 10.2 m^3/h for Unit 3* (as of Oct. 15.)

*Injecting water via Feed Water line and Core Spray line


RPV Bottom Temperatures (upper) and water injection volume (lower)

② Installation of centralized monitoring system in the Main Anti-Earthquake Building [Countermeasures 12,14,45]

- Installed a system that enables the monitoring of various parameters such as the water injection volume, injection pressure, buffer tank water level, operation status of accumulated water treatment system, etc., from monitors installed in the Main Anti-Earthquake Building (Sep. 30.)
- That enables monitoring at the place with minimum radiation exposure in the Main Anti-Earthquake Building.
- Also, the condition which enables accurate and prompt comprehension of the operation status of equipments was established.

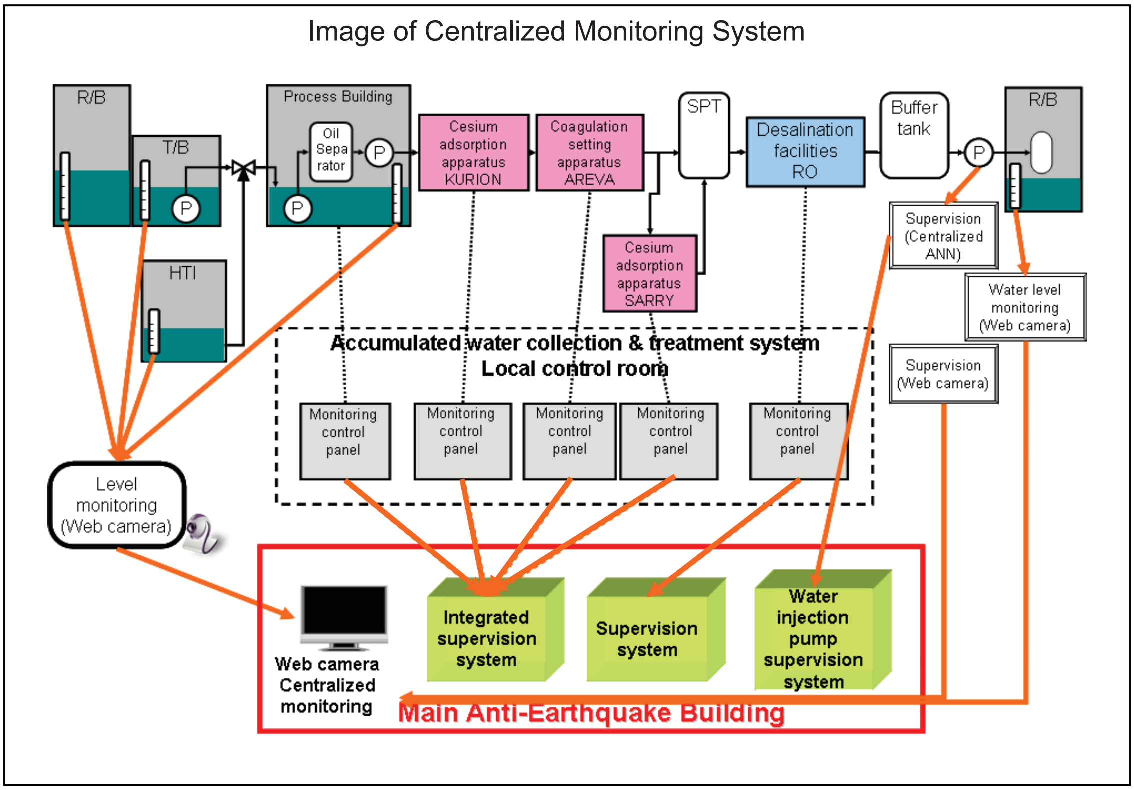
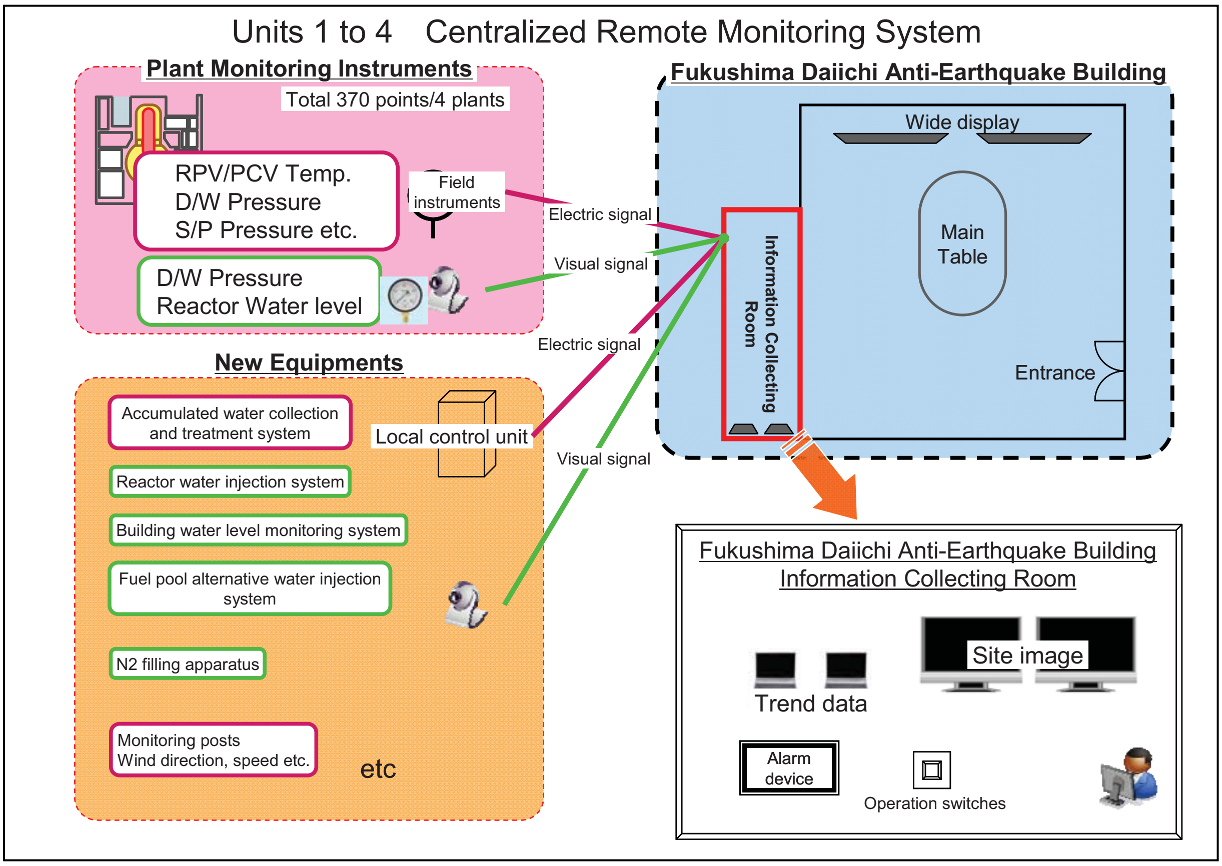


Image of Centralized Monitoring System



R/B: Reactor Building, T/B: Turbine Building, HTI: High Temperature Incinerator building, RO: Reverse Osmosis membrane, ANN: Annunciator, RPV: Reactor Pressure Vessel, PCV: Primary Containment Vessel, D/W: Dry-well, S/P: Suppression Pool

(2) Spent Fuel Pool

1. Target for Step 2 “More stable cooling”

- “More stable cooling” (target for Step 2) for Units 2 and 3 was achieved by the end of Step 1 by having installed heat exchangers and maintaining pool water level.
- Circulating cooling systems for Units 1 and 4 have been installed, thus the target for Step 2 has been achieved in all Units. (Aug. 10.)

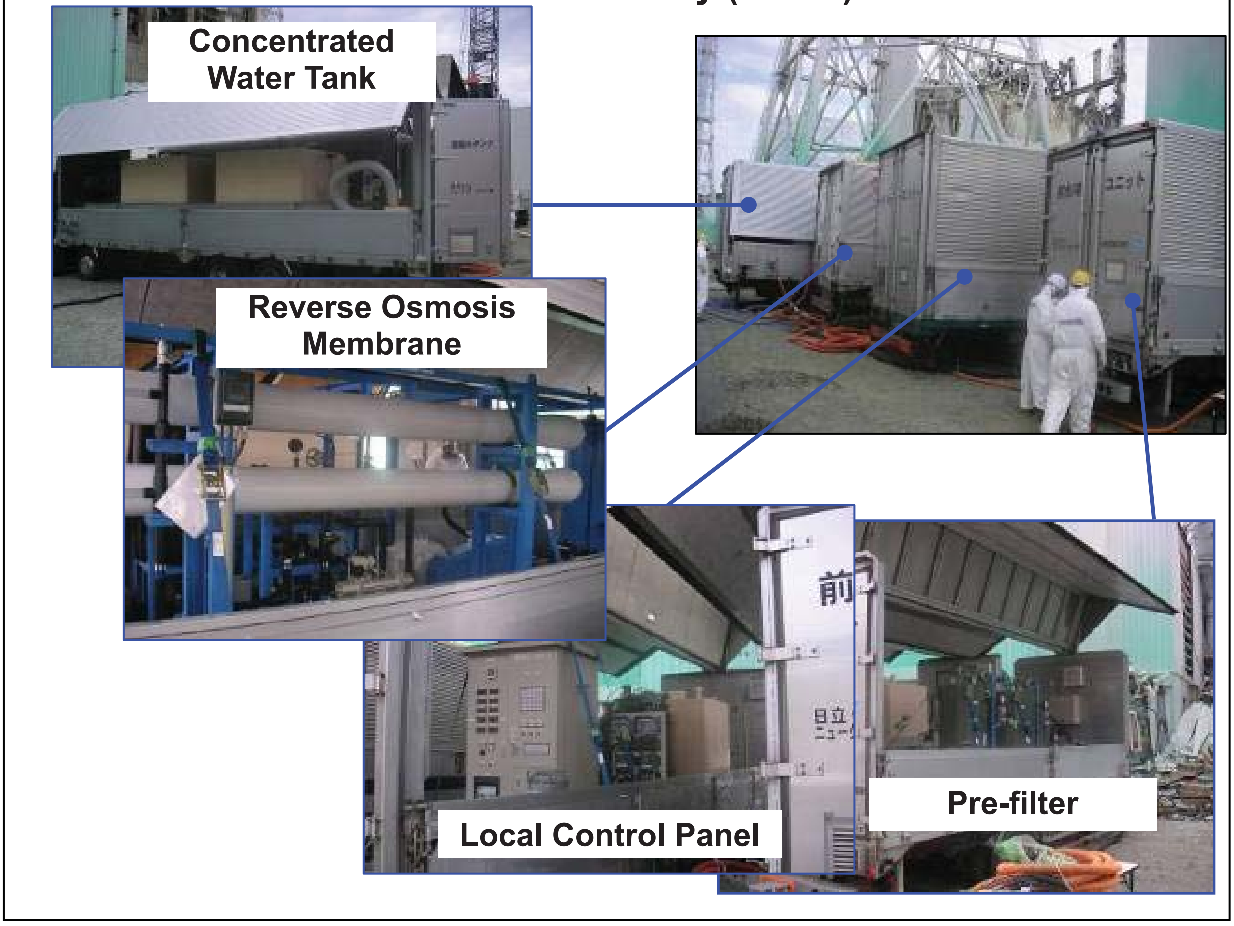
2. Current status and work implemented

① Current status of Spent Fuel Pool

- Unit 1: 25℃, Unit 2: 27℃, Unit 3: 27℃ and Unit 4: 35℃ (as of Oct. 15)

② Operation of Unit 4 desalination facility (Aug. 20) [Countermeasures 25, 27]

- In order to prevent corrosion of the spent fuel pool, the desalination facility has begun operation (Aug. 20.)
- The salt concentration of water (chloride ion concentration) in the spent fuel pool before the operation of the desalination facility was 1,944 ppm (Aug. 20), while its concentration after the operation was 410 ppm (Sep. 28.)
- The desalination for Units 2 and 3, in which sea water injections were carried out, are planned to be implemented in turn.


Desalination Facility (Unit 4)

II. Mitigation

(3) Accumulated Water

1. Target for Step 2 “Reducing the total amount of accumulated water”

- Reduction of the total amount of accumulated water by processing the accumulated water in the buildings via the stable operation of processing facility.
- Augmentation of reuse by expansion of high-level contaminated water processing facility, steady operation and desalination of decontaminated water.
- Begin consideration of full-scale water processing facilities for high-level contaminated water.
- Storage/management of sludge waste generated from high-level contaminated water processing facility.
- Implement steel pipe sheet pile installation work at the port to mitigate contamination in the ocean.

2. Current status and work implemented

① Status of the accumulated water processing

- Regarding accumulated water processing performance, approx.128,140 tons have been processed in total（as of Oct. 13.）
- The accumulated water level is being kept at the present target level（O.P 3,000.）In other words, the total amount of accumulated water is at the level where it is able to withstand heavy rains as well as long-term processing facility outages.
- Decontamination factor* of the processing facility for cesium is 10^6 in the apparatus of Kurion-Areva (as of Aug.9), 10^4 in Kurion（as of Sep.26）and 10^6 in SARRY (as of Sep 26.）*Decontamination factor＝cesium concentration of a sample before processing / cesium concentration of a sample after processing

② Implemented reliability enhancement countermeasures towards stable processing [Countermeasure 43]

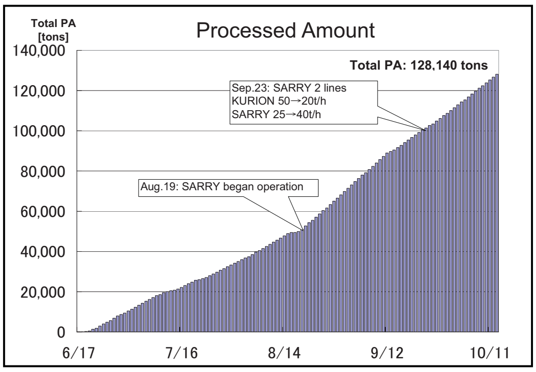
- Installed cesium adsorption apparatus (SARRY) and completed the augmentation of decontamination facility (Aug.18.)

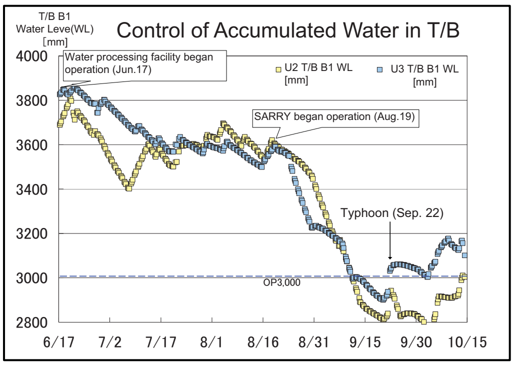
③ Completed augmenting desalination processing facility [Countermeasure 43]

- Installed the evaporative concentration apparatus (two lines, Aug.7 and 31) in addition to the reverse osmosis membrane method (Jun.17.)
- Confirmed that chlorine concentration had been decreased from 6,000 ppm to approx. 20ppm by the reverse osmosis equipment (per the Aug. 9 results) and that had been decreased from 12,000 ppm to less than 1 ppm by the

evaporative concentration apparatus (per the Aug. 16 results).

- Completed augmentation of desalination processing facility via the evaporative concentration apparatus (Oct.9), enabling more stable water injection into the reactors.





④ Storage/management of sludge waste, etc. [Countermeasure 81]

- Sludge waste with high radioactive concentration generated by processing the high-level contaminated water and high radioactive used-adsorption tower are properly being secured and managed respectively in the Centralized Waste Processing Building and the adsorption tower storage facility.
- Implementing preparation work to install storage facility for sludge waste in order to expand storage capacity for sludge waste.
- Implementing installation work for used-adsorption tower storage facility in order to expand storage capacity for used-adsorption tower.

⑤ Securing storage [Countermeasure 42]

- Installed tanks for high-level contaminated water (2,800 tons) in order to expand storage facility for high-level contaminated water (Sep.17.)

⑥ Prevent contamination in the ocean [Countermeasure 64]

- Completed the placement of the steel pipe sheet pile in order to block the damaged parts of permeation prevention structure due to the tsunami at the south side of the intake canal of Units 1 to 4 as a countermeasure to mitigate contamination in the ocean (Sep.28.)

