

Section L Annexes

L1 Inventory of spent fuel

Nuclear operators and facilities		Inventory (t)	Stored spent fuel
The Japan Atomic Power Co.	Tokai-No.2 Power Station	320	Uranium oxide fuel assemblies
	Tsuruga Power Station	560	
Hokkaido Electric Power Co., Inc.	Tomari Power Station	330	
Tohoku Electric Power Co., Inc.	Higashidori Nuclear Power Station	10	
	Onagawa Nuclear Power Station	340	
Tokyo Electric Power Co., Inc.	Fukushima Daiichi Nuclear Power Station	1,580	
	Fukushima Daini Nuclear Power Station	980	
	Kashiwazaki Kariwa Nuclear Power Station	2,140	
Chubu Electric Power Co., Inc.	Hamaoka Nuclear Power Station	840	
Hokuriku Electric Power Co., Inc.	Shika Nuclear Power Station	100	
The Kansai Electric Power Co., Inc.	Mihama Power Station	290	
	Ohi Power Station	1,200	
	Takahama Power Station	1,090	
The Chugoku Electric Power Co., Inc.	Shimane Nuclear Power Station	360	
Shikoku Electric Power Co., Inc.	Ikata Power Station	520	
Kyushu Electric Power Co., Inc.	Genkai Nuclear Power Station	760	
	Sendai Nuclear Power Station	770	
Japan Atomic Energy Agency	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
Japan Nuclear Fuel Limited	Rokkasho Reprocessing Plant	2,535	Uranium oxide fuel assemblies
Total		14,870	

L2 Inventory of radioactive waste

L2.1 High level radioactive waste

Facility		Vitrified waste (number of containers*)	High level liquid waste
Japan Atomic Energy Agency	Reprocessing facility	247	404 m ³
Japan Nuclear Fuel Limited	Reprocessing facility	57	0
	Waste Storage Facility	1,310	0

* : 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)
The Japan Atomic Power Co.	Tokai- Power Station	0	0	1393	1,393
	Tokai-No.2 Power Station	230	158	51,538	51,926
	Tsuruga Power Station	2,716	174	62,231	65,121
Hokkaido Electric Power Co., Inc.	Tomari Power Station	1,020	0	4,735	5,755

Tohoku Electric Power Co., Inc	Onagawa Nuclear Power Station	2,792	0	22,516	25,308
	Higashidori Nuclear Power Station	0	0	2,524	2,524
Tokyo Electric Power Co., Inc.	Fukushima Daiichi Nuclear Power Station	13,680	4,089	161,524	179,293
	Fukushima Daini Nuclear Power Station	599	2,603	14,716	17,918
	Kashiwazaki Kariwa Nuclear Power Station	0	0	22,378	22,378
Chubu Electric Power Co., Inc	Hamaoka Nuclear Power Station	3,295	1,116	31,627	36,038
Hokuriku Electric Power Co., Inc.	Shika Nuclear Power Station	8	440	3,836	4,284
The Kansai Electric Power Co., Inc.	Mihama Power Station	2,196	1,066	23,919	27,181
	Takahama Power Station	4,669	0	35,108	39,777
	Ohi Power Station	3,207	2,409	19,621	25,237
The Chugoku Electric Power Co., Inc.	Shimane Nuclear Power Station	239	833	26,327	27,399
Shikoku Electric Power Co., Inc.	Ikata Power Station	1,577	0	26,444	28,021
Kyushu Electric Power Co., Inc.	Genkai Nuclear Power Station	3,550	0	25,666	29,216
	Sendai Nuclear Power Station	2,131	0	11,751	13,882
Japan Atomic Energy Agency	Reactor Decommissioning R&D Center	2,016	0	16,890	18,906
	Prototype Fast Breeder Reactor "Monju"	20	0	3,592	3,612

Inventories are in the number of 200 liter drums (or converted into number of drums for miscellaneous solid).

