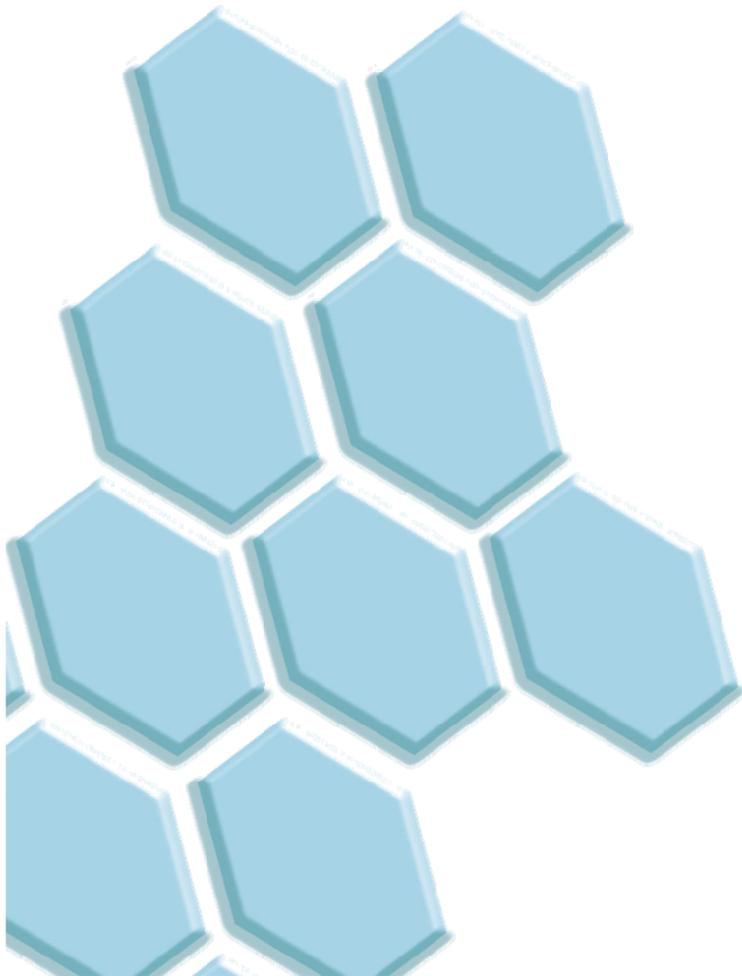


Regulatory Guides for Spent Fuel Storage using Metal Dry Cask in Japan