Status of steel pipe sheet pile

(4) Groundwater

1. Target for Step 2 “Mitigating contamination in the ocean”

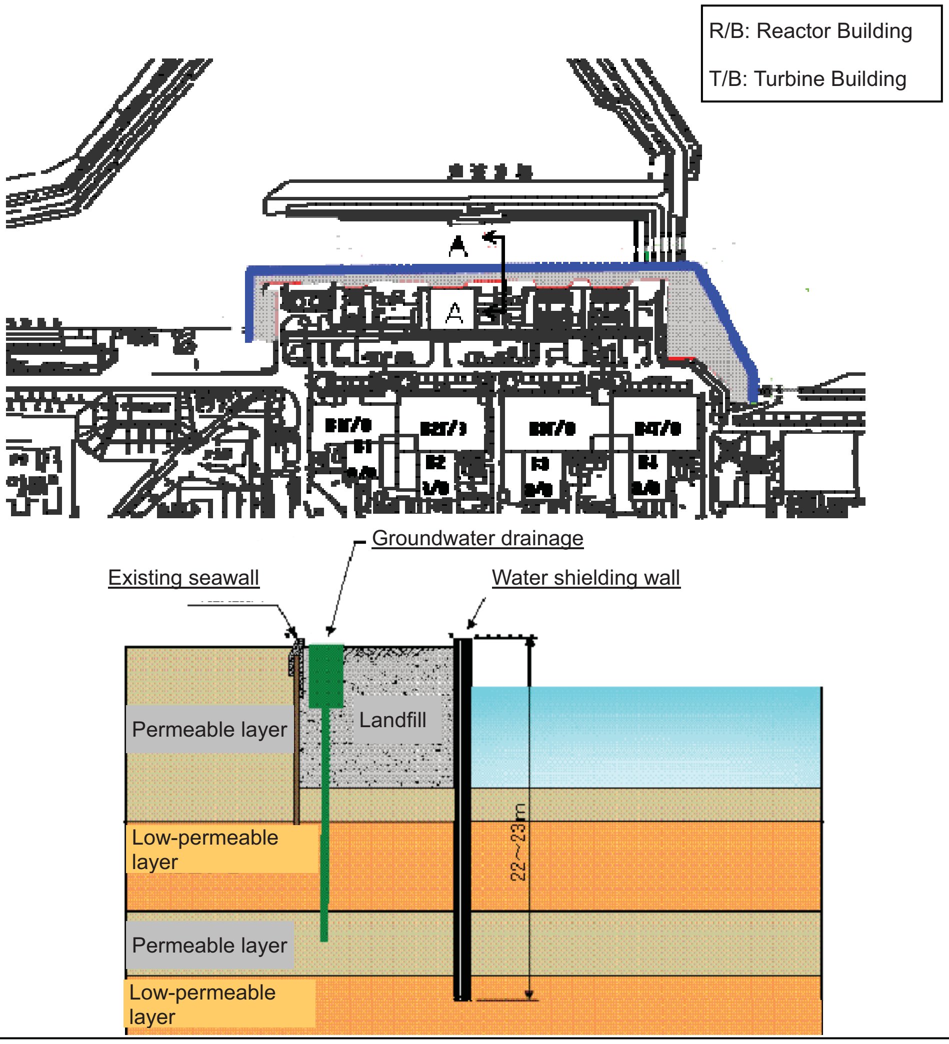
- Mitigate contamination in groundwater as well as contamination in the ocean via groundwater by controlling accumulated water inflow into groundwater.
- Commencing installation work for water shielding wall in front of existing seawalls of Units 1 to 4, with the expectation of mitigating contamination in the ocean via groundwater.

2. Current status and work implemented

①Consideration of water shielding wall [Countermeasure 68]

- In order to further ensure the mitigatation of contamination in the ocean, the basic design for installing the water-proof steel pipe sheet piles in front of the existing seawalls of Units 1 to 4 has been completed (Aug. 31.)
- Currently the design specificaitons for construction are under consideration. Construction work will commence from around the end of October.

Basic design of water shielding walls for groundwater



②Implementation of prevention against expansion of contamination in groundwater [Countermeasure 67]

- Installed pumps at sub-drainage pit on the turbine building side at seven places (Jul. 29.)

(5) Atmosphere/Soil

1. Target for Step 2 “Mitigating dispersion of radioactive materials”

- Reduce dispersion of radioactive materials deposited in the site.
- Continue dust inhibitor spraying as well as removal of debris.
- Install the reactor building cover (Unit 1.)
- Commence removal of debris on top of the reactor buildings (Units 3 and 4.)
- Consider containers for the reactor buildings.

2. Current status and work implemented

①Installation of the Unit 1 reactor building cover [Countermeasures 54, 55]

- Steel frames has been installed (Sep. 9.)
- Installing panels between steel frames is under construction. The work will be completed around the end of October.

Installation work of the cover

②Removal of debris at the upper part of the reactor buildings (Units 3 and 4) [Countermeasure 84]

- Began removing debris at the upper part of the reactor building of Unit 3 (Sep. 10.)
- Began removing debris at the upper part of the reactor building of Unit 4 (Sep.21). Covered the fuel pool by floats against drop of debris (Oct. 14.)

Removing debris at Unit 3

As of Sep. 10

As of Oct. 13

Unit 4, Fuel pool protection

③ Removal and management of debris [Countermeasures 53, 84, 87]

<Removal of debris>

- The volume of approx. 900 containers of debris has been removed (as of Oct. 17.) [Countermeasures 53, 84]
- The waste such as the removed debris and the trees cut down for site preparation are classified according to their kinds as well as the amount of radiation dose in the storage area and transported.

<Management of debris>

- Debris are stored in the containers and reserved in the buildings according to the amount of radiation dose.
- The approach lane to the waste storage area is marked off and a No Entry sign was posted to prevent entrance of unauthorized personnel.
- Except for the radioactive accumulated water treatment facilities and the other areas under construction, the storage areas are secured, fully utilizing the land within the site.

Debris storage area (Left: Containers storing the debris, Right: Storage tent)

<Water spray in the site>

- Purified water, which satisfies the guideline for bathing water, is reused to spray in the site in order to prevent lumber from firing spontaneously and dust from dispersing.

Result of purified water analysis and guideline for the bating water

(Unit: Bq/cm^3)

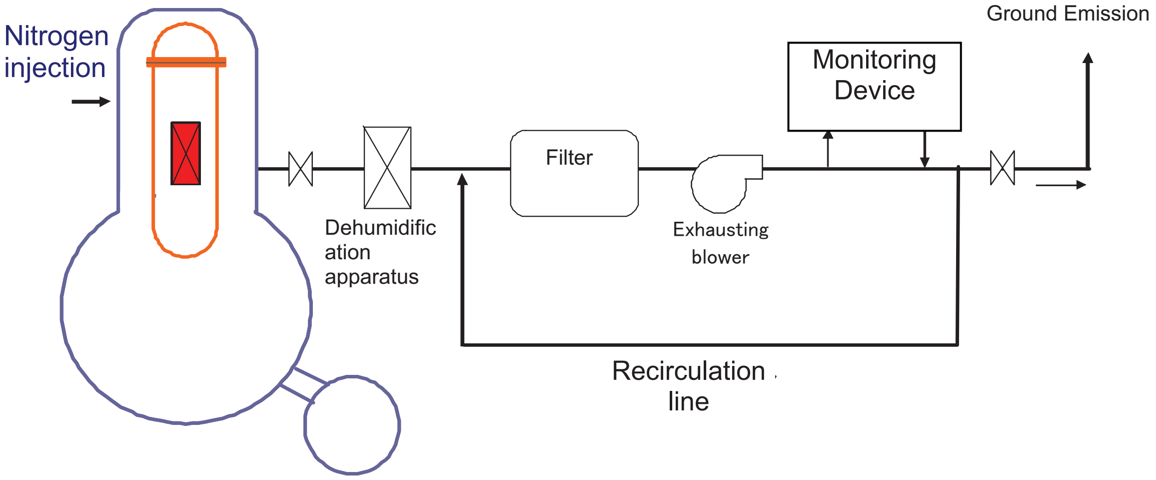
Nuclide	Result of purified water analysis	Guideline for radioactive materials in the bathing water (Ministry of the Environment)
Iodine 131	ND (<4.7E-03)	3.0E-02
Cesium 134	ND (<9.7E-03)	5.0E-02 (Sum of Cesium 134&137)
Cesium 137	ND (<1.2E -02)	

④ Installation of PCV gas control system [Countermeasure 86]

- Installation of PCV gas control system started (Unit 1-Oct 7, Unit 2-Oct 10, Unit 3 (preparation work)-Sep 30).
- Careful measures were taken such as nitrogen injection and the adoption of static electricity resistant hose since highly concentrated hydrogen was detected in the Unit 1's piping arrangement on which were to be worked. (Oct 10.)

Conceptual Diagram of PCV Gas Control System

- A system to adjust the pressure in the PCV to the almost same level as the atmospheric pressure by extracting almost the same amount of gas as the nitrogen fill ration in the PCV in order to reduce the amount of radioactive materials released from PCV after the temperature at the bottom of the reactor is kept below 100°C.
- The system is designed to monitor the extracted and filtered gas before releasing it.
- The amount of radioactive materials released from PCV will be further reduced using the system, while it is expected to reduce due to the decline in the temperature of the reactor.



III. Monitoring and decontamination

(6) Measurement, reduction, disclosure

1. Target for Step 2 “Sufficient reduction of radiation dose”

- Expansion and enhancement of monitoring, and continuation of disclosure.
- Monitoring by government, prefectures, municipalities and operators.
- Commencement of full-scale decontamination.

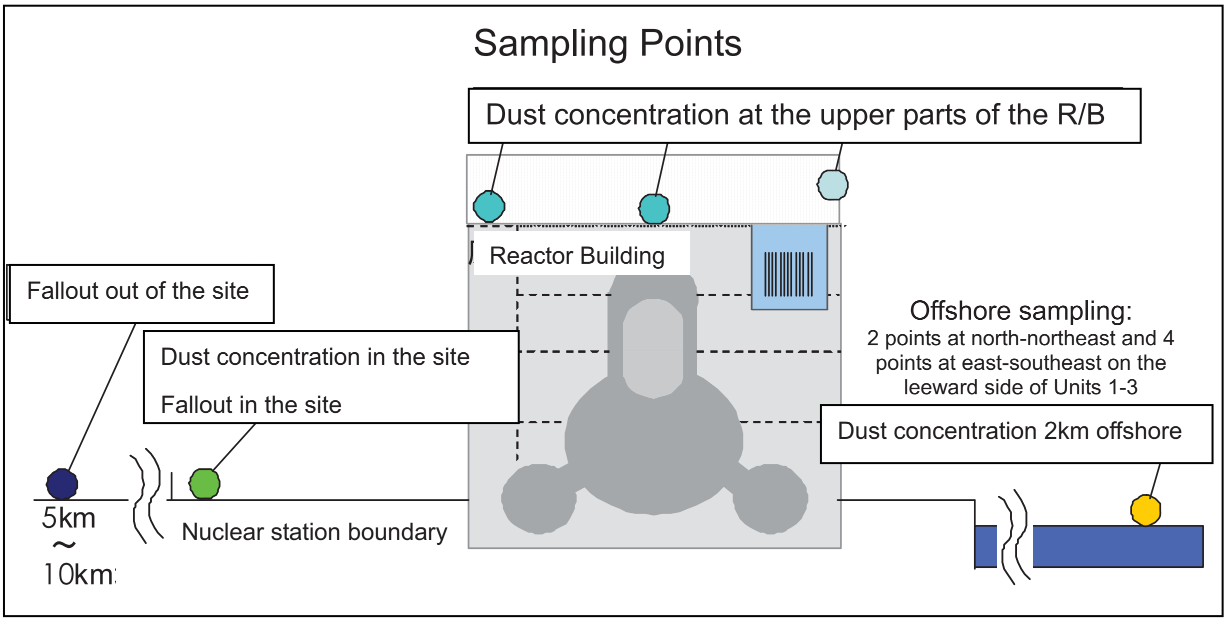
2. Current status and work implemented

①Evaluated the amount of radioactive materials currently released from PCVs [Countermeasures 60, 61]

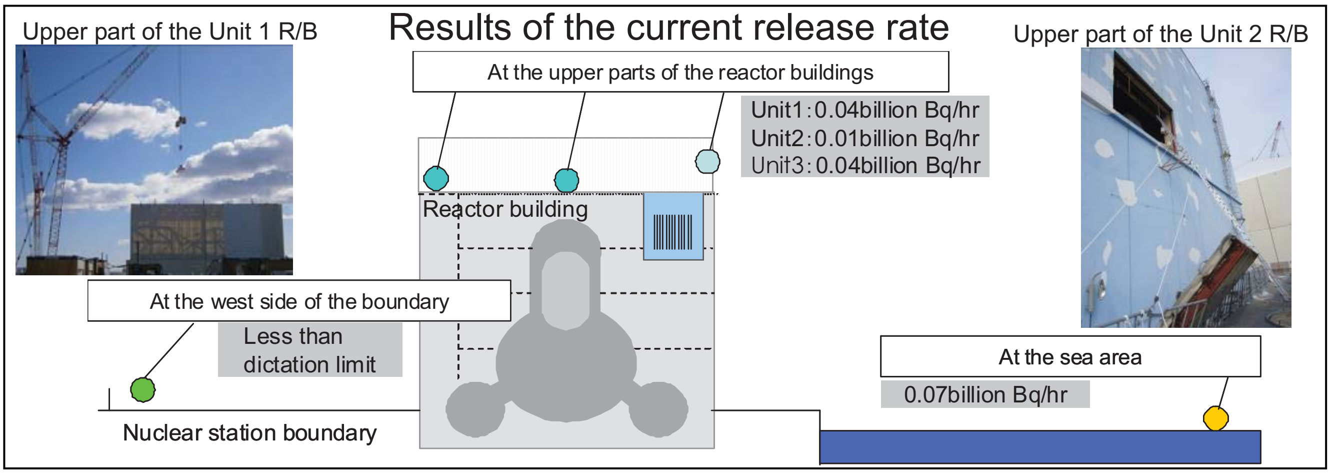
- In order to estimate the amount of radioactive materials currently released from PCVs, implemented the measurement of the airborne radioactivity concentration (dust concentration) at the upper part of the reactor buildings and at land and sea.

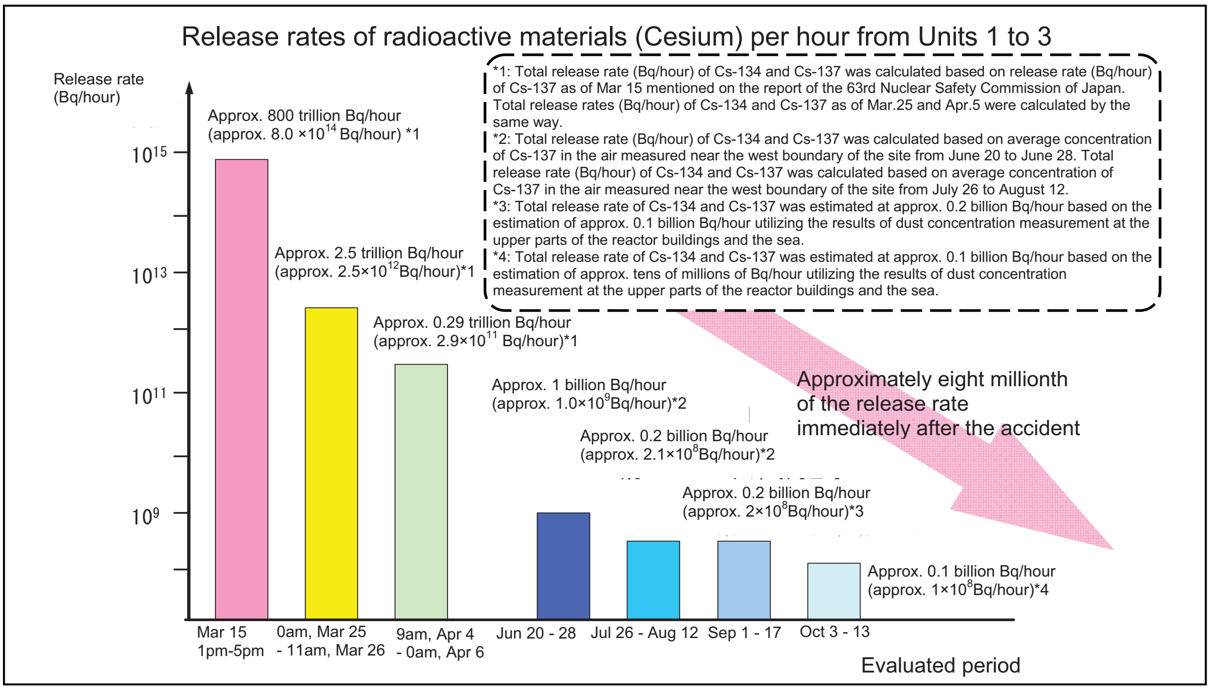
・ Measured dust concentration in the site area and sea area (15 points.) As the dust concentration in the site such as near the west gate and monitoring posts in 15 points is showing decreasing trend, and is almost below detectable limit, we did not employ these data for estimating current release rate of radioactive materials from PCVs.

・ Implemented sampling of radioactive fallout (12 points in and out of the site.) As we estimated that almost all of samples were occupied by re-suspended radioactive materials which were released in the past, we did not employ these data for estimating current release rate of radioactive materials from PCVs.



- The current release rate from PCVs of Units 1 to 3 has been estimated utilizing the airborne radioactivity concentration (dust concentration) at the upper parts of the reactor buildings and in the sea.
  - The current release rate for each Unit is estimated at, Unit 1: approx. 0.04 billion Bq/h, Unit 2: approx. 0.01 billion Bq/h and Unit 3: approx. 0.04 billion Bq/h, respectively, using dust concentration at the upper parts of the reactor buildings. The total release rate from Units 1 to 3 is estimated at approx. 0.08 billion Bq/h (Release rate for each Unit is rounded up.)
  - The current total release rate from Units 1 to 3 is estimated at approx. 0.07 billion Bq/h using dust concentration at the 2km offshore from the site, and there might be little effect of radioactive materials that released previously.
  - Therefore, the current total release rate from Units 1 to 3 is assessed at approx. 0.1 billion Bq/h at the maximum (provisional figure), which is 1/8,000,000 of that at the time of the accident.





*1: Total release rate (Bq/hour) of Cs-134 and Cs-137 was calculated based on release rate (Bq/hour) of Cs-137 as of Mar 15 mentioned on the report of the 63rd Nuclear Safety Commission of Japan. Total release rates (Bq/hour) of Cs-134 and Cs-137 as of Mar.25 and Apr.5 were calculated by the same way.

*2: Total release rate (Bq/hour) of Cs-134 and Cs-137 was calculated based on average concentration of Cs-137 in the air measured near the west boundary of the site from June 20 to June 28. Total release rate (Bq/hour) of Cs-134 and Cs-137 was calculated based on average concentration of Cs-137 in the air measured near the west boundary of the site from July 26 to August 12.