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 Nuclear Power Station	4

3. Control rod, channel box, etc.

Power station		Control rod (number)*	Channel box (number)	Others (m ³)	Resin, etc. (m ³)
The Japan Atomic Power Co.	Tokai- Power Station	91 m ³	0	1,310	60
	Tokai-No.2 Power Station	235	3,248	14	874
	Tsuruga Power Station Unit 1	165	1,893	47	825
	Tsuruga Power Station Unit 2	346	0	0	80
Hokkaido Electric Power Co., Inc.	Tomari Power Station	270	0	0	75
Tohoku Electric Power Co., Inc	Onagawa Nuclear Power Station	110	2,610	1	433
	Higashidori Nuclear Power Station		78	0	23
Tokyo Electric Power Co., Inc.	Fukushima Daiichi Nuclear Power Station	1,175	19,871	182	3,579
	Fukushima Daini Nuclear Power Station	561	8,287	32	4,714
	Kashiwazaki Kariwa Nuclear Power Station	616	12,044	0	2,261
Chubu Electric Power Co., Inc	Hamaoka Nuclear Power Station	437	9,301	23	2,564
Hokuriku Electric Power Co., Inc.	Shika Nuclear Power Station	35	731	0	103
The Kansai Electric Power Co., Inc.	Mihama Power Station	676	0	0	110
	Takahama Power Station	1,320	0	0	111
	Ohi Power Station	1,085	0	0	105
The Chugoku Electric Power Co., Inc.	Shimane Nuclear Power Station	220	4,210	56	820

Shikoku Electric Power Co., Inc.	Ikata Power Station	633	0	0	139
Kyushu Electric Power Co., Inc.	Genkai Nuclear Power Station	691	0	0	150
	Sendai Nuclear Power Station	412			128
		Control rod (number)	Neutron detector (number)	Others (number)	Resin, etc. (m ³)
Japan Atomic Energy Agency	Reactor Decommissioning R&D Center	5	102	0	216
		Control rod drive mechanism guide tube, etc. (number)			
Japan Atomic Energy Agency	Prototype Fast Breeder Reactor "Monju"	5			

* For other than Tokai Power Station.

L2.3 Long-lived low heat generation radioactive waste

Facility		Drum (drums)	Bituminized solid (drums)	Plastic solid (drums)	Other waste (drums)	Total (drums)
Japan Atomic Energy Agency	Reprocessing facility	31,726	29,967	1,812	11,733	75,238
Japan Nuclear Fuel Limited	Reprocessing plant	9,236* ¹	0	0	12,152	21,388
		Sheared cladding (drums)	Spent filter (drums)	Sample bottle (drums)	Total (number)	
Japan Atomic Energy Agency	Reprocessing facility	4,892	302	1,328	6,522	
Japan Nuclear Fuel Limited	Reprocessing plant	157* ²	0	0	157	
		Low activity concentrated liquid waste (m ³)	Sludge (m ³)	Waste solvent (m ³)		
Japan Atomic Energy Agency	Reprocessing facility	2,685	1,117	106		

The storage unit is (or is converted into) 200 liter drum.

*1: Including 784 drums of wastes stored in the Waste Storage Facility located in Reprocessing Site.

*2: The sheared cladding pieces are stored in 1,000 liter drums.

L2.4 Uranium waste

		Drum (drums)	Other waste (drums)	Total (drums)	Low level liquid waste (m ³)
Global Nuclear Fuel - Japan Co., Ltd.		11,817	3,913	15,730	0
Mitsubishi Nuclear Fuel Co., Ltd.		9,560	1,041	10,601	1.74
Nuclear Fuel Industries, Ltd.	Tokai Works	4,924	1,190	6,114	8.05
	Kumatori Works	6,459	149	6,608	11.4
Japan Atomic Energy Agency	Prototype Uranium Enrichment Plant	497	56	553	0
Japan Nuclear Fuel Limited	Enrichment and Disposal Office	4,101	400	4,533	0

The storage unit is (or is converted into) 200 liter drum.