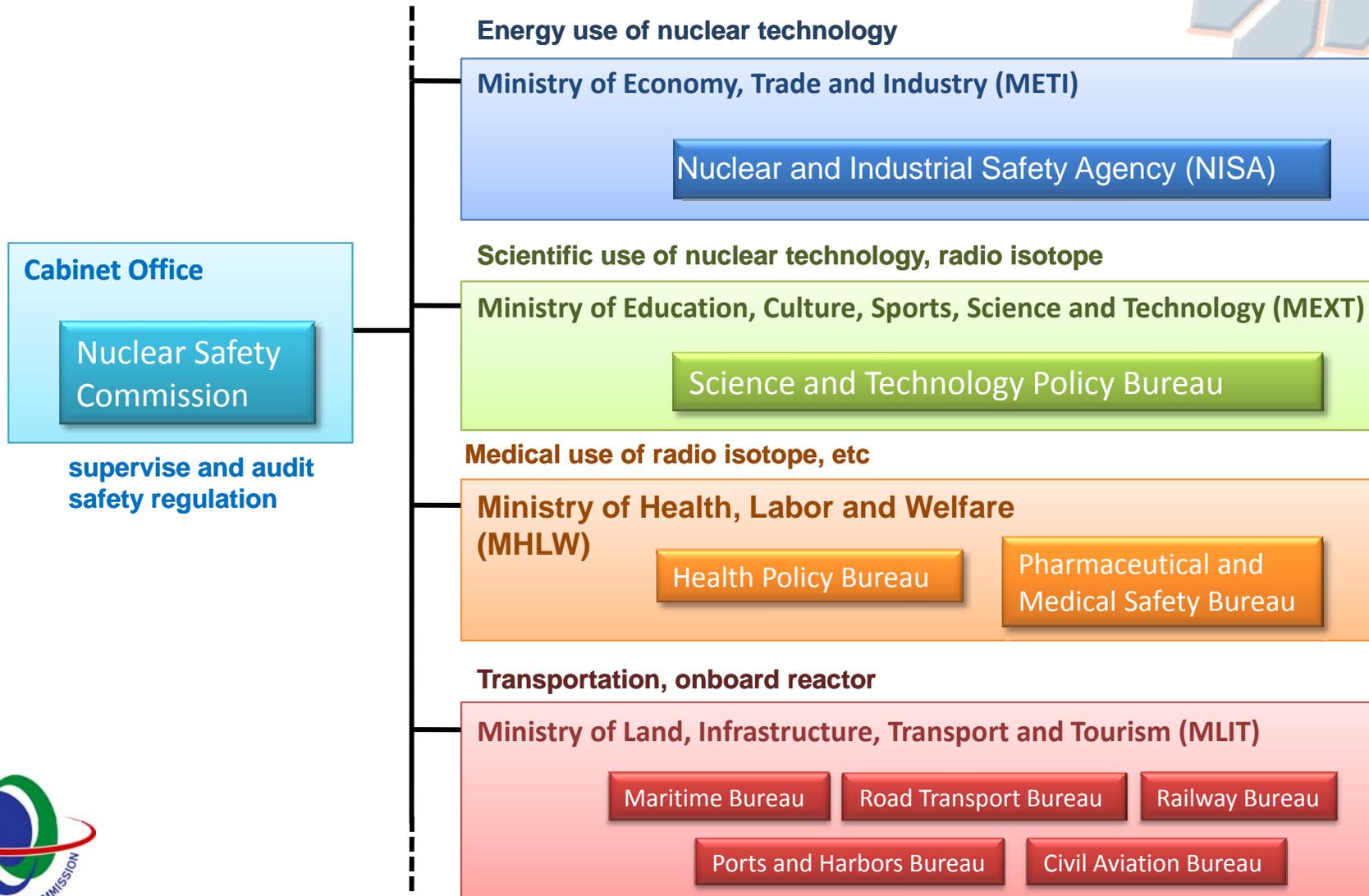
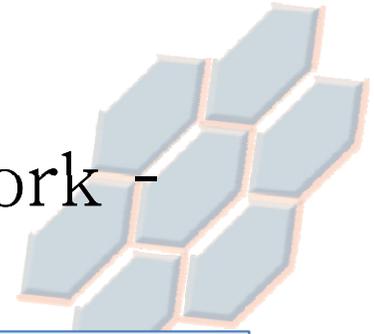
Hideaki MARUYAMA