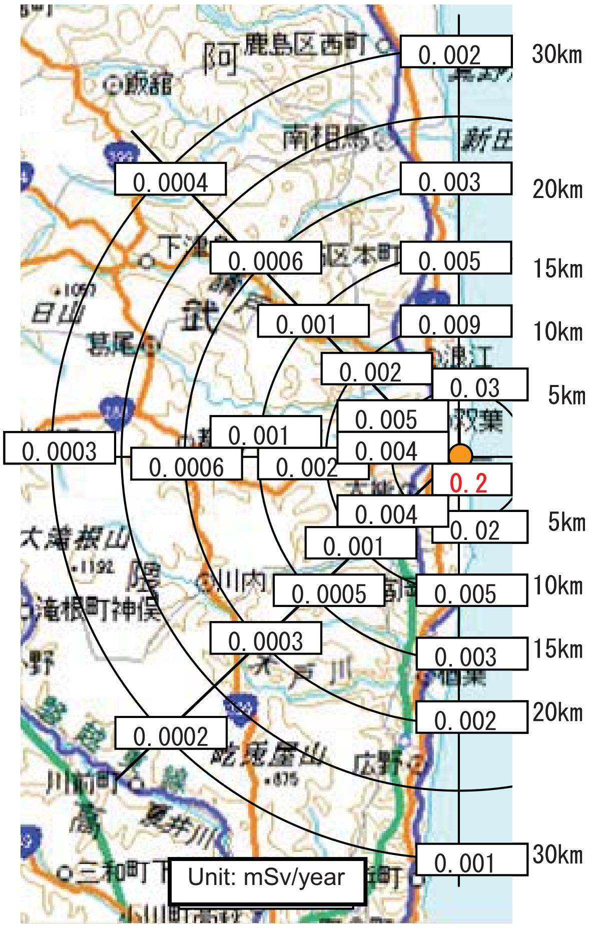
*3: Total release rate of Cs-134 and Cs-137 was estimated at approx. 0.2 billion Bq/hour based on the estimation of approx. 0.1 billion Bq/hour utilizing the results of dust concentration measurement at the upper parts of the reactor buildings and the sea.

*4: Total release rate of Cs-134 and Cs-137 was estimated at approx. 0.1 billion Bq/hour based on the estimation of approx. tens of millions of Bq/hour utilizing the results of dust concentration measurement at the upper parts of the reactor buildings and the sea.

- The radiation exposure per year at the site boundaries is assessed at approx. 0.2 mSv / year provisionally (The target is 1 mSv / year, excluding the effect of the radioactive materials already released up until now.)

Exposure doses in case that the current release rate from PCVs of Units 1 to 3 continues for one year (mSv/year)

(Excluding the effect of already released radioactive materials)



[Map Source: “Digital Japan" URL http://cyberjapan.jp/]

(Overview of the estimated figures)

Site boundary: Less than or equal to approx. 0.2 mSv/year

5km radius : Less than or equal to approx. 0.03 mSv/year

10km radius : Less than or equal to approx. 0.009 mSv/year

20 km radius : Less than or equal to approx. 0.003 mSv/year

As a reference, the dose limit by reactor facilities at an outside of a nuclear power station is 1 mSv/year.

- Continuously implement the measurement of airborne radioactivity concentration at the upper parts of the reactor buildings and in surrounding area (land and sea), thus grasping the reduction tendency of the radioactivity release rate due to the mitigation countermeasures.

② Joint monitoring by the central government, prefectures, municipalities and the operator [Countermeasure 62]

- Having instructions from the Ministry of Education, Culture, Sports, Science and Technology, the operator has implemented sampling and measurement at land and sea as below.

[Land]
<Monitoring within 20km radius>

- Measurement of airborne radioactivity concentration by the support team from the Federation of Electric Power Companies at 50 points（once a week）
- Dust sampling at 5 points near 10km radius by the same team（once a month）

[Sea]
<Fukushima Prefecture>

- Seawater at 11 points within the site bay (once a day)
- Seawater at 4 points along the coast (once a day)
- Seawater at 8 points within 20km radius (every two days)
- Seawater at 3 points within 30km radius (once a week)
- Seawater at 10 points outside 30km radius (once a week)
- Seabed soil survey at 25 points (once a month)

<Ibaraki Prefecture>

- Seawater at 5 points (once a week)

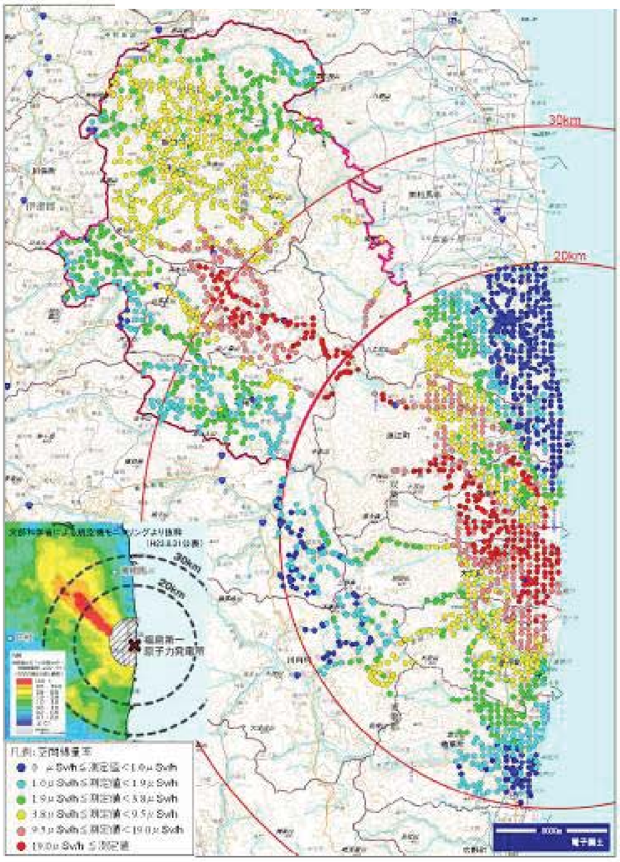
<Miyagi Prefecture>

- Seawater at 6 points (twice a month)

- Sampling of seawater and seabed soil at a few kilometers offshore in front of the power station will be implemented with an unmanned survey boat.

- The Cabinet Office and the Ministry of Education, Culture, Sports, Science and Technology announced the implementation of “Wide Area Monitoring” at restricted areas and deliberate evacuation areas (Sep. 1.)

Wide Area Monitoring results map（height: 1m）and selection method of monitoring points



Divide the target areas by 2km x 2km meshes, selected approx. 20 points[*1] from each mesh based on the basic data collection results[*2] and monitor the airborne radioactivity concentration (Jul.4 – Aug.20.)

*1 Various places such as 16 points by dividing each mesh 500m x 500m as well as crowded places (schools, public facilities, parks, shopping malls, supermarkets, shrines and temples, etc.) were selected.

*2 Airborne radioactivity concentration was monitored at around Namie Station and Tomioka Town Station which have various types of environments. The distribution of air dose rate was developed based on the density of radioactive materials that were discharged by the accident and accumulated in the soil etc.

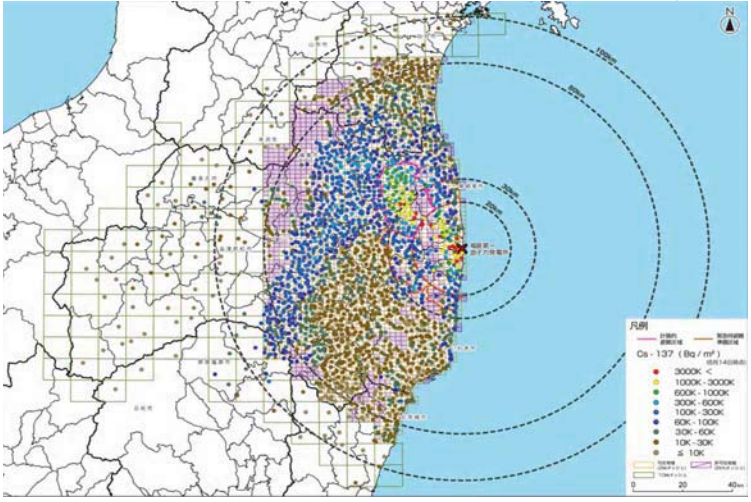
- The operator also developed the “Wide Area Monitoring” plan and conducted monitoring together (approx. 800 persons in total.)

Measurement work of Wide Area Monitoring

- Based on the result of Wide Area Monitoring, the “Individual Detailed Monitoring” on houses, roads and school grounds is being implemented in order to collect the basic data for the development of implementation plan to improve the environment in these areas (from mid-June to the end of October.)

● The Ministry of Education, Culture, Sports, Science and Technology published “Map of radioactive contamination (Cesium contamination map)” (Aug. 30.)

Cesium contamination map



This map is developed based on the measurement of airborne radioactivity concentration at approx. 2,200 points within about 100km radius from the station and the sampling of soil at 5cm depth from the ground surface at around 5 points for each radiation measurement point. Nuclide analysis by germanium semiconductor detector was conducted on those sampled soil.

- Measurement of airborne radioactivity concentration and soil sampling were conducted by universities, Japan Atomic Energy Agency, National Institute of Radiological Sciences, Japan Chemical Analysis Center and the team from Federation of Electric Power Companies.

③ Consideration and commencement of full-scale decontamination [Countermeasure 63]

[Countermeasures implemented by the central government]

- The decontamination support team (composed of Ministry of the Environment and Cabinet Office etc.) for Fukushima prefecture started providing municipals with advice on the development of municipal decontamination plans and allocating experts (Japan Atomic Energy Agency, TEPCO) (Oct. 3.)
- Utilizing the Great East Japan Earthquake Recovery and Reconstruction Reserve Fund, the central government is swiftly preparing the model project of decontamination at the areas that possibly have over 20mSv of additional exposure dose per year (restricted areas and deliberate evacuation areas). Currently, the preliminary monitoring is underway.
- The central government started planning of the interim storage facilities that would stably store the contaminated soil for a certain period. The roadmap will be developed by the end of October.

[Activities where the operators are participating]

- Through the Wide Area Monitoring and the "Individual Detailed Monitoring, the operator collects information that would contribute to the effective decontamination work. (With these outputs and the knowledge about the radioactivity management, the operator will support the decontamination test conducted by the central government at the restricted area.)
- In order to support the developments of municipal decontamination plans, the operator started personnel support for the experts allocation program by the central government (Oct. 3.)
- The operator also provided Fukushima Prefecture with personnel support for the model project for reduction of radiation at general residential areas (Aug. 25 and 26.)

IV. Countermeasures against aftershocks, etc.

(7) Tsunami and reinforcement, etc.

1. Target for Step 2 “Mitigation of further disasters”

- Prevent situation from deterioration by mitigating disasters with countermeasures against emergencies (earthquakes and tsunami, etc.)
- Consideration of reinforcement work of each unit as necessary.
- Continue implementing various radiation shielding measures.

2. Current status and work implemented

① Implementation of seismic resistance evaluation for each unit [Countermeasure 71]

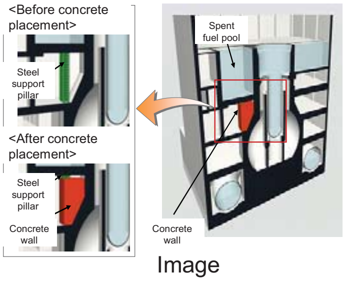
- Consideration of current seismic resistance and reinforcement, etc. for reactor buildings of Unit 2, Unit 5 and Unit 6 was implemented and evaluated by Aug. 26 (Unit 1 and Unit 4 were completed by May 28 and Unit 3 was completed by Jul. 13.)
- As a result of the analysis, it was evaluated that seismic resistance can be secured without any reinforcement.
- A survey inside the buildings will be conducted after implementation of measures to reduce radiation dose.

Installation status of support structures in Unit 4 (Completed on Jul. 30)

Before installing steel support pillars (photographed on May 31)

Installation status of steel support pillars (photographed on Jun. 20)

Concrete placement status (photographed on Jul.21)



Image

Grout filling status (photographed on Jul. 30)

Completion of support structures (photographed on Jul. 30)

V. Environment improvement

(8) Living/ working environment

1. Target for Step 2 “Enhancement of Environment Improvement”

- Improve workers’ living/working environment that had been harsh during the initial phase of the accident, thus leading to maintaining workers’ motivation.
- Expansion of temporary dormitories and on-site rest stations.
- Improvement of environment such as meals, bath, laundry, etc.

2. Current status and work implemented

① Expansion status of temporary dormitories [Countermeasure 75]

- Completed construction of temporary dormitory able to accommodate 1,600 persons (Aug. 31). Approx. 1,100 persons have already moved in (as of Oct. 1.)

② Establishment status of on-site rest stations [Countermeasure 75]

- Twenty on-site rest stations have been established (approx. 4,400m^2 in size with a capacity to accommodate approx. 1,500 persons) (as of Oct. 5.)

Exterior (left) and interior (right) appearances of on-site rest stations

Inside of on-site rest stations (from left: drinking water, etc., restroom and air shower)

(9)Radiation Control/Medical Care

1. Target for Step 2 “Enhancement of Healthcare”

- Thorough radiation exposure control and countermeasures against heat stroke and influenza.
- Reinforcement of radiation control by NISA.
- Increase in the number of whole body counters, monthly measurement of internal exposure.
- Automated recording of personal radiation dose, report of personal exposure dose in writing, introduction of workers’ certificates with photos.
- Consideration of a long-term healthcare such as enhancement of workers’ safety training and establishment of a database.

2. Current status and work implemented

① Expansion of whole body counters (WBC) [Countermeasure 78]

- Increased WBCs as planned (12 units have already been added as of Oct. 3.)
- Started measuring internal exposure once a month from September.

② Written notification of exposure dose etc. [Countermeasure 78]

- Provided recording format of personal exposure in every entry (Aug. 16.) Started to use workers’ certificates with photos step by step (July 29.) Automated recording of personal exposure is under preparation. (Exposure data are currently manually secured in preparation for the use in future.)

③ Consideration for long-term healthcare such as establishing a database [Countermeasure 78]

- Announced the report of expert committee on the database creation and long-term health management (Sep. 26.)
- Obligate utilities to submit exposure dose records and health check records for long-term health management by revision of the Ordinance on Prevention of Ionizing Radiation Hazards, and announced a guideline regarding implementation of examination, etc. according to exposure dose (Oct. 11.)

④ Continuous reinforcement of medical system [Countermeasure 80]

- Changed Units 5/6’s emergency medical room’s period of operations from summer-only to all year round and emergency doctors, etc. have continuously been in place after September.
- Assigned nurses and radiation specialists (not regular basis in the meantime).
- Reinforcement of medical facility and decontamination facility to enable the speedy

Preparation of Ambulance
(near Units 5/6’s emergency medical room)

transportation of patients and also the direct transportation of non-contaminated severely ill or injured patients to hospitals.

- Ambulance has been prepared (Sep. 16.) * Three transportation cars in total.
- Implementation of prevention and mitigation countermeasures against influenza (Start of protective vaccination, etc. from Nov. 1).

(10) Staff training/personnel allocation

1. Target for Step 2 “Systematic staff training and personnel allocation”

- Promotion of staff training in conjunction with the Government and utility operators, etc.

2. Current status and work implemented

① Promote staff training, etc. in conjunction with the government and utility operators in order to train and allocate staffs systematically. [Countermeasure 85]

- Conducting training for staffs engaged in radiation related work, who will be in great demand.
- TEPCO has been conducting “radiation survey staff training” targeted for employees and TEPCO group companies’ employees and has already trained approx. 3,000 personnel.
- The government has been conducting “radiation survey staff training” (7 times till Oct. 7 and approx. 200 personnel were trained.), “radiation protection staff training” (approx. 10 personnel were trained from Aug. 8 to 12, approx. 30 personnel were trained from Sep. 26 to 30) and will continue these trainings.
- According to affiliated companies needs, launched a new framework of looking for workers widely through Japan Atomic Industrial Forum (JAIF).

Radiation survey staff training

VI. Action plan for mid-term issues

1. Target for Step 2

- Development of "Policy on the mid and long term security" by the government
- Development of plant operation plans by the operator based on the above policy

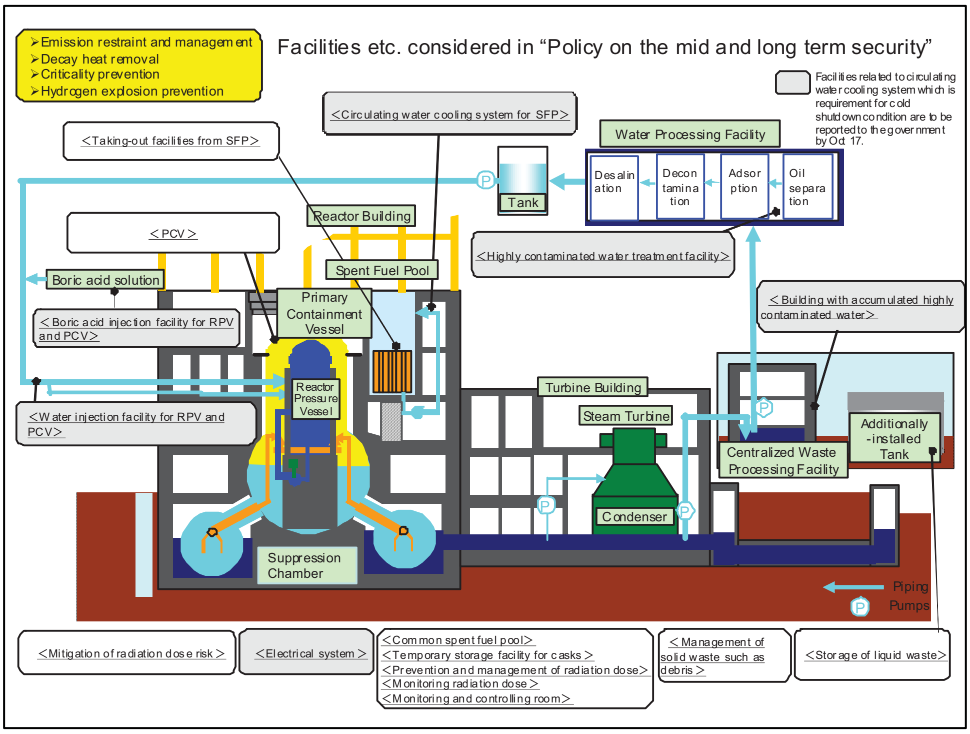
2. Current status and work implemented

① NISA instructed the operator to comply with "Policy on the mid and long term security"

- NISA disclosed (on Oct. 3) "Policy on the mid and long term security" regarding Units 1 to 4 of Fukushima Daiichi Nuclear Power Station of TEPCO" in order to secure safety during the period (mid-term: within approx. 3 years) which starts from completion of Step 2 and ends before starting the work for decommissioning the reactors".