L2.5 Waste stored in research facilities

<Waste Inventory data reported under the Reactor Regulation Law>

Facility		Solid waste (drums)	Liquid waste (m ³)	Description
Japan Atomic Energy Agency	Tokai Research and Development Center Nuclear Science Research Institute	135,574	-	Reactor facility, using facility for nuclear material (hereinafter referred to as "using facility")
	Tokai Research and Development Center Nuclear Fuel Cycle Engineering Laboratories	61,762	-	Using facilities
	Oarai Research and Development Center(North Area)	29,614	-	Reactor facility, Using facilities, Waste management facility
	Oarai Research and Development Center(South Area)	121 (*1)	0.03 (*2)	(*1)Reactor facility (temporary storage) (*2)Using facility
	Ningyo-toge Environmental Engineering Center	14,401	10.1	Using facility
	Aomori Research and Development Center Mutsu Office	1,053	22.4	Reactor facility
The University of Tokyo, Nuclear Professional School, School of Engineering		24 (*1)	5.3 (*2)	(*1)Reactor facility, Using facility (temporary storage) (*2)Reactor facility.
Kyoto University, Research Reactor Institute		60	0.0	Reactor facility, Using facility
National Institute of Radiological Science		768	-	Using facility
Nuclear Material Control Center	Tokai Safeguards Center	59	-	Using facility
	Rokkasho Safeguards Analytical Laboratory	84	-	Using facility
Rikkyo University Institute for Atomic Energy		15	6.6	Reactor facility
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		6,114	8.1	Using facility(same in the Table L2.4; this facility is also categorized as fabrication facility)
Nippon Nuclear Fuel Development Co., Ltd.		195	9.1	Using facility
Nuclear Development Corporation		1,630	-	Using facility
Toshiba Corporation	Research Reactor Center	72	-	Reactor facility
	Nuclear Engineering Lab.	1,597 (*1)	0.7 (*2)	(*1)Reactor facility, Using facility (*2)Using facility.
Hitachi, Ltd. Power & Industrial Systems Nuclear System Division Ozenji Hitachi Training Reactor Center		494	-	Reactor facility
Other small Using Facilities (189 facilities)		78388 drums		The sum of solid waste inventory and liquid waste inventory

* This data includes the data of inventory of Long-lived low heat generation radioactive waste and Uranium waste which generated in the using facilities. The storage unit is (or is converted into) 200 litter drum.

<Waste Inventory data reported under the Radiation Hazards Prevention Law>

		Waste (drums)	Description
Facilities of the waste management business		-	
The University of Tokyo, Radioisotope Center		1	
Japan Radioisotope Association	Kanto Waste Relay Station	14,875	
	Kanto Waste Relay Station II	9,330	
	The Kaya Memorial Takizawa Laboratory	15,261	
	Ichihara Office	72,300	
	Kansai Waste Relay Station	0	
	Kanto Storage Facility	0	
VESTA Co., Ltd.		7,006	
Japan Atomic Energy Agency	Tokai Research and Development Center Nuclear Science Research Institute	135,574	This data is also reported under the Reactor Regulation Law.
	Oarai Research and Development Center (North Area)	28,157	This data is also reported under the Reactor Regulation Law
T.N. Technos Co., Ltd. TSUKUBA LABORATORIES		238	
Facilities of the using radioisotopes, etc.		12,541	

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 an 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 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) The duties of personnel engaged in the operation and management of the spent fuel storage facility and organization
- (2) 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
- (3) Operation of the equipment especially necessary to be managed in view of safety preservation.
- (4) Designation of controlled areas, and environment monitoring areas, and restriction of access to these areas
- (5) Matters related to gaseous and liquid discharge monitoring equipment
- (6) 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
- (7) Management of radiation measuring instruments and the method of radiation measurement
- (8) Patrols and checks of the spent fuel storage facility and their associated measures
- (9) Voluntary periodical inspections of the spent fuel storage facility
- (10) Receipt, delivery, transport, storage and other handling of spent fuels
- (11) Disposal of radioactive waste
- (12) Measures to be taken in emergency
- (13) Records on safety preservation of the spent fuel storage facility (including observance status)
- (14) Periodic Assessment of the spent fuel storage facility
- (15) Quality assurance of the spent fuel storage facility
- (16) 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 Safety Rules and Regulations for the following points and shall get approval for the revision.

- (1) Duties and organization of a person who will carry out decommissioning work.
- (2) 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) 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.
- (3) Operation of systems requiring special control for safety.
- (4) Establishment of the controlled area, conservation area, and environmental monitoring area, and access control to those areas.
- (5) Exhaust monitoring system and discharge water monitoring system.
- (6) 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.
- (7) Control of radiation measuring devices and radiation measurement methods.
- (8) Periodic self-imposed inspection of the spent fuel storage facility.
- (9) Patrol of the spent fuel storage facility and handling of findings.