Cabinet Office

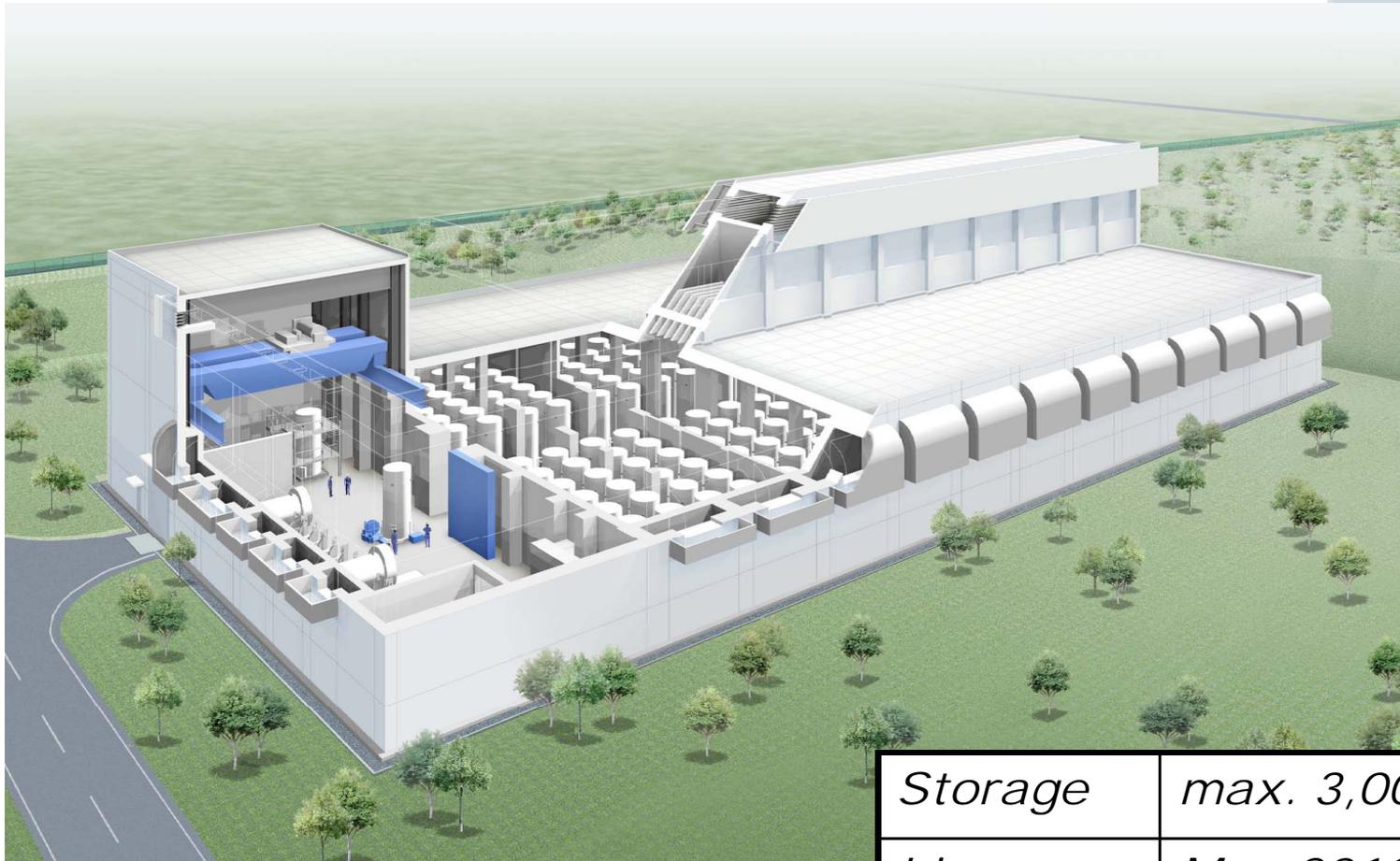
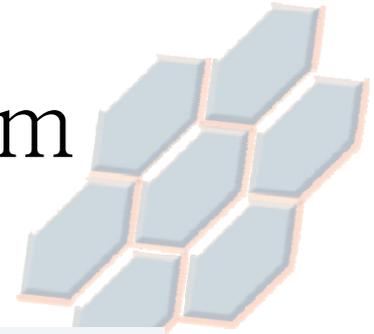
Nuclear Safety Commission



- Legislative and Regulatory Framework -

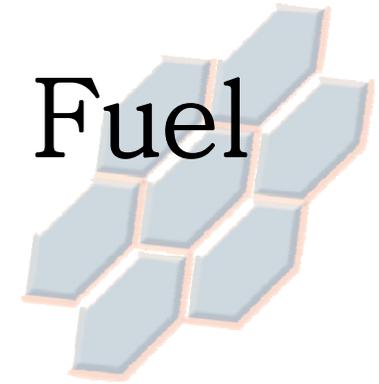


Outline of Spent Fuel Interim Storage Facility in Mutsu



<i>Storage</i>	<i>max. 3,000 tU</i>
<i>License</i>	<i>May 2010</i>
<i>Operation</i>	<i>July 2012</i>

Regulatory Guides for Spent Fuel Storage



Regulatory Guides

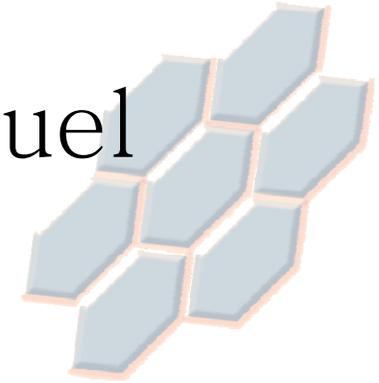
- ① Reviewing Safety Review of Nuclear Fuel Facilities
- ② Reviewing Safety of Spent-fuel Interim Storage Facilities Using Metallic Dry Casks
- ③ Reviewing Seismic Design of Nuclear Power Reactor Facilities

Relevant documents

- ① Specific Considerations due on earthquakes, in reviewing the safety of the spent fuel interim storage facilities
- ② Specific Considerations due on natural phenomena, in reviewing the safety of the spent fuel interim storage facilities
- ③ Long-term integrity of metallic dry casks and their containers used at the spent-fuel interim storage facilities