*In order to manage additional emission of radioactive materials from the nuclear reactor facilities and to restrain radiation dose, it requires the following four (4) items and also requires setting basic targets and necessary conditions for safety securement.

- To identify emission sources of radioactive materials, implement adequate restrain measures and monitor them (Emission restraining and managing functions)
- To adequately remove the decay heat of the reactor pressure vessels, the primary containment vessels and the spent fuel pools (Cooling function)
- To prevent criticality in the reactor pressure vessels, the primary containment vessels and the spent fuel pools (Criticality preventing function)
- To detect, adequately manage and treat flammable gasses (Hydrogen explosion preventing function)


Facilities etc. considered in "Policy on the mid and long term security"

② The operator shall report to NISA in accordance with the instructions

- Reported on operation plan and safety assessment results regarding circulating water cooling system (Oct. 17.)
- Other systems, etc. shall be reported on as well in a rapid manner.

END

Appendix 3

October 17, 2011
Nuclear Emergency Response Headquarters
Government-TEPCO Integrated Response Office

Current Status of "Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station, TEPCO" (Revised edition)

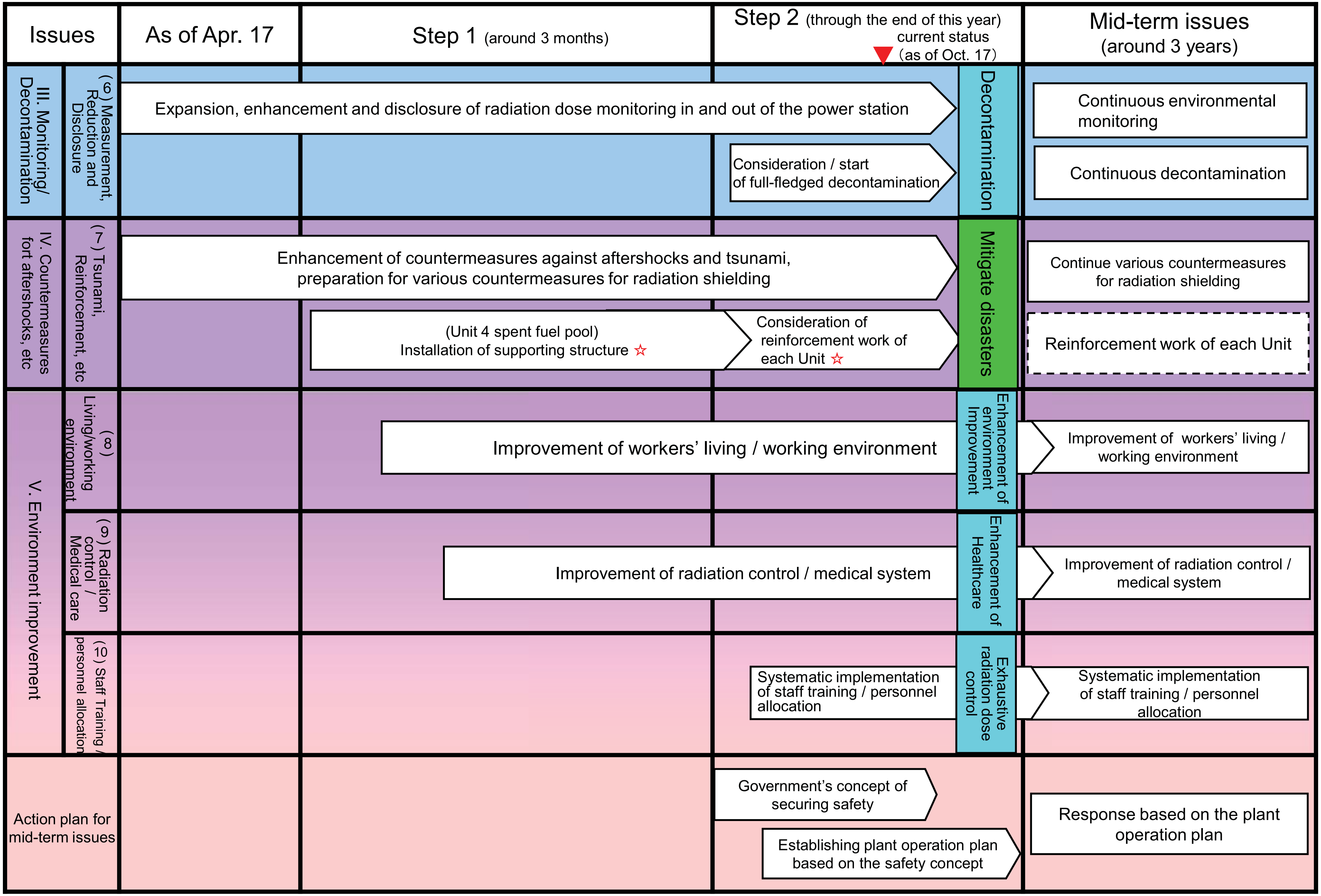
Red colored letter: newly added to the previous version, ☆: already reported to the government, Green colored shading: achieved target

Issues		As of Apr. 17	Step 1 (around 3 months)		Step 2 (through the end of this year) current status (as of Oct. 17)		Mid-term issues (around 3 years)
I. Cooling	(1) Reactor	Fresh water Injection	Cooling by minimum injection rate (injection cooling) Consideration and preparation of reuse of accumulated water Circulating water cooling (start) ☆ Nitrogen gas injection ☆ Improvement of work environment ☆	🟩 Stable cooling	Circulating water cooling (continued) Nitrogen gas injection (continued)	Cold shutdown condition	Continuous cold shutdown condition Protection against corrosion cracking of structural materials* *partially ahead of schedule
	(2) Spent Fuel Pool	Fresh water injection	Reliability improvement in injection operation / remote-control operation *ahead of schedule Circulation cooling system (installation of heat exchanger)☆ *partially ahead of schedule	🟩 Stable cooling	Remote-controlled injection operation Consideration / installation of heat exchanging function	🟩 More stable cooling	Start of removal work of fuels
II. Mitigation	(3) Accumulated Water	Transferring water with high radiation level Storing water with low radiation level	Installation of storage / processing facilities ☆ Installation of storage facilities / decontamination processing	🟩 Secure storage place	Expansion ☆ / consideration of full-fledged processing facilities Decontamination ☆ / desalination processing (reuse), etc Storage / management of sludge waste etc. ☆ Mitigation of contamination in the ocean	🟩 Reduction of total amount of accumulated water	Installation of full-fledged water processing facilities Continuous processing of accumulated water Storage / management of sludge waste etc. Research on processing of sludge waste etc. Mitigation of contamination in the ocean
	(4) Ground water		Mitigation of contamination in groundwater Consideration of method of impermeable wall against groundwater	🟩 Mitigate ocean contamination	(Restoration of sub-drainage pumps with expansion of storage / processing facilities) Design / implementation of impermeable wall against groundwater	Mitigate ocean Contamination (continued)	Mitigation of contamination in groundwater Establishment of impermeable wall against groundwater
	(5) Atmosphere / Soil	Dispersion of inhibitor Removal / management of debris	Dispersion of inhibitor Removal / management of debris	🟩 Mitigate scattering	Dispersion of inhibitor (continued) Removal / management of debris (continued) Installation of reactor building cover (Unit 1) ☆ Removal of debris (top of Unit 3&4 R/B) Consideration of reactor building container Installation of PCV gas control system	Mitigate scattering (continued)	Dispersion of inhibitor Removal / management of debris Removal of debris / installation of reactor building cover (Unit 3&4) Start of installation work of reactor building container Installation of PCV gas control system

Current Status of “Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station, TEPCO” (Revised edition)

October 17, 2011
Nuclear Emergency Response Headquarters
Government-TEPCO Integrated Response Office

Red colored letter: newly added to the previous version, ☆: already reported to the government, Green colored shading: achieved object



Issues | As of Apr. 17 | Step 1 (around 3 months) | Step 2 (through the end of this year) current status ▼ (as of Oct. 17) | Mid-term issues (around 3 years)

III. Monitoring/ Decontamination
(6) Measurement, Reduction and Disclosure
- Expansion, enhancement and disclosure of radiation dose monitoring in and out of the power station
- Consideration / start of full-fledged decontamination
- Decontamination
- Continuous environmental monitoring
- Continuous decontamination

IV. Countermeasures fort aftershocks, etc
(7) Tsunami, Reinforcement, etc
- Enhancement of countermeasures against aftershocks and tsunami, preparation for various countermeasures for radiation shielding
- (Unit 4 spent fuel pool) Installation of supporting structure ☆
- Consideration of reinforcement work of each Unit ☆
- Mitigate disasters
- Continue various countermeasures for radiation shielding
- Reinforcement work of each Unit

V. Environment improvement
(8) Living/working environment
- Improvement of workers’ living / working environment
- Enhancement of environment Improvement
- Improvement of workers’ living / working environment

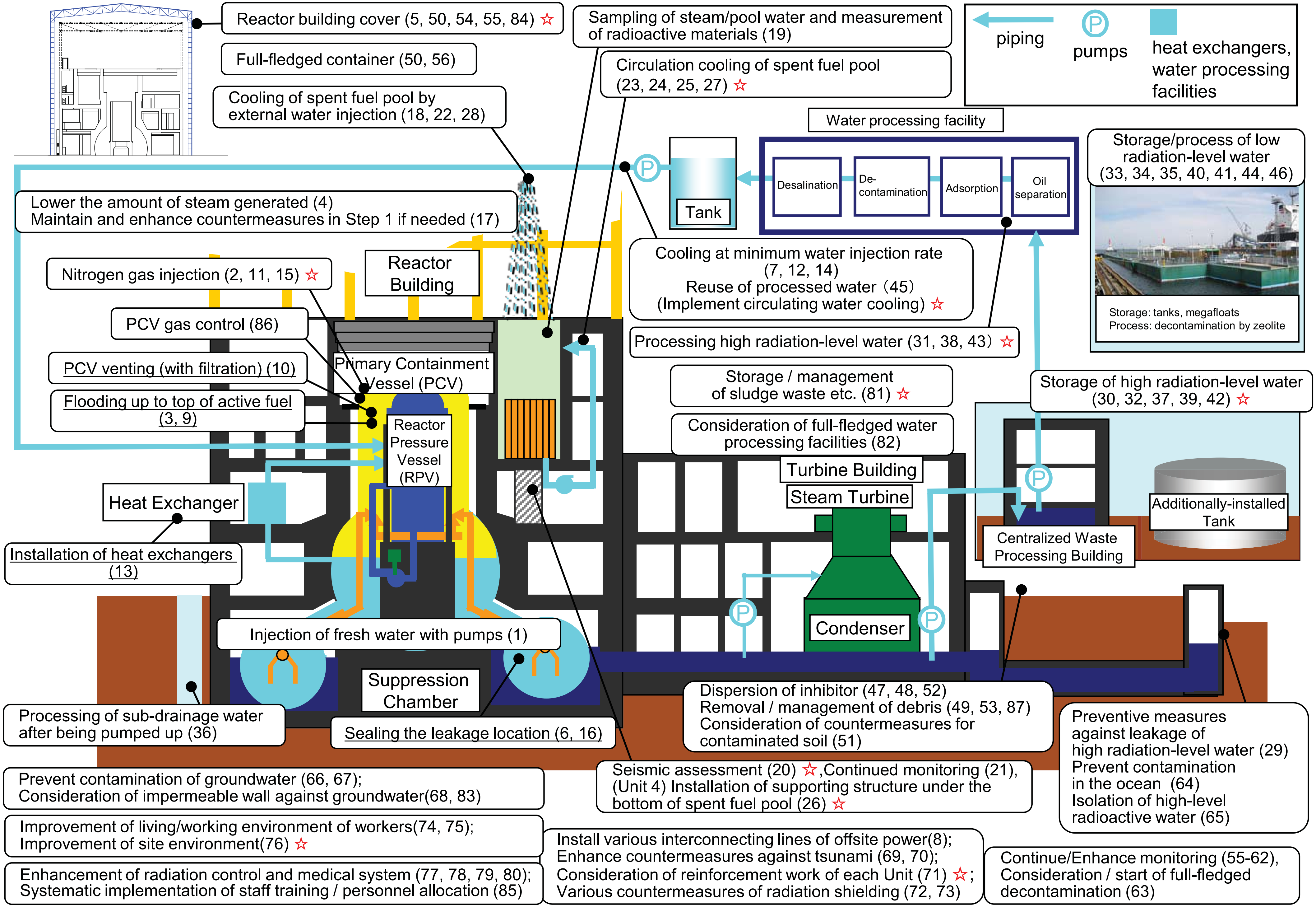
(9) Radiation control / Medical care
- Improvement of radiation control / medical system
- Enhancement of Healthcare
- Improvement of radiation control / medical system

(10) Staff Training / personnel allocation
- Systematic implementation of staff training / personnel allocation
- Exhaustive radiation dose control
- Systematic implementation of staff training / personnel allocation

Action plan for mid-term issues
- Government’s concept of securing safety
- Establishing plant operation plan based on the safety concept
- Response based on the plant operation plan

Overview of Major Countermeasures in the Power Station as of October 17

Underlined: deleted countermeasures, red colored: newly added countermeasures, ☆: already reported to the government



Reactor building cover (5, 50, 54, 55, 84) ☆

Full-fledged container (50, 56)

Cooling of spent fuel pool by external water injection (18, 22, 28)

Sampling of steam/pool water and measurement of radioactive materials (19)

Circulation cooling of spent fuel pool (23, 24, 25, 27) ☆

Storage/process of low radiation-level water (33, 34, 35, 40, 41, 44, 46)

Lower the amount of steam generated (4)
Maintain and enhance countermeasures in Step 1 if needed (17)

Nitrogen gas injection (2, 11, 15) ☆

PCV gas control (86)

PCV venting (with filtration) (10)

Flooding up to top of active fuel (3, 9)

Cooling at minimum water injection rate (7, 12, 14)
Reuse of processed water（45)
(Implement circulating water cooling) ☆

Processing high radiation-level water (31, 38, 43) ☆

Storage / management of sludge waste etc. (81) ☆

Consideration of full-fledged water processing facilities (82)

Storage of high radiation-level water (30, 32, 37, 39, 42) ☆

Heat Exchanger

Installation of heat exchangers (13)

Injection of fresh water with pumps (1)

Processing of sub-drainage water after being pumped up (36)

Sealing the leakage location (6, 16)

Dispersion of inhibitor (47, 48, 52)
Removal / management of debris (49, 53, 87)
Consideration of countermeasures for contaminated soil (51)

Preventive measures against leakage of high radiation-level water (29)
Prevent contamination in the ocean (64)
Isolation of high-level radioactive water (65)

Prevent contamination of groundwater (66, 67);
Consideration of impermeable wall against groundwater(68, 83)

Seismic assessment (20) ☆,Continued monitoring (21),
(Unit 4) Installation of supporting structure under the bottom of spent fuel pool (26) ☆

Improvement of living/working environment of workers(74, 75);
Improvement of site environment(76) ☆

Install various interconnecting lines of offsite power(8);
Enhance countermeasures against tsunami (69, 70);
Consideration of reinforcement work of each Unit (71) ☆;
Various countermeasures of radiation shielding (72, 73)

Enhancement of radiation control and medical system (77, 78, 79, 80);
Systematic implementation of staff training / personnel allocation (85)

Continue/Enhance monitoring (55-62),
Consideration / start of full-fledged decontamination (63)

Current Status of Countermeasures (1)

Red frame: progressed countermeasures from the previous version, ☆: already reported to the government

Issues: I. Cooling — (1) Reactor

Unit

<Step 2 (through the end of this year)>: Release of radioactive materials is under control and radiation dose is being significantly held down

Start of Step 2 (Jul. 17)

Current status (as of Oct. 17)

Term to keep the amount of accumulated water and to improve reliability

Term to complete measures to improve reliability and reduce the amount of accumulated water

Term to inject enough water for cold shutdown condition without increasing the amount of accumulated water

Target [3] Cold shutdown condition

1

Implementation of circulating water cooling [Countermeasures 12,14,45] ☆

- Construction of centralized monitoring system in the main anti-earthquake building (Sep. 30)
- Injection of water required to achieve "stable cooling"
- Injection toward cold shutdown condition without increasing the amount of accumulated water

Nitrogen gas injection [Countermeasure 11] ☆

2

Implementation of circulating water cooling [Countermeasures 12,14,45] ☆

- Establishment of centralized monitoring system in the main anti-earthquake building (Sep. 30)
- Injection of water required to achieve "stable cooling" (Inject water through core spray line in addition to feed water line (Sep. 14))
- Change injection flow rate experimentally, and verify transition of reactor temperatures
- Injection toward cold shutdown condition without increasing the amount of accumulated water

Nitrogen gas injection [Countermeasure 11] ☆

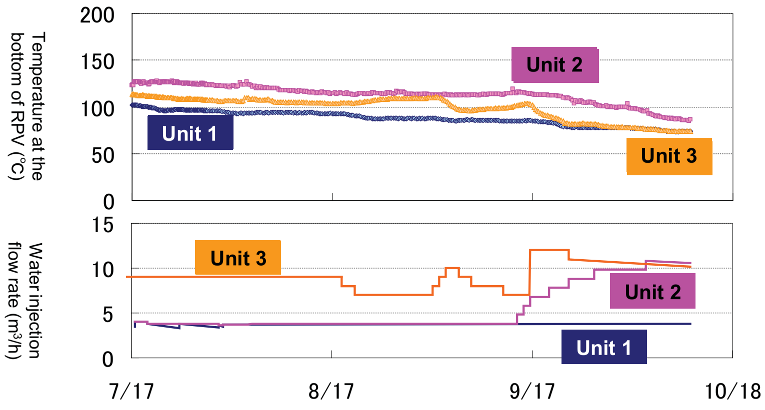
3

Implementation of circulating water cooling [Countermeasures 12,14,45] ☆

- Establishment of centralized monitoring system in the main anti-earthquake building (Sep. 30)
- Injection of water required to achieve "stable cooling" (Inject water through core spray line in addition to feed water line (Sep. 1))
- Change injection flow rate experimentally, and verify transition of reactor temperatures
- Injection toward cold shutdown condition without increasing the amount of accumulated water