- (10) Disposal of radioactive wastes.
- (11) Measures to be taken at an emergency.
- (12) Records on the safety of the spent fuel storage facility (including the compliance with the Safety Rules and Regulations).
- (13) Records on the safety of the decommissioning (including the compliance with the Safety Rules and Regulations).
- (14) Quality assurance for the spent fuel storage facility.
- (15) Quality assurance for the decommissioning work.
- (16) Decommissioning management.
- (17) 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 Specific Waste Disposal Facility or Specific Waste Storage Facility”

(Prevention of fire damage)

Article 3 If the safety of a specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 handling 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or radioactive waste management system of specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific waste storage facility shall not be impaired by such sharing.
- (2) If necessary for maintaining the functions to maintain the safety of specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 specific waste disposal facility or specific 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 Fundamental Guidelines for Licensing Review of Land Disposal Facilities of Low-Level Radioactive Waste (Excerpt)

Fundamental Site Conditions

It shall be considered that the initiating event to the big accident does not occur in or around the site of the waste disposal facility. Moreover, if the accident occurs, events shall be seldom to escalate the effect.

Dose Evaluation

1 Evaluation under Normal Conditions

The radiation dose of the general public in normal times shall be as low as reasonably achievable in the planning of a step-wise control, in the design of the waste disposal facility, and in relation with the situation of the site and its vicinity.

2 Safety Evaluation

When it is presupposed that the technically assumed abnormal event occurs, excessive radiation exposure shall not be imposed to the general public.

Radiation Control

1 The Function of Enclosure

In the case of disposal at the waste disposal facility installed with engineered barriers, the design shall be provided with function to enclose radioactive materials in the restricted area of the waste

disposal facility in the first step.

2 Inhibition of Radioactive Nuclides Migration

In the case of disposal at the waste disposal facility not installed with engineered barriers, appropriate measures shall be taken with due consideration of migration inhibition of radioactive nuclides from the waste disposal facility to the human environment in the disposal step.

3 Radiation Protection

(1) The waste disposal facility shall be installed with radiation shields to reduce the radiation dose of the general public as low as reasonably achievable by direct gamma ray and the sky shine gamma ray.

(2) In the case of disposal in non-engineered barriers type disposal facility, and when there is the possibility of scattering of radioactive materials, measures shall be taken to reduce the radiation dose of the general public by the scattering as low as reasonably achievable.

(3) The waste disposal facility shall be installed with appropriate radiation shields and the ventilation etc. with due consideration of the working conditions of the personnel engaged in radiation work.

4 Radiation Exposure Control

Measures for monitoring and controlling of the radiation doses of the personnel engaged in radiation work shall be taken at the waste disposal facility.

Environmental Safety

1 Discharge Control of Radioactive Gaseous and Liquid Wastes

Concentrations of radioactive materials discharged to the environment shall be controlled as low as reasonably achievable at the waste disposal facility by appropriate processing of radioactive gaseous waste and the radioactive liquid waste generated at the associated facilities in the waste disposal facility.

2 Radiation Monitoring

(1) Measures shall be taken at the waste disposal facility to appropriately monitor the concentration of radioactive materials etc. on the discharge route of radioactive gaseous and liquid wastes that is discharged from the associated facilities of the waste disposal facility.

Measures shall be taken to appropriately monitor the radiation dose, the concentration etc. of radioactive materials in the environment in accordance with the amount of released radioactive materials.

(2) Measures shall be taken at the waste disposal facility to appropriately monitor the concentration of radioactive materials etc. leaking out from the waste disposal facility to the underground water etc. and migrating to the human environment in the 1st step and the 2nd step, or in the disposal step.

Other Safety Measures

1 Design Considerations to Earthquakes

The waste disposal facility shall be designed for the design base earthquake force to preserve safety functions required for the appropriate time period.

This design base earthquake force shall be defined corresponding to the C class facility in the classification of importance for seismic design specified in the "Examination Guide for Seismic Design of Nuclear Power Reactor facilities".

2 Design Considerations to Natural Phenomena other than Earthquake

The waste disposal facility shall be designed taking into considerations of the expected natural phenomena other than the earthquake to preserve required safety functions required for the appropriate time period referring to the past record, at-the-spot observation, etc. in the site and its vicinity.

3 Considerations to Fire and Explosion

Measures shall be taken at the waste disposal facility to prevent occurrence of the fire and explosion, and to prevent excessive release of radioactive materials to the outside of the facility even at the emergency of fire and explosion.

4 Considerations to Loss of Power Supply

Measures shall be taken at the associated facilities of the waste disposal facility responding to the loss of function of the external power supply system.