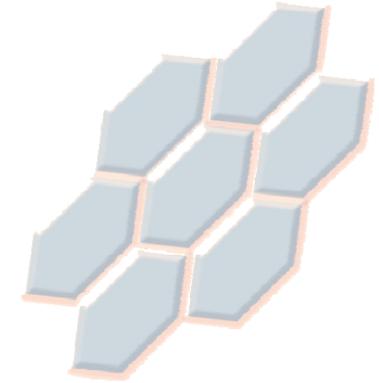


Reviewing Safety of Spent-fuel Interim Storage Facilities



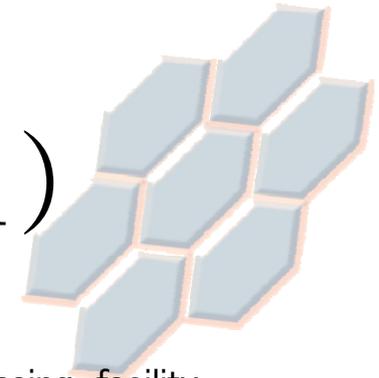
- These guides provided here are a summary of basic philosophy in performing Safety Review of Spent-fuel Interim Storage Facilities which introduce spent fuels from power reactors in a metal dry cask, store a long period and transfer.
- The spent-fuel interim storage facilities assume that 40–60 years of storage term.

I. Scope



- These guides provided
 - The Spent-fuel Interim Storage Facilities are built independently with the nuclear power plant.
 - Spent-fuel is stored in a metal dry cask without refilling it to another container.
 - After storage for predetermined period, the dry cask is transferred to outside facilities.
 - A cover of the metal dry cask is not assumed to open for inspection of the stored spent-fuel.
 - Spent-fuels stored in this facilities are UO₂ and MOX fuel.
 - Long term integrity of casks and spent fuels inside is assumed.
 - Spent-fuels are to be cooled for a necessary period at the power plant site.
 - The nuclear power plant operation data and fuel sipping inspection shall confirm the long-term integrity of the fuel assembly.

II. Siting Conditions(1)



Guide 1 Basic Conditions

Eliminate accident contributors, review a site of a specifically classified uranium processing facility and the following events around the site with the aim of preventing the expansion of any disaster and then confirm that the site has no difficulties in ensuring safety.

(1) Natural environment

- ① Natural phenomena such as earthquakes, floods, typhoons, heavy snow, storm surges, tsunamis, volcano, landslides and subsidence(Fig.1)
- ② Ground, soil bearing, faults and other geologic and topographic features
- ③ Meteorological factors such as wind direction, wind velocity and rainfall
- ④ Water phenomenon and hydraulics of rivers and underground water

(2) Social environment

- ① Fire, explosions, and other events in neighboring industrial plants and other facilities.
- ② Objects coming by air due to airplane accidents and other causes.
- ③ Water resource utilization, situation of food production and circulation, and the population distribution.

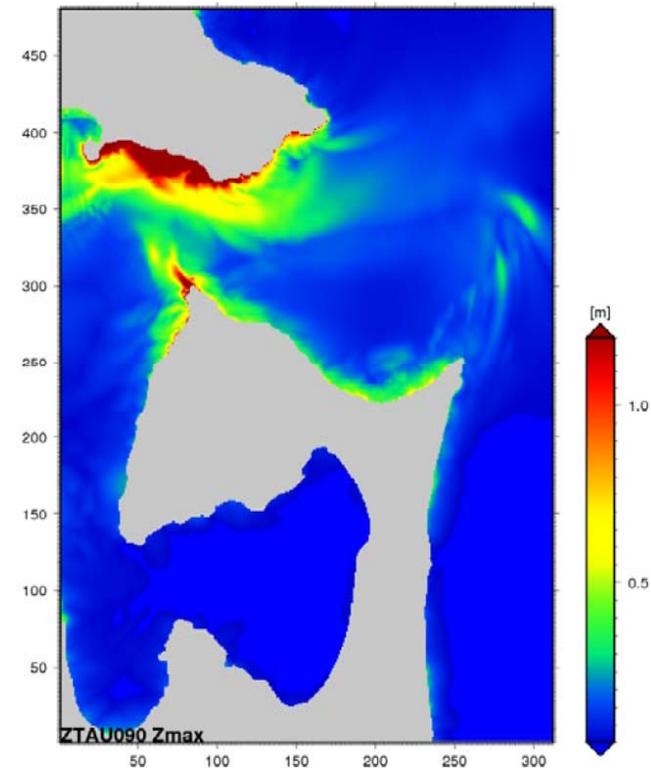
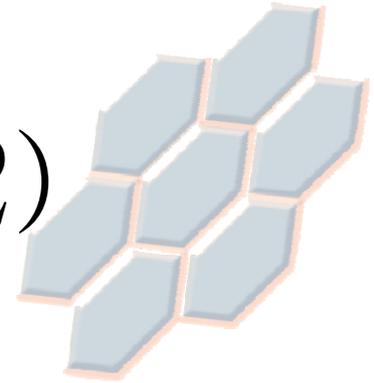