Nitrogen gas injection [Countermeasure 11] ☆

Temperature at the bottom of RPV (upper) and water injection flow rate (lower)

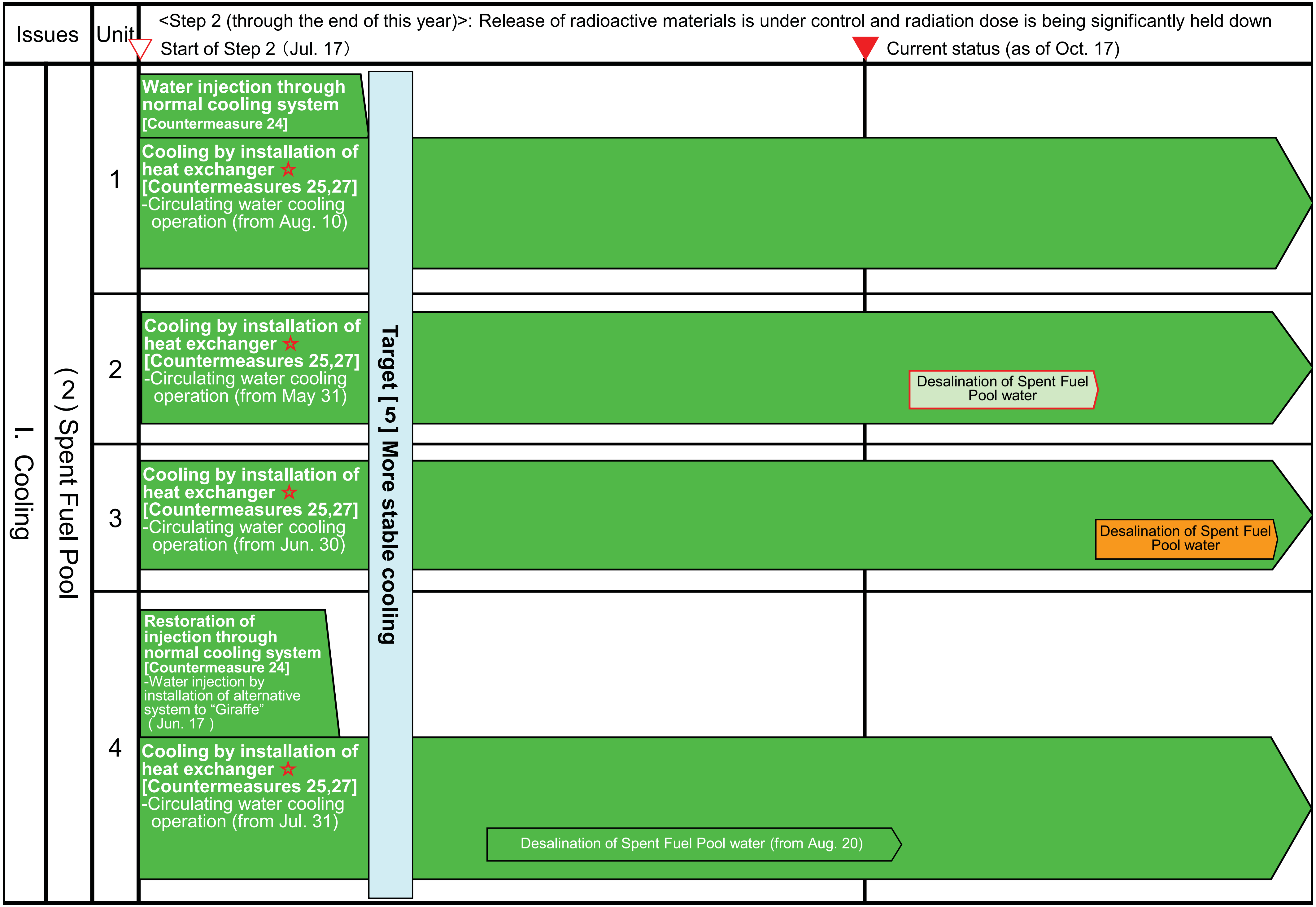


Legend 🟩 : Implemented (monitored by government as necessary) ☆ : Safety check by government (reported) 🟩 : Under construction 🟨 : Field work started 🟧 : Field work not started yet

Current Status of Countermeasures (2)

Red frame: progressed countermeasures from the previous version, ☆: already reported to the government

V



Issues | Unit

<Step 2 (through the end of this year)>: Release of radioactive materials is under control and radiation dose is being significantly held down

Start of Step 2（Jul. 17）

Current status (as of Oct. 17)

I. Cooling

(2) Spent Fuel Pool

Target [5] More stable cooling

1

Water injection through normal cooling system [Countermeasure 24]

Cooling by installation of heat exchanger ☆ [Countermeasures 25,27]
-Circulating water cooling operation (from Aug. 10)

2

Cooling by installation of heat exchanger ☆ [Countermeasures 25,27]
-Circulating water cooling operation (from May 31)

Desalination of Spent Fuel Pool water

3

Cooling by installation of heat exchanger ☆ [Countermeasures 25,27]
-Circulating water cooling operation (from Jun. 30)

Desalination of Spent Fuel Pool water

4

Restoration of injection through normal cooling system [Countermeasure 24]
-Water injection by installation of alternative system to "Giraffe" (Jun. 17)

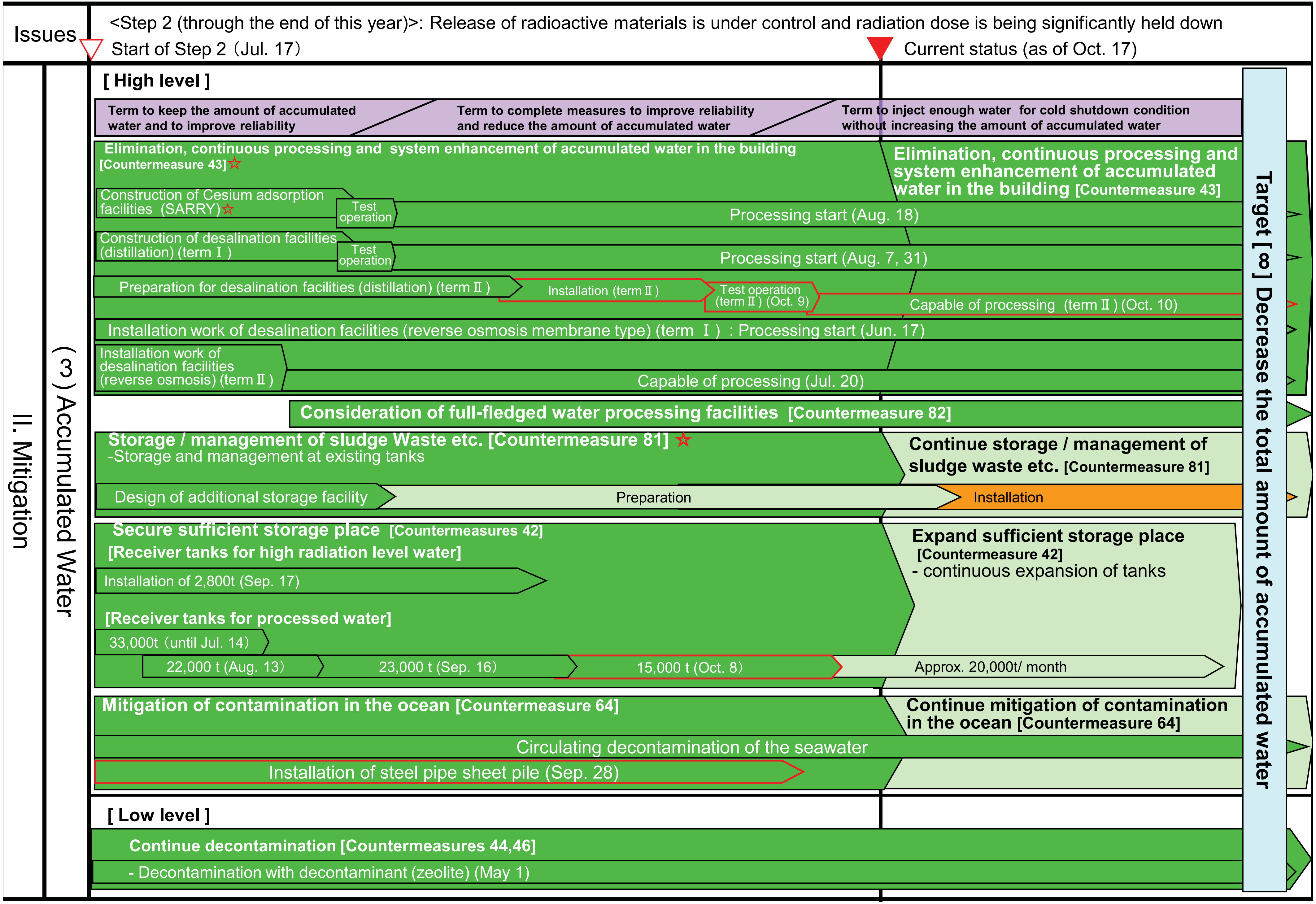
Cooling by installation of heat exchanger ☆ [Countermeasures 25,27]
-Circulating water cooling operation (from Jul. 31)

Desalination of Spent Fuel Pool water (from Aug. 20)

Legend 🟩 : Implemented (monitored by government as necessary) ☆: Safety check by government (reported) 🟩 : Under construction 🟨 : Field work started 🟧 : Field work not started yet

Current Status of Countermeasures (3)

Red frame: progressed countermeasures from the previous version, ☆: already reported to the government



Issues

<Step 2 (through the end of this year)>: Release of radioactive materials is under control and radiation dose is being significantly held down

Start of Step 2 (Jul. 17)

Current status (as of Oct. 17)

II. Mitigation

(3) Accumulated Water

Target [∞] Decrease the total amount of accumulated water

[High level]

Term to keep the amount of accumulated water and to improve reliability

Term to complete measures to improve reliability and reduce the amount of accumulated water

Term to inject enough water for cold shutdown condition without increasing the amount of accumulated water

Elimination, continuous processing and system enhancement of accumulated water in the building [Countermeasure 43]☆

Construction of Cesium adsorption facilities (SARRY)☆ → Test operation → Processing start (Aug. 18)

Construction of desalination facilities (distillation) (term Ⅰ) → Test operation → Processing start (Aug. 7, 31)

Preparation for desalination facilities (distillation) (term Ⅱ) → Installation (term Ⅱ) → Test operation (term Ⅱ) (Oct. 9) → Capable of processing (term Ⅱ) (Oct. 10)

Installation work of desalination facilities (reverse osmosis membrane type) (term Ⅰ) : Processing start (Jun. 17)

Installation work of desalination facilities (reverse osmosis) (term Ⅱ) → Capable of processing (Jul. 20)

Elimination, continuous processing and system enhancement of accumulated water in the building [Countermeasure 43]

Consideration of full-fledged water processing facilities [Countermeasure 82]

Storage / management of sludge Waste etc. [Countermeasure 81] ☆

-Storage and management at existing tanks

Design of additional storage facility → Preparation → Installation

Continue storage / management of sludge waste etc. [Countermeasure 81]

Secure sufficient storage place [Countermeasures 42]

[Receiver tanks for high radiation level water]

Installation of 2,800t (Sep. 17)

[Receiver tanks for processed water]

33,000t (until Jul. 14)

22,000 t (Aug. 13) → 23,000 t (Sep. 16) → 15,000 t (Oct. 8) → Approx. 20,000t/ month

Expand sufficient storage place [Countermeasure 42]

- continuous expansion of tanks

Mitigation of contamination in the ocean [Countermeasure 64]

Circulating decontamination of the seawater

Installation of steel pipe sheet pile (Sep. 28)

Continue mitigation of contamination in the ocean [Countermeasure 64]

[Low level]

Continue decontamination [Countermeasures 44,46]

- Decontamination with decontaminant (zeolite) (May 1)

Legend 🟩 : Implemented (monitored by government as necessary) ☆: Safety check by government (reported) 🟩 : Under construction 🟨 : Field work started 🟧 : Field work not started yet

Current Status of Countermeasures (4)

Red colored letter: newly added countermeasures, Red frame: progressed countermeasures from the previous version, ☆: already reported to the government

Issues

<Step 2 (through the end of this year)>: Release of radioactive materials is under control and radiation dose is being significantly held down

▽ Start of Step 2（Jul. 17）

▼ Current status (as of Oct. 17)

II. Mitigation

(4) Groundwater

Implementation of preventions against expansion of groundwater contamination [Countermeasure 67]
- Restoration of sub-drainage pumps with expansion of storage / processing facilities

Design of impermeable wall against groundwater
[Countermeasure 68]

Start establishment of impermeable wall against groundwater [Countermeasure 83]
(planned around the end of Oct.)

Target [14] Mitigation of ocean contamination

(5) Atmosphere / Soil

Confirmation of solidification of inhibitor [Countermeasure 52]

Removal / management of debris [Countermeasure 53, 87]
-Collected debris (Volume of approx. 900 containers (as of Oct. 17))
-Management of collected debris etc. in storage areas

Spraying treated water, which meets the guideline in the bathing area, in the NPS to prevent radioactive dust from scattering (Oct. 7)

Installation of reactor building cover (Unit 1) [Countermeasures 54,55] ☆ - Under construction (planned to be completed at around the end of Oct.)

Removal of debris on top of reactor buildings (Unit 3&4) [Countermeasures 84]
- Under preparatory construction (Unit3: Jun. 20, Unit4: Jun. 24)

Preparation for Unit 3（Removal of debris on the ground, maintenance of road for crane etc,）

Removal of debris on top of reactor building (Sep. 10)

Preparation for Unit 4（Removal of debris on the ground, maintenance of road for crane etc,）

Removal of debris on top of reactor building (Sep. 21)

Consideration of reactor building container [Countermeasure 50]

Installation of PCV gas control system [Countermeasure 86]

Start installation work (Unit 1: Oct. 7, Unit 2: Oct. 10, Unit 3 (preparatory work): Sep. 30)

Target [10] Prevent scattering of radioactive materials

III. Monitoring / Decontamination

(6) Measurement, Reduction and Disclosure

Continue to assess current release of radioactive materials from PCVs [Countermeasures 60,61]

- The current release rates from PCVs of Units 1 to 3 were assessed comprehensively utilizing the airborne radioactivity concentration (dust concentration) at the upper part of the reactor buildings, the land and the sea.
  - The current total release rate from Units 1-3 based on the assessment this time is estimated at approx. 0.1 billion Bq/h at the maximum (provisional figure), which is 1/8,000,000 of that at the time of the accident.
  - The radiation exposure per year at the site boundaries is assessed at approx. 0.2 mSv / year at the maximum (provisional figure) based on the aforementioned release rate (The target is 1 mSv / year. Excluding the effect of the radioactive materials already released until now).
- Continuously implement the measurements of airborne radioactivity concentration at the upper part of reactor buildings, the land and the sea to grasp the reduction tendency of the release rate due to mitigation countermeasures.

Implementation of monitoring in cooperation with the government, prefectures, municipalities and operators [Countermeasures 62]

Consideration / start of full-fledged decontamination [Countermeasures 63]
"Basic Concept for Pushing Ahead with Decontamination Works" and "Basic Policy for Emergency Response on Decontamination Work", etc. have been established (Aug. 26). Substantiative decontamination operations have been conducted since the end of Aug.

Target [12] Sufficiently reduce radiation dose

Legend 🟩 : Implemented (monitored by government as necessary) ☆: Safety check by government (reported) 🟩 : Under construction 🟨 : Field work started 🟧 : Field work not started yet

Current Status of Countermeasures (5)

Red colored letter: newly added countermeasures, Red frame: progressed countermeasures from the previous version, ☆: already reported to the government

Issues

<Step 2 (through the end of this year) Release of radioactive materials is under control and radiation dose is being significantly held down

Start of Step 2（Jul. 17）

Current status (as of Oct. 17)

IV. Countermeasures against aftershocks, etc

(7) Tsunami, reinforcement, etc

(Unit 4) Installation of supporting structure under the bottom of the fuel pool [Countermeasure 26] ☆ (Jul. 30)

Consideration of reinforcement work of each Unit [Countermeasure 71]
- Evaluation of seismic resistance has been completed (Aug.26) ☆

Continue various countermeasures for radiation shielding [Countermeasure 73]

Target [16] Mitigation of disasters

V. Environment improvement

(8) Living / working Environment

Continuation and enhancement of improvement of workers’ living / working environment [Countermeasure 75]
- Accommodations for approx. 1,600 people have been prepared. Approx. 1,100 people have already moved in (as of Oct. 1)
-20 on-site rest stations have been established (approx. 4,400m^2 in size with a capacity to accommodate approx. 1,500 people) (as of Oct. 5)

Target [18] Enhancement of environment improvement

(9) Radiation control /Medical care

Continuous improvement of radiation control [Countermeasure 78]
- Reinforcement of radiation control by NISA
- Expansion of whole-body counters, implementation of monthly internal exposure measurement ☆
- Automated recording of personal radiation dose, written notification of exposure dose ☆, introduction of workers’ certificates with photos ☆
- Consideration of long-term healthcare such as enhancement of safety training for workers and establishing database etc.