5 Conformity to Standards and Criteria

The waste disposal facility shall be designed and constructed based on the standards and the criteria accepted as appropriate.

Termination of Control Time Period

Management and control of the waste disposal facility carried out from a viewpoint of the exposure control may be terminated by the end of the limited time span, and the radiation dose of the general public assumed to be imposed from the waste disposed shall be low enough so as the control is no more necessary after the termination of the control.

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 artificial 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 artificial 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 artificial 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 artificial 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 intermediate depth 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 paragraph 3.

2 Technical standards of radioactive waste form for intermediate depth disposal and for disposal with artificial 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) Duties and organization of personnel engaged in management of the radioactive waste disposal facility
- (2) 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.
- (3) Operation of systems to be specially controlled for safety reasons
- (4) Establishment of a controlled area, a peripheral monitoring area and preservation area of a disposal facility, and restriction of access to these areas;
- (5) Gaseous and liquid discharge monitoring equipment;
- (6) Monitoring of dose, dose equivalent, radioactive material concentration and surface contamination density by radioactive materials, and decontamination;
- (7) Management of radiation measurement equipment and measuring method;
- (8) Patrol and inspection of disposal facility and measures to be taken after patrol and inspection;
- (9) Self-imposed periodic facility inspection of waste disposal facility
- (10) Receipt, transport, storage and handling of radioactive waste;
- (11) Emergency preparedness;
- (12) Records of the safe operation of disposal facility (including compliance with the Operational Safety Program); and
- (13) Periodic assessment of waste disposal facility
- (14) Quality assurance for waste disposal facility
- (15) 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 a 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 Recycle Fuel Storage Center
(Source: Home page of Recycle Fuel Storage Company)

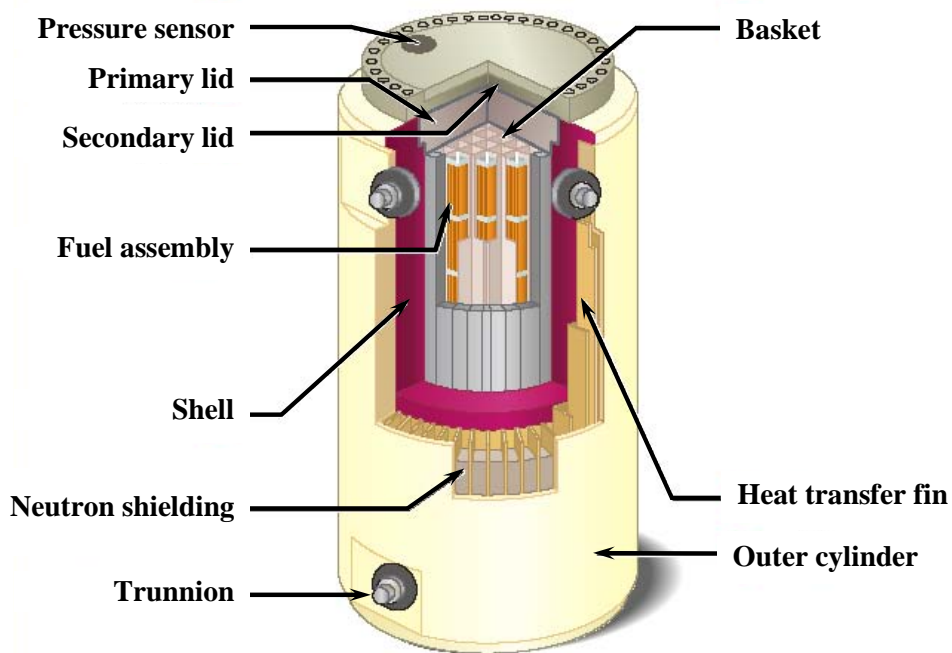


Fig. L5-2 Concept of metallic cask
(Source: Home page of Recycle Fuel Storage Company)