Fig.1 Tsunami Simulation

II. Siting Conditions(2)



Guide 2 Normal Conditions

The dose equivalent to usual operations of spent fuel interim storage facilities from the public standpoint shall be as low as is reasonably achievable.

Guide 3 Accident Conditions

In the case a maximum credible accident should occur in the spent-fuel interim storage facilities, the sequence of the accident shall not result in significant radiation exposure to the public.(Fig.2)

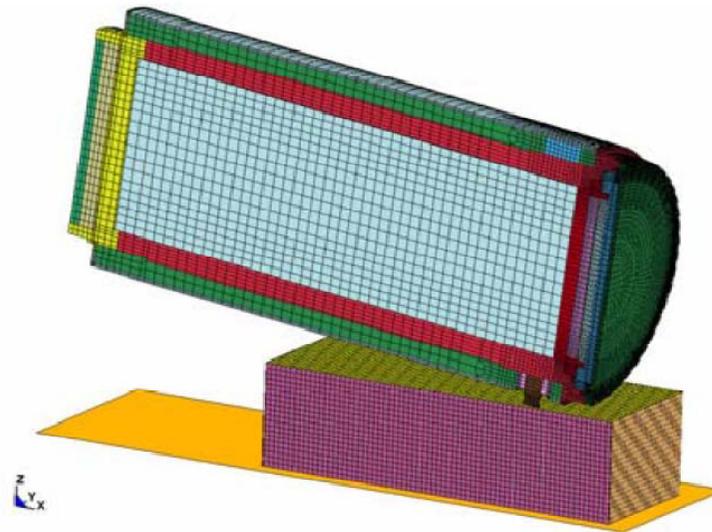
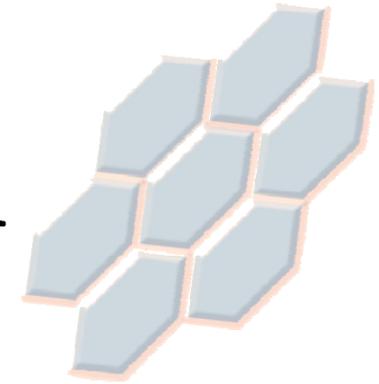


Fig.2 Example of accident Conditions calculation model

III. Radiation Control



Guide 4 Confinement Function

Spent-fuel interim storage facilities shall be designed to confine radioactive materials in a limited zone.

Guide 5 Radiation Shielding

Appropriate radiation shielding shall be provided so that radiation exposure to both the public and workers by direct gamma rays from the storage facilities and gamma rays via skyshine will be at a level sufficiently low.

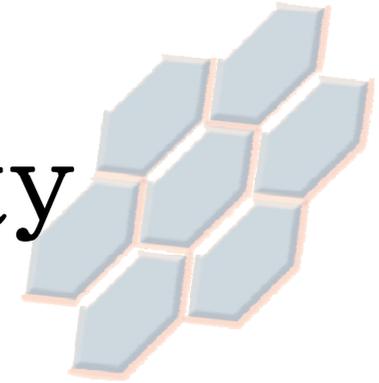
Should radiation shielding depend on materials other than metal cask, such as concrete, the temperature of the shielding materials shall be designed to maintain the point below shielding critical one.