Continuous reinforcement of medical system [Countermeasure 80]
- Install new emergency medical facility, establish organization with resident specialists (on call 24 hours a day), speedy transportation of patients
- Intensive preventive measures against heat stroke ☆ (trainings for new workers), countermeasures for mental health, conducting medical examination, prevention and mitigation of flu
- Establish industrial hygiene system such as preventive healthcare

Target [20] Enhancement of healthcare

(10) Staff Training / personnel allocation

Systematic staff training and personnel allocation [Countermeasure 85]
- Promote human resources training in conjunction with the government and operators

Target [21] Exhaustive radiation dose control

Legend 🟩 : Implemented (monitored by government as necessary) ☆: Safety check by government (reported) 🟩 : Under construction 🟨 : Field work started 🟧 : Field work not started yet

Main Points of the Progress Status of the “Roadmap for Immediate Actions for the Assistance of Residents Affected by the Nuclear Incident”

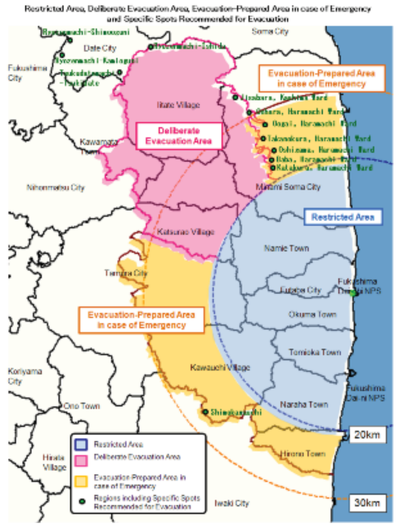
Main details of the progress made during the term (from mid-September to mid-October)

October 17, 2011
Nuclear Emergency Response Headquarters

Lifting of the Evacuation-Prepared Areas in Case of Emergency designation, and subsequent supports

- On September 30, the Nuclear Emergency Response Headquarters **lifted the designation of Evacuation-Prepared Areas in Case of Emergency.** ,
- In cooperation with the Reconstruction Headquarters in response to the Great East Japan Earthquake and related ministries and agencies, every effort will be made to take the following actions for homecoming of the affected residents.
  (1) **To implement the recovery plan for five municipalities concerned**
  (2) **To properly decontaminate the areas where the designation was lifted**
- **Based on the request from the five municipalities previously designated as the Evacuation-Prepared Areas in Case of Emergency,** as part of the supports to recover these areas, **detailed monitoring mainly focusing on the roads necessary for living as well as the well water and rivers** are now under implementation.
- **”The Municipalities Reconstruction Support Team in response to the Nuclear Accident”**, established in the Reconstruction Headquarters in response to the Great East Japan Earthquake in order to always and promptly response to various requests from the affected people, **is now exchanging opinions with the affected municipalities**.

<Before the lifting>



<After the lifting>

Supports provided for the evacuees (Providing temporary access

- Concerning temporary access to the Restricted Areas, on the assumption of securing safety for the residents, **the second round of temporary access by private vehicle** has been allowed since September 19.

※Actual temporary accesses allowed in the second round (as of October 14)
5,435 households, 12,448 people
(the number of households accessed by private vehicle: 3,917 households)

Efforts towards full-scale decontamination

- Meetings are now being held to explain “the Basic Policy for Emergency Decontamination Work” and “Act on Special Measures concerning Handling of Radioactive Pollution” in Fukushima Prefecture and in the neighboring prefectures.
- **To support preparing of the decontamination plan by municipalities, visiting to the municipalities and dispatching of experts** have been started.
- Concerning the model projects of decontamination, preparations are now being made to promptly implement it in all 12 municipalities on which evacuation order was placed.

Implementation and release of monitoring

- **Based on the request from the five municipalities previously designated as the evacuation prepared areas in case of emergency,** as part of the supports to recover these areas, **detailed monitoring mainly focusing on the roads necessary for living as well as the well water and rivers** are now under implementation. (re-posted)

A long-term health care

- For the residents in Fukushima Prefecture at and under the age of 18 at the time of the accident (approx. 360,000 people), **a thyroid examination has been started since October 9.**
- The survey on the exposure dose of all the residents in Fukushima Prefecture (approx. 2 million people) is still ongoing.

Progress of the "Roadmap for Immediate Actions for the Assistance of Residents Affected by the Nuclear Incident"

October 17, 2011
Nuclear Emergency Response Headquarters

The progress status of the "Roadmap for Immediate Actions for the Assistance of Residents Affected by the Nuclear Incident" decided on May 17 is as follows:

1. Efforts to support evacuees

(1) Providing of temporary access

- Concerning temporary access to the restricted areas, the second round of temporary access by private car in addition to the existing bus system has been ongoing, on the assumption of securing safety for the residents.
  * Results of the second round of temporary access (as of October 14):
  5,435 households; 12,448 people
  (number of granted temporary access by private car: 4,989 households)
- The Ministry of Environment and Fukushima Prefectural Government are working together to retrieve and protects pets, in conjunction with temporary access. As of August 26, arrangements to protect 302 dogs and 190 cats have been made. Since the second round of temporary access granted to residents, the requests from residents to protect their pets have been accepted at Sousou Public Health Office, and the activity to protect and collect pets is being taken based on their requests.

(2) Maintaining order in the evacuation areas

- On June 2, a "Special Security Team" (of approx. 300 individuals) was organized to maintain public safety in the 30km-radius zone of Fukushima Dai-ichi Nuclear Power Station (NPS) as well as the Deliberate Evacuation Areas, and is conducting patrols, questioning suspects, implementing movable checkpoints, etc.
- Additionally, to secure more peace of mind and safety for the residents through improved crime prevention in the Deliberative Evacuation Areas and previous Emergency-Prepared Areas in Case of Emergency, "Iitate Village Minders", consisting of the Iitate Village residents, was formed and began patrolling the village on June 6. The town of Kawamata's "Kawamata Regional Safety Patrol" began operating on June 20, the village of Katsurao's "Katsurao Special Watch Team" on June 21, and the town of Hirono's "Hirono Watch Patrol" on July 10. Ongoing patrols are

being conducted in these villages. In the village of Kawauchi, the "Kawauchi Village Regional Security Team" has newly started patrolling since September 30.

(3) Promptly obtaining emergency temporary housing and other related housing

- As of October 11, the construction of about 90%, or 15,787 units, has started (of these, the construction of about 90%, or 15,199 units, has been completed).
- There has been ongoing coordination of the relocation of affected residents into government employees' housing, employment promotion housing and local governmental public housing, etc. As of October 7, 2,073 households in Fukushima Prefecture had moved into their new houses or have been assigned housing (nationwide, 16,537 households have moved into their new houses or have been assigned housing).

(Note) Emergency temporary housing and other related housing include those for residents affected by the earthquake and tsunami.

(4) Implementation of Deliberate Evacuation

1) Progress status of Deliberate Evacuation

- Resident evacuation has been almost completed in the five municipalities that were wholly or partially designated as the Deliberate Evacuation Areas.
- As an exception to continuing business operations in Deliberate Evacuation Areas, on May 17, the Nuclear Emergency Response Headquarters informed Iitate Village and Kawamata Town which had applied for exceptions that, in case the municipality permits a business to continue operating on the basis of an exceptional reason, there should be no impediment provided that ample safety precautions are taken (8 businesses in Iitate Village and 2 in Kawamata Town are continuing operations on this basis).

2) Livestock relocation and other related issues

- In addition to providing necessary assistance such as identifying a relocation destination outside the area, there were notifications provided to Fukushima Prefecture on procedures and other related issues for livestock screening and decontamination.
- As of October 5, 126 cattle remain in the Deliberate Evacuation Area out of the approximately 9,300 heads subject to evacuation.

(5) Establishing "Specific Spots Recommended for Evacuation"

- Multiple spots, where the cumulative dose over a one-year period after the accident is estimated to exceed 20mSv, located in areas that are outside the Deliberate Evacuation Areas or Restricted Areas and do not show as much regional spread as the Deliberate Evacuation Areas, are designated as “Specific Spots Recommended for Evacuation”, to raise the residents’ awareness and to assist and promote evacuation. (On June 30, 104 spots (113 households) were designated in the city of Date, and on July 21 and August 3, 122 spots (131 households) were designated in the city of Minamisoma and 1 spot (1 household) in the village of Kawauchi.)

2. Efforts towards homecoming

(1) Review on evacuation areas and supports after lifting the designation for evacuation areas

- On September 30, the Nuclear Emergency Response Headquarters lifted the designation of Evacuation-Prepared Areas in case of Emergency.
- In cooperation with the Reconstruction Headquarters in response to the Great East Japan Earthquake and related ministries and agencies, prudential efforts are being made for residents’ homecoming by means of realizing the recovery plan of the affected five municipalities (Hirono Town, Naraha Town, Kawauchi Village, Tamura City, and Minamisoma City), decontaminating the areas where the designation was lifted, and so on.
- Taking into account the request from the affected municipalities, including the expansion and strengthening of monitoring in line with the Recovery Plan of the affected five municipalities which had been previously designated by the Evacuation-Prepared Areas in case of Emergency, the Support Team for Residents Affected by the Nuclear Incidents, the Ministry of Education, Culture, Sports, Science and Technology (MEXT), the Ministry of Environment, etc. are now carrying out in-depth monitoring mainly on the roads for living, the well water, rivers, etc. (the results will be officially announced around October to November, and around February in 2012).
- The Municipalities Reconstruction Support Team in response to the Nuclear Incident, which was established in the Reconstruction Headquarters in response to the Great East Japan Earthquake in order to always and promptly respond to various requests from the affected people, has been exchanging opinions with the affected municipalities.
- Concerning the subsidy for employment coordination, the business owners of private schools and hospitals whose major users are children and the care needed persons among the business owners with offices located in the previous Evacuation-Prepared Areas in case of Emergency were, on principle, not regarded as the grantees of the subsidy; however, it has been

decided that these business owners are also granted provided that their business has been reduced (including the prospects) after the day when the designation as the Evacuation-Prepared Area was lifted, and that a certain requirement is satisfied.

- With regard to the special measure on employment insurance (the measure the persons who are under suspension of business or temporarily out of employment can be granted with unemployment allowance), it has been decided that the measure will be continuously applied even after the day when the designation is lifted.
- Concerning the Restricted Areas and Deliberate Evacuation Areas, although the review will be conducted at the completion of Step 2, efforts will be made in advance for decontamination, monitoring, and reconstruction of the living environment.

(2) Efforts towards full-scale decontamination

- On August 26, the “Act on Special Measures concerning the Handling of Environment Pollution by Radioactive Materials Discharged by NPS Associated with the Tohoku District-Off the Pacific Ocean Earthquake that Occurred on March 11, 2011”, a lawmaker-initiated bill, was enacted by the Diet. As a result, work is underway for the legislation to come into effect on January 1, 2012, with the Ministry of Environment leading the initiative.
- The Nuclear Emergency Response Headquarters, determining that decontamination was an urgent matter for immediate action, put together “The Basic Concept for Pushing Ahead with Decontamination Works” and “Basic Policy for Emergency Response on Decontamination Works”, and established that thorough and ongoing decontamination would be carried out in partnership with relevant parties. Within the scope of this plan, areas whose annual exposure dose exceeds 20mSv will be targeted for dose reduction to under 20mSv, and areas whose exposure dose under 20mSv will also be targeted for reduction towards an estimated annual exposure dose of 1mSv, with cooperation of municipal governments and local residents. In addition, highest priority was given to thorough decontamination of the everyday environment of children, with an aim of reducing the estimated annual exposure dose towards 1mSv as soon as possible, and eventually undercutting that figure.
- In order to support efforts based on these policies, a Cabinet decision was made on September 9 to expend approximately JPY220 billion of the fund allocated to Great East Japan earthquake recovery and rebuilding for decontamination and organize a “Fukushima Decontamination Promotion Team” within the local off-site center.

- Given this decision, the Support Team for Residents Affected by the Nuclear Incident is preparing to take the decontamination work which has been conducted in advance as pilot projects in the cities of Date and Minamisoma since late August, and rapidly deploy them in all 12 municipalities subjected to evacuation orders.
- In Fukushima Prefecture and neighboring prefectures, sessions for related municipalities are being held to explain about "the Basic Policy for Emergency Decontamination Work" and "the Act on Special Measures concerning Handling of Radioactive Pollution."
- In addition, consecutive visits to each municipality and dispatch of experts have been started in order to support planning out the decontamination scheme by municipalities.
- With regard to contamination by radioactive materials, on August 25, the Cabinet Secretariat established the "Office of Response to Radioactive Materials Contamination" in order to ensure close partnership, and to carry out comprehensive coordination, among the relevant ministries and agencies, in terms of the regulations other responses necessary for decontamination of contaminated areas, rubble disposal, health management for the residents and preventing the spread of contamination.

[The basic approach to cleanup work (decontamination) in residential areas]

- On July 15, the Nuclear Emergency Response Headquarters put together "The Basic Approach to Cleanup Work (Decontamination) in Residential Areas (Except Restricted Area and Deliberate Evacuation Area) in Fukushima Prefecture", and notified Fukushima Prefecture and the Ministry of Environment of cautions to be taken when residents perform cleanup work, and the approach to the waste collected during cleanup.

[Decontamination of agricultural soil]

- In collaboration with Fukushima Prefecture, the Ministry of Agriculture, Forestry and Fisheries began verification testing on May 28 for the development of decontamination technology for agricultural soil. Based on tests conducted by the end of August, methods for decontaminating agricultural soil according to use classification and concentrations of contaminants were released to the public on September 14.
- On September 30, the Nuclear Emergency Response Headquarters officially announced appropriate methods for decontamination of agricultural soil based on the "Guidelines for Municipal Decontamination Work".

[Decontamination of forests]

- With regard to the investigations on the distribution status of radioactive materials in forests and verification tests on decontamination in forests, which the Forest and Forest Products Research Institute (an Incorporated Administrative Agency) has been conducting as the central body, the Ministry of Agriculture, Forestry and Fisheries officially announced on September 30 the results obtained so far, and the decontamination points in the forests near residential areas which have been determined based on these results.
- On September 30, the Nuclear Emergency Response Headquarters officially announced appropriate methods for decontamination of forests based on the “Guidelines for Municipal Decontamination Work”.

[Dose surveying for schoolyards and managing the soil]

- The Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Ministry of Health, Labor and Welfare (MHLW) set a goal of limiting every student’s annual exposure at schools to 1mSv, and allocation of financial support was decided for those schools with a schoolyard air dose rate of higher than 1mSv/hour that seek soil dose reduction measures (May 27, June 6). The support was also extended to communities outside Fukushima Prefecture (June 20).
- MEXT distributed approximately 1,800 cumulative dosimeters to every elementary and junior high school in Fukushima Prefecture. Cumulative dosimeter allocation was also approved for schools outside Fukushima Prefecture that request them, provided those institutions have a schoolyard air dose rate of higher than 1mSv/hour (June 20).
- The second supplementary budget included appropriations for dose reduction work on schoolyards and other locations, including those regions outside Fukushima Prefecture (approximately JPY4.5 billion through MEXT and JPY0.5 billion through MHLW) and (JPY18 billion out of JPY96.2 billion) for the aforementioned “Health Fund for Children and Adults Affected by the Nuclear Accident” created by Fukushima Prefecture, to be used for dose reduction projects for public facilities such as schools, parks, and school zones.
- In response to the Nuclear Emergency Response Headquarters’ “The Basic Policy for Emergency Response on Decontamination Works” and “Guidelines for Municipal Decontamination Work”, MEXT and MHLW sent out notices that the dose received by children at schools, day cares and other facilities was to be under 1mSv annually as a rule, the schoolyard air dose rate should be under 1μSv/hour in order to achieve this dose, and that spots with relatively high reading should be identified and

their decontamination started. The Ministries also informed Fukushima Prefecture of the future approach to dose reduction in child welfare facilities other than day cares (August 26).

(3) Review of revitalization and reconstruction of local communities

- On June 25, "Proposal for Reconstruction" was put together by the Reconstruction Design Council in Response to the Great East Japan Earthquake.
- With the enactment of the Basic Act on Great East Japan Earthquake Reconstruction (June 24), the Headquarters for the Reconstruction from the Great East Japan Earthquake and the Local Headquarters in Iwate, Miyagi and Fukushima Prefectures were established.
- Based on the above Act, a "Basic Policy on Reconstruction" was put together on July 29.
- Based on the above Basic Policy on Reconstruction, the Japanese government and Fukushima Prefecture established the "Council for Reconstructing Fukushima from the Nuclear Accident". In the first session on August 27, the topics for future exploration were organized such as the proposition of the Special Act on Reconstruction from Fukushima Prefecture, and in the second session on October 17, the governmental bill on the tertiary supplementary budget was reported.

3. Ensuring security and safety of affected residents

(1) Managing the long-term health of local residents (assessing radiation levels)

- More than 220,000 people have been screened in terms of body surface contamination as of October 1 (from March 13), with experts sent from related organizations, universities and local governments working under the supervision of Fukushima Prefecture. No cases of adverse health effects have been found to date.
- In light of request from Fukushima Prefecture, appropriations were made in the secondary supplementary budget for the "Health Fund for Children and Adults Affected by the Nuclear Accident" created by Fukushima Prefecture through mid- to long-term projects (JPY78.2 billion out of JPY96.2 billion in total).
- For the Health Management Survey for the Residents in Fukushima Prefecture which is implemented using the Health Fund, Fukushima Prefecture will conduct a basic survey to estimate exposure dose and an in-depth survey to grasp health conditions. A preliminary survey was initiated in the town of Namie, village of Iitate, and the Yamakiya ward of the town of Kawamata, where environmental monitoring results indicated a possibility of higher external and internal exposure relative to other

communities. The results of this preliminary survey will be taken into account, and questionnaires will be mailed to residents beyond these communities starting on August 26 (as of September 30, the questionnaires were mailed to approx. 400,000 people).

- Concerning the in-depth survey, mid- and long-term investigations are scheduled, including the ultrasonic thyroid examination for all residents in Fukushima Prefecture at and under the age of 18 at the time of the accident for early discovery of the thyroid cancer (started on October 9), the health checkup for the residents in evacuation areas with additional necessary checkup items in addition to the existing ones, the checkup opportunities to be newly given to the residents in the prefecture who were excluded from the existing checkups, the survey on mental health and lifestyle for the residents in evacuation areas, and the survey for pregnant women who were provided with a maternity passbook during the period from August 1, 2010 to July 31, 2011.
- Since June 27, the National Institute of Radiological Sciences (NIRS) has been evaluating methods for measuring internal contamination level using whole body counters and internal exposure level using urine bioassays and other means, with cooperation from 122 residents of those areas subject to the preliminary survey as well as 52 people who were evacuated out of the 20km zone soon after the accident.
- The Japan Atomic Energy Agency (JAEA) carried out an internal exposure survey by whole body counters, etc. for approx. 3,200 evacuees (Namie Town, Iitate Village, Kawamata Town) between July 11 and the end of August. In addition, since September, the survey has been conducted for approx. 5,300 people, by extending the target areas to towns and villages in Futaba County (except Namie Town).
- Fukushima Prefecture is now supporting the loan business of personal-use cumulative dosimeters (such as film badges) for children and pregnant women (approx. 300,000 people), and the municipalities which will implement the mental and physical health care business for children.