L6 Illustrations related to waste disposal

L6.1 Categorization of waste disposal methods

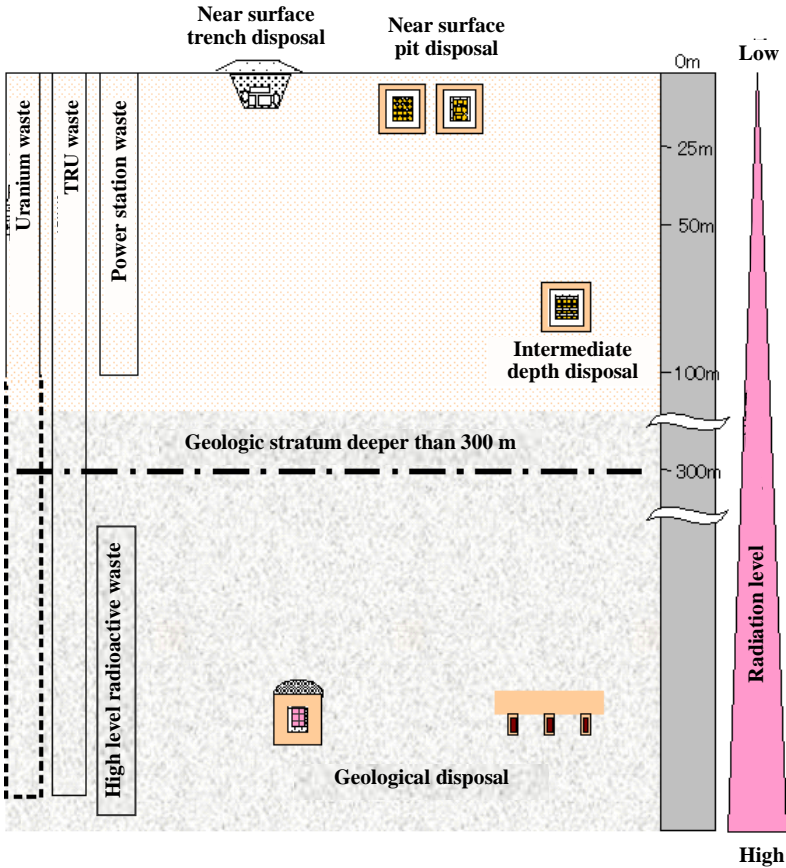


Fig. L6-1 Categorization of radioactive waste disposal methods in Japan (Source: Home page of the Agency for Natural Resources and Energy)

L6.2 Near surface pit disposal

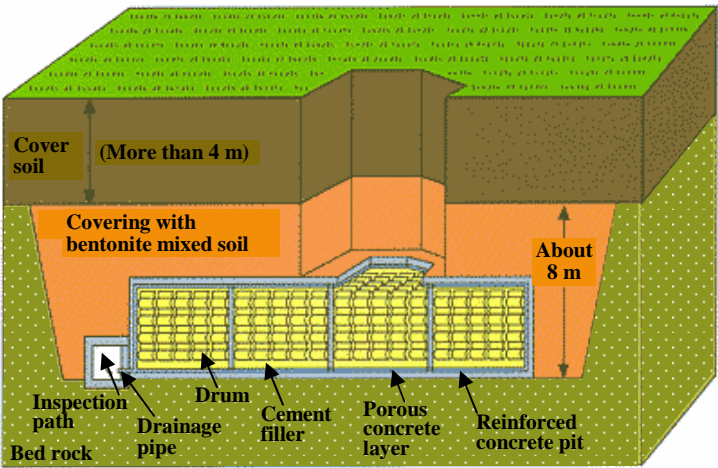


Fig. L6-2 Example of near surface pit disposal (Source: Home page of the Agency for Natural Resources and Energy)

L6.3 Intermediate depth disposal

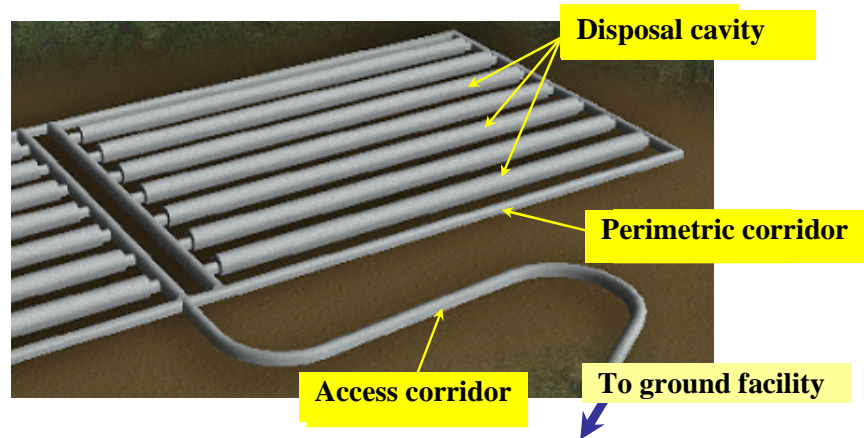


Fig. L6-3-1 Underground structure of waste disposal facility
(Source: "Safety Regulation on Intermediate depth disposal of low level radioactive waste", Waste Safety Subcommittee, Subcommittee on Nuclear and Industrial Safety, Advisory Committee for Natural Resources and Energy, January 2008)