(2) Ongoing implementation of environmental monitoring (atmosphere, soil, rivers, ground water, seawater and seabed) and its evaluation

1) Implementation of ongoing environmental monitoring

- In order to implement radiation monitoring related to TEPCO's Fukushima NPS accident in a certain and deliberate manner, MEXT organized a Coordination Meeting for Monitoring to unify and coordinate the radiation monitoring work being conducted by the related ministries and agencies, local authorities and operators (1st round on July 4, 2nd round on August 2). The meeting resulted in the creation of a "Total

Monitoring Plan" on August 2, which lays out the content and role allotments for the monitoring to be conducted in partnership among the Japanese and local governments and other entities by the end of 2011.

- Regarding the Evacuation-Prepared Areas in case of Emergency, a child-centered perspective and the wishes of the community were emphasized in the monitoring of schools, hospitals, libraries, and their environs implemented by MEXT and the Support Team for Residents Affected by the Nuclear Incidents, and the results were officially announced on August 9, 16, and September 22. (The results were used as a reference data for lifting of the designation "Evacuation-Prepared Areas in case of Emergency.)
- Taking into account the request from the affected municipalities, including the expansion and strengthening of monitoring in line with the Recovery Plan of the affected five municipalities which had been previously designated by the Evacuation-Prepared Areas in case of Emergency, the Support Team for Residents Affected by the Nuclear Incidents, MEXT, the Ministry of Environment, etc. are now carrying out in-depth monitoring mainly on the roads for living, the well water, rivers, etc. (the results will be officially announced around October to November, and around February in 2012). (Re-posted)
- On September 1, the Support Team for Residents Affected by the Nuclear Incidents and MEXT officially announced the "Results of Wide-Area Monitoring in Restricted Areas and Deliberate Evacuation Areas".
- MEXT conducted aircraft radiation monitoring on a zone approximately 100km in radius around Fukushima Dai-ichi NPS over the Prefectures of Miyagi, Tochigi, Ibaraki, Yamagata, the western Fukushima, Gunma, Saitama, Chiba, Kanagawa, Niigata, Akita, as well as Tokyo Metropolitan Area, and published the results. Aircraft monitoring is currently being conducted over the Prefectures of Iwate, Shizuoka, Nagano, Yamanashi, Gifu, Toyama, Aomori, Aichi, and Ishikawa. Aircraft monitoring is scheduled to be implemented over the whole East Japan, aimed to be completed by the end of 2011.
- MEXT has updated the "Dose Rate Map" and "Accumulated Dose Estimation Map". (So far, updates have been released on April 26, May 16, June 3 and 21, July 20, August 19, and September 16.)

2) Creation of dose rate map and other maps

- Between June 6 and July 8, MEXT conducted air dose rate measurements and soil survey as a means of creating maps of radiation dose and other distributions all over Fukushima Prefecture and neighboring regions. An air dose map was released on August 2, a surface deposition map of radioactive cesium on August 30, and a surface deposition map of iodine 131 on September 21. In addition, a survey of migration of radioactive materials was conducted, and the study results on the migration of radioactive materials in forests were published on September 14. Furthermore, a nuclide analysis on plutonium and radioactive strontium was conducted and the result was announced on September 30.

- In terms of forests, the Ministry of Agriculture, Forestry and Fisheries is currently conducting air dose rate and soil survey of forests as a means of mapping the concentration distribution of radioactive materials by the end of February 2012.

3) Implementation of environmental monitoring on farm land

- The Ministry of Agriculture, Forestry and Fisheries began conducting a soil survey of farm land on May 30 as a means of mapping the distribution of radioactive materials concentration, and released the map on August 30.

4) Implementation of environmental monitoring offshore

- MEXT has expanded the target area for marine radiation monitoring off the coasts of Fukushima, Ibaraki and Miyagi, and will continue to conduct seawater and seabed soil measurements.
- The Ministry of Environment implemented radiation as well as hazardous materials monitoring off the coasts of Miyagi and Iwate prefectures.
- In terms of concentrations of radioactive materials in offshore seawater and seabed, MEXT and the Ministry of Environment released their survey results on October 5 and July 8, respectively.
- The Ministry of Environment implemented radiation as well as hazardous materials monitoring for public water basins (rivers) and groundwater in Fukushima Prefecture. The measurement results for concentrations of radioactive materials for public water basins were released on June 3 and August 1 (the measurement during high water levels following rainfall), and for groundwater on June 21 for 5 spots, on July 7 for 41 spots, on July 14 for 55 spots, and on August 4 for 10 spots.

5) Implementation of monitoring for radioactive materials in food and tap water

- Regarding radioactive materials in food and tap water, the relevant local governments are conducting ongoing examinations, and the results are being disclosed daily by the Government.

  (*) Of the 27,015 cases of examination for food, 675 cases exceeded the provisional regulation limit (as of October 3), and of 48,521 cases of examination for tap water, 69 cases exceeded the indicator values (as of

October 3). There have been no instances of tap water level exceeding the limit since March 30.

- The Consumer Affairs Agency will provide assistance to local governments for installing radiation dose inspection equipment for food through the “Funds to Improve Regional Consumer Policy” and existing subsidies for the operating costs of the National Consumer Affairs Center of Japan.

6) Others

- MEXT has been proceeding the procurement procedures necessary for strengthening the environmental monitoring in Fukushima Prefecture, such as building of real-time radiation monitoring systems and installing of transportable monitoring posts. In addition, MEXT is now under cooperation with relevant organizations to enhance the environmental monitoring nationwide, such as installing of additional monitoring posts in other prefectures and the maintenance of environmental sample analysis equipment (an additional appropriation of approximately JPY23.5 billion was made in the secondary supplementary budget, part of which is for the “Health Fund for Children and Adults Affected by the Nuclear Accident”).

(3) Disposal of rubble, sludge and other waste

[Disposal of rubble]

- On June 23, the Ministry of Environment finalized the disaster waste disposal policy for Fukushima Prefecture.
- The temporary storage method for incinerated ash of between 8,000Bq/kg and 100,000Bq/kg was organized, and the Ministry of Environment published “Temporary Storage of Disaster Waste Disposal in Fukushima Prefecture” on July 28.
- The handling of electric air cleaners and the monitoring frequency for incinerated ash and exhaust were organized, and the Ministry of Environment published “Incineration Facilities and Monitoring of Disaster Waste Disposal in Fukushima Prefecture” on August 9.
- A policy on the disposal method for incinerated ash and other waste of between 8,000Bq/kg and 100,000Bq/kg was announced by the Ministry of Environment on August 31, taking into account technology-oriented examination by the Review Meeting on Safety Assessment of Disaster Waste.

[Disposal of sludge and other waste]

- Radioactive materials have been detected from sewage sludge and other by-products outside Fukushima Prefecture, mostly in eastern Japan.

Consequently, on June 16, the Nuclear Emergency Response Headquarters put together a provisional policy regarding the handling of sludge and other byproducts of water and sewage treatment found to contain radioactive materials.

4. Ensuring employment and support for agriculture and industries

(1) Ensuring employment

- The Ministry of Economy, Trade and Industry (METI), the Ministry of Health, Labour and Welfare (MHLW) and Fukushima Prefecture have joined forces to expand job opportunities for, and offer management assistance to, residents and businesses affected by the nuclear incident, and are aiming to create 20,000 jobs in the prefecture through the following measures.
- To provide the affected people with employment opportunities, joint job fairs will be held in the prefecture with a target of 5 events by the end of 2011. (So far, three fairs have been held. A 4th fair is scheduled in the city of Koriyama on November 24.)
- A request was made jointly by METI, MHLW and Fukushima Prefecture to 26 economic organizations in manufacturing, retail and other sectors to maintain or create job opportunities in light of the Fukushima NPS accident (May 26).
- A plan to hire 11,000 people in Fukushima Prefecture has been arranged by the Job Creation Fund Programs, and of these, 6,769 people have already secured jobs (according to the data processed by MHLW as of September 29).
- Limited to the New Graduate Employment Support Project (Internship Project) held in Fukushima Prefecture, matching of new graduates and smaller businesses is now being proceeded under the condition of more relaxed requirements than before during the practice period at work places.

(2) Agricultural, livestock and fishery industries, etc.

- To ensure swift and appropriate processing of compensation for damages to the business operators in agricultural, forestry and fishery industries, liaison conferences were held (a total of 7 since April 18) by the Ministry of Agriculture, Forestry and Fisheries, the prefectures and cities involved and other relevant parties (190 organizations as of September 29) to offer information and exchange views regarding the development in nuclear damage compensation.
- In response to the identification of cesium exceeding provisional limits in beef and rice straw, emergency support measures were issued on July 26,

namely 1) measures to restore trust in domestic beef, 2) assistance to beef cattle ranchers, and 3) assistance to enable emergency supply of rice straw. On August 5, given that there are now 4 prefectures subject to shipping restrictions, new measures were announced, including support for the de-facto purchase of shipping-delayed cattle by prefectural livestock industry associations.

- In terms of rice, the Nuclear Emergency Response Headquarters issued instructions on April 22 to refrain from planting in Restricted Areas, Deliberate Evacuation Areas and Evacuation-Prepared Areas in Case of Emergency. In addition, 2-stage radiation surveys were conducted on the rice before and after harvest, in those municipalities outside the above and showing high soil concentration of radioactive materials.
- Bridge loans are being offered by Japan Agricultural Cooperatives (JA) and Japan Fisheries Co-operatives (JF) groups to support those business operators in agricultural, forestry and fishery industries subjected to shipment suspension, and approximately 630 loans have been made as of September 20 (approx. JPY2.2 billion).

(3) Measures for small and medium enterprises

- The new long-term, low-interest (some no-interest for all intents and purposes) loan system "The Great East Japan Earthquake Special Recovery Loans" for small- and mid-sized companies that saw significant direct or indirect damage from the disaster, including via the nuclear incident or harmful rumors, and the new guarantor system "The Great East Japan Earthquake Emergency Guarantee for Recovery", which establishes a new framework completely separated from the existing guarantor system, began operating on May 23. Between May 23 and October 7, "The Great East Japan Earthquake Special Recovery Loans" served 92,298 cases totaling JPY2.85 trillion, and "The Great East Japan Earthquake Emergency Guarantee for Recovery" served 55,571 cases totaling JPY1.38 trillion.
- For small and medium enterprise owners with their places of business in the restricted area who were therefore forced to relocate to new premises, METI and Fukushima Prefecture agreed on a system of special support to provide them with long-term, no-collateral, no-interest loans independent of regular funding support. The program began accepting applications on June 1 at Fukushima Prefectural Industrial Revitalization Center as well as chamber of commerce offices throughout the prefecture. There have been 343 applications, for a total of approximately JPY7.8 billion (as of October 12).
- For small- and medium-sized businesses whose places of work are located

in the Evacuation-Prepared Areas in Case of Emergency, METI and Fukushima Prefecture have made a basic agreement on providing new loans which are required for continuing and restarting businesses in these areas after the designation was lifted. Discussions are now being made towards planning of a system.

- Regarding the restoration projects for temporary storefronts and plants (taken in the primary and secondary supplementary budgets) by the Organization for Small & Medium Enterprises and Regional Innovation, the organization received restoration requests from 35 locations in 16 cities, towns, and villages in Fukushima as of October 6. Works were consequently initiated in 23 locations where a basic agreement was finalized: Iwaki City (2 locations), Shinchi Town (2 locations), Bandai Town (1 location), Minamisoma City (3 locations), Soma City (2 locations), Koori Town (1 location), Iitate Village (5 locations), Naraha Town (1 location), Fukushima City (1 location), Namie Town (4 locations), Okuma Town (1 location), Katsurao Village (3 locations). Of these, works have been completed in a total of 13 locations in Iwaki City, Shinchi Town (2 locations), Minamisoma City (2 locations), Soma City (2 locations), Koori City, Fukushima City, Iitate Village (2 locations), and Okuma Town. Ongoing requests for appropriation on this business are also made in the tertiary supplementary budget.
- Concerning the Restoration Assistance Business for Small and Medium Enterprises, Groups and Facilities to support recovering the facilities and equipment owned by core small and medium enterprises in the regions, offers were made for public applications in Fukushima Prefecture from September 5 to 22, and the applications are now under review. Ongoing requests for appropriations are still made in the 2012 initial budget, so that the business will be continuously implemented.
- JETRO, in cooperation with the Organization for Small & Medium Enterprises and Regional Innovation, has extended assistances for measures such as participating in exhibitions at home and abroad, holding business meetings by inviting overseas buyers, and dispatching trade missions to open overseas sales channels, with an aim of predominantly supporting small and medium businesses in Tohoku District for their overseas business deployment (JPY1.98 billion in the secondary supplementary budget and request is being made for appropriation of the tertiary supplementary budget).

(4) Countermeasures against harmful rumors and export assistance
<Agriculture, livestock and fisheries>

- In conjunction with the “Recovery Action” campaign and as a way to assist in promoting consumption of agricultural and fisheries product from the affected areas (catchphrase: "Show Your Support – Eat!"), PR is being conducted in the form of newspaper advertisements and television commercials (scheduled to be aired 800 times by the end of this year), as well as information release about private-sector events that support this effort through the Ministry of Agriculture, Forestry and Fisheries Web site (168 releases as of September 30).

- For domestic export-related business operators, a spectrum of responses is being implemented such as disseminating information regarding regulations on Japanese food products on a country-by-country basis, readying a contact office to advise affected companies individually and organizing a system for issuing certificates to the countries that demand certificates of origin for products.
- For alcoholic beverages, the Regional Taxation Bureau handles the issuing of export certificates, and has been issuing the certificates for production date and place of origin for alcoholic beverages exported to the EU and Asia since April. A radiological analysis system was also organized, and from June on, the Bureau has also been handling the issuance of certificates linked to radiological analysis. Furthermore, since October, the Bureau is making efforts, in cooperation with the National Research Institute of Brewing, to provide brewers with technical information and to investigate radioactive materials for the alcoholic beverages prior to shipment stored in breweries, anticipating ensuring safety for alcoholic beverages.
- To respond to other nations' demands for radiological inspection of food of Japanese origin, support is being provided for deployment of inspection equipment. At the same time, information is being actively disseminated so that trust in Japanese food can be regained.

<Manufacturing and retailing>

- In terms of fee subsidization for radiation dose inspection of export items conducted by government-designated inspection organizations, these entities were designated and officially announced on June 7 by METI. On June 20, the subsidization for radiation dose inspection was initiated for exporters. The scope of assistance was expanded to inspections of export containers applied for by shipping companies, and the operation began on September 8.
- The relevant ministries and agencies, overseas diplomatic missions and Japan External Trade Organization's (JETRO) overseas offices are working together to hold information sessions for foreign industries in major cities (15 cities in 12 nations and regions), on the nuclear accident

and domestic monitoring as well as Japan's efforts on securing safety of food and mining/manufacturing products since the accident. Information sessions have also been held domestically (3 in Tokyo, 3 in Osaka) for foreign-affiliated firms as well as consulates and international organizations based in Kansai.

- Country-by-country information such as export restrictions and radiological inspections are being provided to businesses on the official METI and JETRO Web sites. JETRO's urgent help desk, 36 trade information centers nationwide and 73 overseas offices worldwide are also advising businesses.

<Tourism>

- Dissemination of accurate and timely information is ongoing, including exhibitor booths at travel expos and through overseas diplomatic missions.

(5) Other actions

1) Assistance to regional financing

- In addition to maintaining and strengthening financial functions in the affected areas overall, an amendment bill for the Financial Function Reinforcement Law was submitted to the Diet on May 27 addressing the content of relaxing the requirements for capital participation by the Government, in order to establish in advance a framework to provide reassurances to depositors. The law was passed on June 22, and went into effect on July 27.

2) Proper information release to consumers

- As a risk communication, the Consumer Affairs Agency held 2 opinion exchange sessions in August on the topic of radiation and food safety, with participation from both experts and consumers at large. In cooperation with local governments and consumer groups, information will continue to be shared with consumers nationwide and opinion exchange sessions will be held, taking these events into account.
- The Consumer Affairs Agency created "Q&A about Food Products and Radioactivity" (to be revised as needed), a clear and accessible guide to radioactivity and safety of food and other related products, currently available through the Agency Web site.

5. Support for affected local governments

(1) Support for affected local governments

- With regard to an existing fund endowed by the power plant siting subsidy, the initial objective was modified to enable utilization in projects geared towards disaster recovery and rebuilding, leading to use for 12 projects totaling approximately JPY3.1 billion. It was also decided that should an application be submitted from a local authority of an affected area that is also eligible for the plant siting subsidy, a payout could take place in April rather than June, the usual month. An estimated JPY 700 million has been paid out as a result. The subsidy application deadline has also been extended from the usual end of May to end of July.

(2) Support for municipalities accepting evacuees

- Due to the effects of the nuclear power station accident as a result of the Great East Japan Earthquake, a large number of residents were forced to evacuate, or even relocate, to areas outside of their municipalities. In order to respond to this situation, The bill for "Law on Measures Involving Residents with a Change of Address and Special Exemption from Administrative Processing of Evacuees, as a Means of Coping with the Nuclear Power Plant Accident Resulting from the Great East Japan Earthquake" was submitted to the Diet on July 22, passed on August 5 and came into effect on August 12. The new law established an exemption where administrative processes for evacuated residents could be performed by the government of the receiving municipality, and determined measures relating to those undergoing a change of address.
- The municipalities designated and notified under the law on September 16 include Iwaki City, Tamura City, Minamisoma City, Kawamata Town, Hirono Town, Naraha Town, Tomioka Town, Okuma Town, Futaba Town, Namie Town, Kawauchi Village, Katsurao Village, and Iitate Village.

6. Compensation for affected residents, business operators and others

(1) Regarding the guidelines established by the Dispute Reconciliation Committee for Nuclear Damage Compensation

- The Dispute Reconciliation Committee for Nuclear Damage Compensation prioritizes rapid aid to those who suffered damage, and set the guidelines starting with those cases deemed the most urgent and likely to fit the definition of a nuclear damage, such as government-ordered evacuations and shipping restrictions. To date, it has issued "The First Guideline Regarding the Judgment of the Scope of Nuclear Damage Due to TEPCO's Fukushima Dai-ichi and Dai-ni NPS Accident" (4/28), the Second Guideline (5/31) and the Supplement to the Second Guideline (6/20). In addition, it has established a Midterm Guideline (8/5) that adds items for consideration to the content already established and released as above, to present the big picture of the extent of the nuclear damage.
- In enabling rapid compensation payout by TEPCO, the government will likely see multiple disputes as well as payout of indemnity (JPY120 billion)

according to the nuclear damage compensation insurance contract. The second supplemental budget proposal includes expenses for organizing a framework for rapid resolution to these.

- On August 29, the Dispute Reconciliation Center for Nuclear Damage Compensation was launched. The Center, which seeks to resolve disputes related to the nuclear accident by acting as a mediator between the parties involved, began accepting applications on September 1, and opened a Fukushima Office in Koriyama on September 13.

(2) Damage compensation for residents, business operators and others

- In April, Tokyo Electric Power Company (TEPCO) began provisional compensation payments on a household basis to residents forced to evacuate according to instructions based on the Act on Special Measures Concerning Nuclear Emergency Preparedness, and approximately JPY 52.3 billion have been paid out to 56,000 households (as of October 3). On July 5, TEPCO announced additional provisional compensation payout. (The payout was on individual basis, ranging from JPY100,000 to 300,000 per person depending on the circumstances and duration of their evacuation and other damage) Payments began on July 25, and to date, approximately JPY4.34 billion have been paid out to approximately 160,000 people (as of October 3).
- With regard to agricultural, forestry and fishery business operators, TEPCO and the trade associations involved met to work towards a prompt payout in the light of the May 12 establishment of "Emergency Support Measures for Residents Affected by the Nuclear Accident". Actual payout began on May 31, and to date, approximately JPY19.4 billion (plus approximately JPY400 million in individually-sought claims, for a total of JPY19.8 billion as of October 3) have been paid out to agricultural associations in 7 prefectures (Fukushima, Ibaraki, Gunma, Tochigi, Chiba, Kanagawa, and Saitama) as well as fishery associations in 3 prefectures (Fukushima, Ibaraki and Chiba).
- With regard to small and medium enterprises, on May 31, TEPCO announced the concrete framework for provisional compensation payment including the scope and method of the payment, and began actual payout on June 10. Approximately 7,200 companies have received payment totaling approximately JPY8.3 billion (as of October 3).
- On August 30, TEPCO announced the policies and standards for full-scale compensation. Applications for compensation have been accepted from September 12 for individuals, and from September 27 for corporations and operators. TEPCO has also taken organizational steps to prepare for implementation of full compensation, including personnel increase. It aims

to expand the staff from 1,200 (before September 30) to 6,500 (after October 1).

- Full-scale payouts have been started on October 5.

(3) "Act on the Nuclear Damage Compensation Facilitation Corporation" and "Act on Emergency Measures Related to the Damage Due to the 2011 Nuclear Accident"

- In order to ensure 1) an implementation of prompt and appropriate compensation for damages, 2) an avoidance of adverse effects on business operators involved in NPS stabilization and incident management, 3) a stable supply of electricity essential for everyday life of the nation, as 3 defining components of the Government's support framework for compensation for nuclear damages caused by the accident at TEPCO's Fukushima NPS, the Cabinet decided on the draft bill for the Act on the Nuclear Damage Compensation Facilitation Corporation on June 14, and submitted it to the Diet. The law was enacted on August 3. The Corporation was established on September 12, and after the inauguration ceremony on September 26, full-scale operation has been started.
- On July 29, "Act on Emergency Measures Related to the Damage Due to the 2011 Nuclear Accident" was enacted as an emergency measure. This legislation establishes the particulars needed for rapid and appropriate payment of provisional payouts by the government to compensate for the damages of nuclear accident, as well as for assisting local authorities that will establish an emergency response fund for nuclear damage. The law came into effect on September 18, along with other related government and ministerial ordinances, and claims for provisional payout have been accepted from September 21.

Basic Policy for Emergency Response on Decontamination Work

August 26, 2011
Nuclear Emergency Response Headquarters

1. Purposes of this policy

1) To eliminate anxieties about radioactive contamination resulting from the accident at TEPCO's Fukushima Dai-ichi Nuclear Power Station as early as possible, the national government intends to take responsibility for eliminating radioactive contamination by working with prefectural and municipal governments and local residents.

2) Currently, lawmakers are deliberating the bill "Bill on Special Measures on Environmental Contamination due to Radioactive Materials Emitted from Nuclear Power Station Accident Caused by the Tohoku district - off the Pacific Ocean Earthquake on March 11, 2011" in the Diet. If this bill is passed in the Diet, the government will systematically and drastically push ahead with decontamination work in line with the framework as set forth in said legislation.
On the other hand, since it is necessary to carefully designate applicable locations or develop technical standards before putting said legislation into practice, it will take a certain period of time for the government to begin drastic decontamination work based on said legislation.

3) Nonetheless, decontamination is an urgent task that should be addressed immediately. Before a new framework for decontamination work becomes operational in accordance with said legislation, the Nuclear Emergency Response Headquarters will clearly describe the basic principles of emergency decontamination services and intends to eliminate radioactive contamination in collaboration with prefectural and municipal governments and local residents.

4) The basic principles described herein are consistent with the purposes of said legislation bill and will be replaced with the new framework when the new legislation is passed in the Diet and comes into effect.

2. Interim targets for decontamination work

1) In line with the 2007 basic recommendations of the International Commission on Radiological Protection (ICRP) and "Basic Policy"[1] suggested by the Nuclear Safety Commission, the government aims at quickly phasing out locations with emergency exposure situations[2] (i.e., additional exposure dose[3] is 20 mSv a year or more, according to the current practices).
2) As a long-term target, the government aims at reducing the additional exposure dose to 1 mSv a year in areas with existing exposure situations[4] (areas where the additional exposure dose is 20 mSv a year or less, according to the current practices).
3) As a specific target for decontamination work, the government aims to reduce the estimated annual exposure dose for the general public by approximately 50% at radiation-contaminated areas within two years at the latest.

   According to the estimate of Nuclear Emergency Response Headquarters, annual exposure dose is expected to decrease by about 40% in two years from the current level because of physical attenuation of radioactive materials as well as natural attenuation due to wind and weather (i.e. weathering effect).

   With decontamination work reducing the exposure dose by approximately 10% at least, the government will attain the aforementioned 50% reduction target and aims to further reduce the exposure dose.
4) In addition, as radiation will pose larger negative impacts on children than adults, it is important to restore a safe environment where children are able to live their lives without worry. In this context, by thoroughly conducting decontamination work in places that children frequent, such

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[1] Nuclear Safety Commission, "Basic Policy of the Nuclear Safety Commission of Japan on Radiation Protection for Termination of Evacuation and Reconstruction," July 19, 2011

[2] "Emergency exposure situation" means that emergency action is necessary to avoid or mitigate undesirable impacts at the time of a nuclear accident or radiological emergency.

[3] "Additional exposure dose" means the exposure dose excluding natural exposure dose and medical-purpose exposure dose.

[4] The term "existing exposure situation" means that radiation exposure already exists, including long-term radiation exposure after an emergency, at the time that making management-related decisions becomes necessary.

as schools or parks, in the next two years, the government aims at reducing the estimated annual exposure dose for children by approximately 60% in two years at the latest.[5]

According to the estimate of Nuclear Emergency Response Headquarters, annual exposure dose for children is estimated to decrease by about 40% in two years from the current level due to physical attenuation of radioactive materials as well as natural attenuation due to wind and weather (i.e., weathering effect).

With decontamination work reducing the exposure dose by approximately 20% at least, the government will attain the aforementioned 60% reduction target and aims to further reduce the exposure dose.

5) The government has set the aforementioned interim targets based on the limited information available because it recognizes the necessity to conduct decontamination work immediately. From now on, it will closely look into these targets and reexamine them at regular intervals through detailed monitoring, data accumulation, actual surveys on exposure doses for children, and decontamination model projects.

3. How to proceed with decontamination work

(1) Basic concept

(a) The national government takes responsibility for proceeding with decontamination work.

(b) To create an appropriate environment for safer and more efficient decontamination work, the national government will provide further assistance, including implementing fiscal policies, enhancing and operating efficient decontamination/measuring equipment, fostering human resources and sending experts.

In addition, the national government will, through model projects in local areas including locations with particularly high radiation dose, continuously provide support, such as technical information, necessary for decontamination work ("Decontamination technology catalogue"), including effective decontamination methods, costs or matters for

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[5] This is calculated for the location that would have a current air dose rate of 3.8 micro Sv/h (accumulative exposure dose of 20 mSv a year). If decontamination work is already done beforehand, target achievement will be evaluated through comparison with the pre-decontamination level.

consideration.

(c) The national government will take responsibility for treating radiation-contaminated soil arising from decontamination work.

(d) When pushing ahead with the aforementioned projects, the national government will work and cooperate with the international community and mobilize expertise from both at home and abroad.

(2) Appropriate local actions in line with radiation dose levels

(a) Areas under evacuation directives

1) If you live in an area designated with an evacuation directive (Deliberate Evacuation Area) because the cumulative dosage might exceed 20 mSv within a year of the nuclear accident, decontamination work will require high-level technologies and considerable attention to the safety of decontamination workers. For this reason, until local residents return home after lifting the evacuation directive, the national government will take the initiative in decontamination work in collaboration with prefectural and municipal governments.

2) In locations designated as Restricted Areas, local governments have been relocated, and access to such locations is prohibited. For this reason, until local residents return home after lifting the evacuation directive, the national government will take the initiative in decontamination work in collaboration with prefectural and municipal governments.

On the other hand, municipalities in these areas are permitted to develop their own decontamination plans and conduct decontamination work on their own if they wish to do so, as long as they are able to ensure the safely of workers and efficacy of the decontamination work. In this case, the national government will provide all-out fiscal support or provide experts to aid those efforts.

3) In locations where the additional exposure dose significantly exceeds 20 mSv a year, the national government will work on decontamination model projects to present effective and efficient decontamination techniques and

safety programs for decontamination workers in high-level exposure areas.

(b) Other areas where the additional exposure dose ranges from 1 to 20 mSv a year

1) If the additional exposure dose stands at 20 mSv a year or less, it is contaminated with radioactive materials, but the municipality is still able to work, and local residents are able to live there. In this case, systematic decontamination work on a community-wide basis would be the most effective solution because the community grasps the local situation and residents' needs.

2) Municipalities will develop their decontamination plans suitable to their contamination status or residents' needs in accordance with the "Guidelines for Municipality's Decontamination Work." The national government will assist in ensuring the smooth operation of such decontamination efforts.

If a municipality develops its decontamination plan including decontamination work at a public facility managed by another entity, it is desirable that the municipality will work with such other entity in managing the public facility.

[Important points in decontamination plans]
1. Setting appropriate targets
2. Deciding on appropriate policies and methods for each decontamination project
3. Responsible organization
4. Setting aside temporary storage space

3) If radioactive dose stands at a relatively higher level from 1 mSv to 20 mSv a year, multi-phase decontamination work will be necessary for improving contaminated conditions.

On the other hand, if the radioactive dose stands at a relatively low level, multi-phase decontamination work is basically unnecessary due to physical attenuation of radioactive materials as well as natural attenuation due to wind and weather (i.e., weathering effect). However, it is important to eliminate contamination at locations that locally show high radiation dosage, such as side ditches or rain water gutters.

The national government will provide all-out support when municipalities develop or conduct their decontamination plans. To be more specific, the national government will provide support suitable to individual municipality's needs. These support services will include sending experts, providing fiscal support, giving local residents information on monitoring results or important considerations in decontamination work, and providing measuring equipment.

4) If a prefectural or the national government manages a public facility, it will work closely with the relevant municipality to conduct decontamination work on the public facility in accordance with the decontamination plan developed by the relevant municipality.

(c) Locations where the additional exposure dose is generally 1 mSv or less

1) If the radiation dosage is generally 1 mSv a year or less, multi-phase decontamination work is basically unnecessary on a municipality basis because of physical attenuation of radioactive materials as well as natural attenuation due to wind and weather (i.e., weathering effect).

2) On the other hand, since side ditches, rain water gutters or some other locations locally tend to show a higher radiation dosage, the national government will work with prefectural governments and municipalities to provide necessary support so that local residents or other stakeholders will be able to safely, effectively and efficiently conduct decontamination work.

4. Treating soil, etc. arising from decontamination work

1) For smoother and quicker decontamination work, it is absolutely necessary to treat soil arising from decontamination work as well as local rice straw, farmyard compost or debris.

2) In relation to such treatment of soil, etc., the national government will take responsibility for allocating repository sites that require long-term management services as well as providing safety at these repository sites. It will develop and disclose a roadmap for constructing repository sites as soon as possible.
3) However, since such a drastic solution will require a certain period of time for securing and developing repository sites of a certain size, and simply waiting for the establishment of repository sites might prevent quick decontamination services.
4) For this reason, it would be more realistic that municipalities or local communities have designated temporary repository sites for soil resulting from decontamination work. The national government will provide fiscal and technical assistance for these municipal projects.

5. Prefecture's cooperation

1) When municipalities develop and conduct their decontamination plans, prefectural government should act as a cross-sectional coordinator as necessary.

2) In addition, prefectural governments should work with the national government to provide information, such as monitoring results or important considerations for residents' daily lives, and to provide an appropriate environment, such as providing measuring equipment, so that local residents will be able to efficiently and effectively conduct decontamination work.

Outline of the Act on Special Measures concerning the Handling of Environment Pollution by Radioactive Materials Discharged by the Nuclear Power Station Accident Associated with the Tohoku District – Off the Pacific Ocean Earthquake that Occurred on March 11, 2011

Purpose

The purpose of this Act is to promptly reduce the impact of environment pollution on human health and living environment caused by radioactive materials by instituting measures of the national government, local governments, the relevant nuclear operator etc.

Roles of Stakeholders

○ The national government shall implement necessary measures in consideration of its social responsibilities associated with the promotional efforts thus far channeled into its nuclear energy policy.
○ Local governments shall carry out their proper role in support of measures by the national government.
○ The relevant nuclear operator shall implement necessary measures in good faith, while cooperating with the national and local governments to implement the measures they have adopted.

Institutions

Basic principles

The Minister of the Environment develops a draft of the basic principles regarding the handling of the environment pollution caused by radioactive materials, and requests a resolution at a Cabinet Meeting.

Standards

The Minister of the Environment shall set standards for the decontamination and disposal of waste, soil, etc., contaminated by radioactive materials.

Monitoring and measurement

The national government promptly prepares and implements a system of unified monitoring and measurement to figure out the situation of the environment pollution.

Disposal of wastes contaminated by radioactive materials

(1) The Minister of the Environment designates areas where wastes may be contaminated by radioactive materials, to such a degree that special control is required.

(2) The Minister of the Environment develops a plan regarding disposal, etc. of wastes in the area of (1).

(3) The Minister of the Environment designates wastes which are located outside the area of (1) and whose state of contamination by radioactive materials exceeds a certain level.

(4) Disposal of the wastes in the area of (1) and the waste designated as (3) (specified waste) is carried out by the national government on the basis of the standard.

(5) As for the disposal of waste with low levels of contamination except those of (4), the regulation of the Waste Management and Public Cleansing Law is adapted.

(6) The unauthorized dumping of waste designated under (4) shall be prohibited.

Measures for decontamination of soils, etc. (including vegetation, structures) contaminated by radioactive materials

(1) The Minister of the Environment, giving due consideration to the degree of contamination, designates areas where it is necessary for the national governments to carry out measures for decontamination, etc.

(2) The Minister of the Environment develops a plan to carry out these measures for decontamination, etc. in the area of (1), and the national government carries out the measures.

(3) The Minister of the Environment designates areas (city, town, village etc.) other than (1) where states of contamination are expected not to conform to requirements.

(4) As for zones recognized as not conforming to the requirements through an investigation on the state of contamination in the area of (3), the governor of the prefecture (*), develops plans designating matters regarding the measures for decontamination, etc.

(5) Based on the plans of (4), the national government, the governor of the prefecture, the mayor of the municipality, etc. carry out measures for decontamination, etc.

(6) The national government implements measures in place of the prefectural governor, or city, town or village when necessary.

(7) The unauthorized dumping of contaminated soil shall be prohibited.

* Including the mayor of the municipality designated by Cabinet Order.

* The relevant nuclear operator shall take necessary measures on decontamination and disposal of on-site waste and soil as well as any rubble from reactor facilities that has been dispersed beyond the site.

Facilitation of the disposal of specified waste or the contaminated waste and soil, etc.

The national government shall take necessary measures aided by the relevant local government to properly promote measures on decontamination and disposal of waste and soil polluted by radioactive materials, including the establishment of necessary facilities.

Financial resources

○ The national government shall take measures to finance the costs required for the promotion of measures to deal with contamination by radioactive materials.
○ Measures taken pursuant to this Act shall be considered to be related to damage to be compensated under the Act on Compensation for Nuclear Damage, and are thus to be implemented at the expense of the relevant nuclear operator.
○ Taking its social responsibility into account, the national government shall implement necessary measures to ensure that the relevant nuclear operator makes timely payments to cover the cost of measures taken by local governments etc. under this Act.

Review clauses

○ In three years from the enforcement of this Act, the status of enforcement shall be reviewed and necessary measures shall be taken.
○ The environmental laws concerning radioactive materials shall be reviewed.
○ Necessary measures shall be considered on the nuclear reactors etc. of the concerned nuclear power station accident.