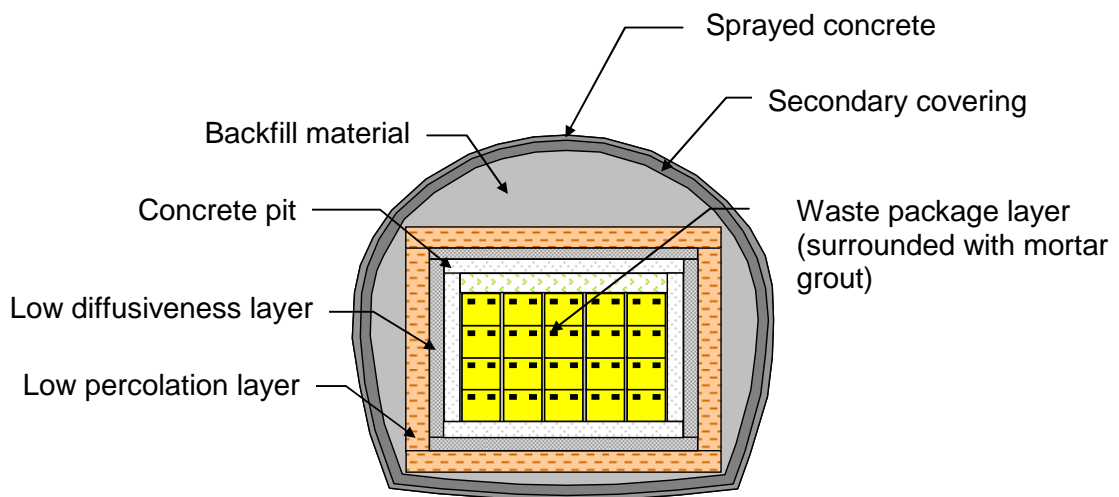


Fig. L6-3-2 Vertical sectional view of disposal cavity
(Source: "Safety Regulation on Intermediate depth disposal of low level radioactive waste", Waste Safety Subcommittee, Subcommittee on Nuclear and Industrial Safety, Advisory Committee for Natural Resources and Energy, January 2008)

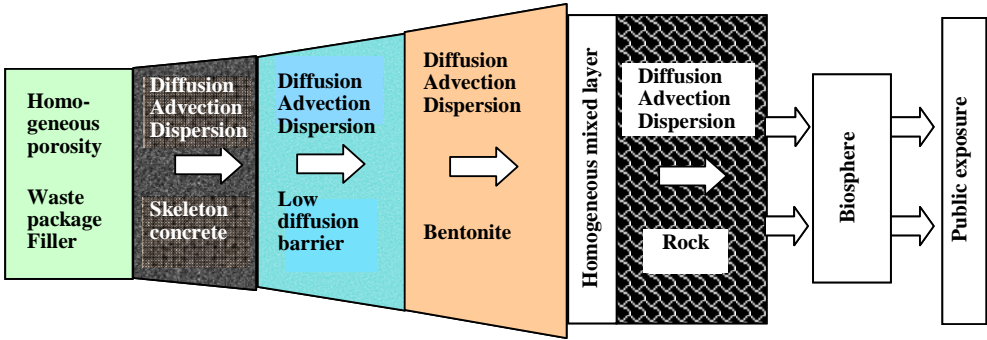


Fig. L6-3-3 Performance evaluation model for safety evaluation
 (Source: "Safety Regulation on Intermediate depth disposal of low level radioactive waste", Waste Safety Subcommittee, Subcommittee on Nuclear and Industrial Safety, Advisory Committee for Natural Resources and Energy, January 2008)

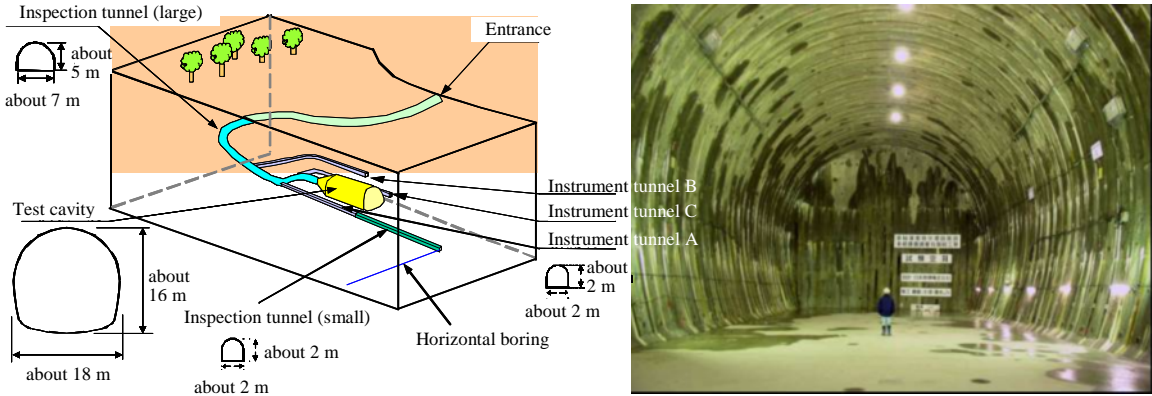


Fig. L6-3-4 Inspection tunnel
 (Source: "Safety Regulation on Intermediate depth disposal of low level radioactive waste", Waste Safety Subcommittee, Subcommittee on Nuclear and Industrial Safety, Advisory Committee for Natural Resources and Energy, January 2008)

L6.4 Geological disposal

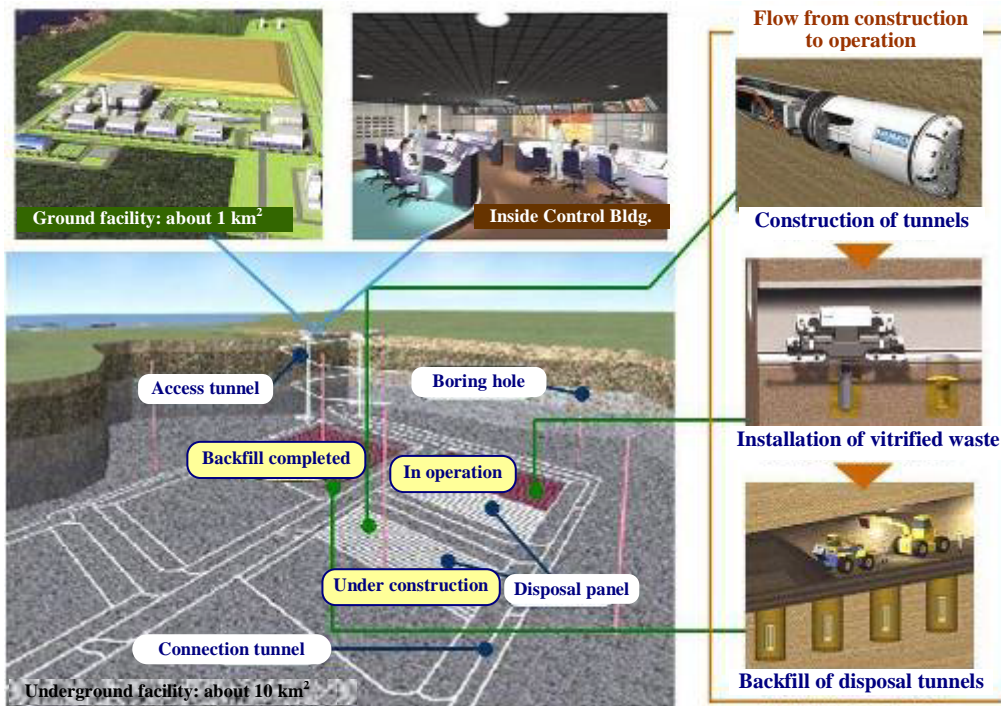


Fig. L6-4-1 Concept of geological disposal
 (Source: Home page of Nuclear Waste Management Organization of Japan)



Fig. L6-4-2 Concept of single-site disposal
 (Source: Home page of the Agency for Natural Resources and Energy)