Guide 6 Control of Radiation Exposure

1. Radiation protection in work environment
2. Exposure control of individuals personnel engaged in radiation work
3. Area classification



IV. Environment Safety



Guide 7 Control of Release of Radioactive Waste

In the spent-fuel interim storage facilities, the level of concentration of radioactive materials emitted to the vicinity shall be capable of being as low as reasonably achievable, by measures such as appropriately processing the radioactive waste produced during the operation.

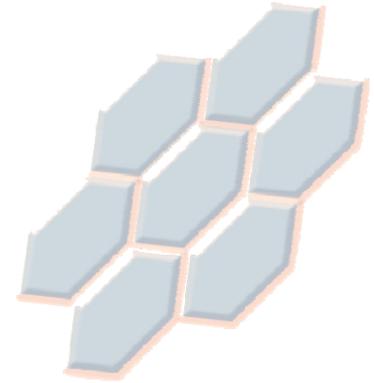
Guide 8 Considerations to Long-term Storage

The design that can keep the long-term integrity of fuel assemblies, metallic dry casks and their containers used at spent-fuel interim storage facilities.

Guide 9 Radiation Monitoring

In the spent-fuel interim storage facilities, measures shall be taken to appropriately monitor the concentration of radioactive material at each point of the path that leads to disposal of radioactive waste. Also, measures shall be taken to appropriately monitor the radiation level at the vicinity environment and concentration of radioactivity, according to the possibility of emission of radioactive materials.

V. Criticality Safety



Guide 10 Criticality Safety of Single Metal Cask

Measures shall be taken to prevent criticality of a single metal cask of the spent-fuel interim storage facility in any situations anticipated from a technical point of view when spent-fuel is stored in metal cask.

Guide 11 Criticality Safety of Several Metal cask

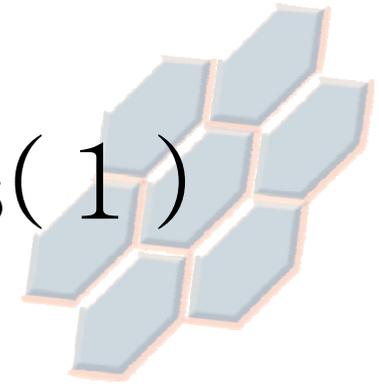
The effect of neutron interaction among several metal cask shall be taken into account and shall be provided with measures to prevent criticality in any situations anticipated from a technical point of view.

Guide 12 Considerations to Criticality Accident

In the spent-fuel interim storage facilities where a risk of critical accident due to erroneous operation exists, appropriate measures shall be taken against any unexpected critical accident.

In the spent-fuel interim storage facilities consideration to critical accident is not necessary, provided that Guide 10 and Guide 11 are fulfilled and the spent fuels are stored in metal dry cask.

VI. Other Safety Measures(1)



Guide 13 Seismic Considerations

As for the facilities in the spent-fuel interim storage facilities that are important from the standpoint of safety, seismic design shall be accomplished to sufficiently bear the design seismic force which is assumed by appropriately consulting the record of earthquakes in the past and by the field investigation at the site location and the vicinity.

Guide 14 Considerations to Natural Phenomena Other Than Earthquakes

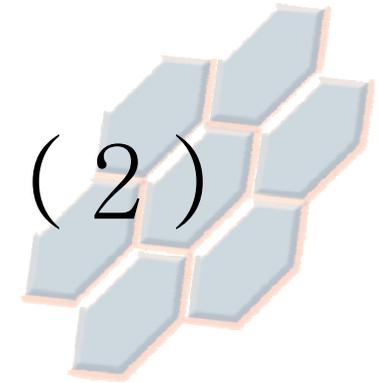
In the spent-fuel interim storage facilities , the facilities that are important from the standpoint of safety shall be so designed that the most severe anticipated natural force other than earthquake, which is selected through research of the past record and the field investigation at the site location and the vicinity, is taken into account.

Guide 15 Considerations to Fire and Explosion

As for the spent-fuel interim storage facilities where there is fear of occurrence of fire and explosions, measures shall be taken to prevent the occurrence. As well, even if fire and explosions would break out, measures shall be taken to prevent the expansion of fire and explosions, and excessive release of radioactive materials to outside the facility.



VI. Other Safety Measures (2)



Guide 16 Considerations to Loss of Power Source

At loss of an external power supply such as a power outage, safety features of spent-fuel interim storage facilities shall include emergency power supplies that have sufficient capacity and reliability to operate installments and equipment necessary for safety, such as (1) confinement function monitoring system, (2) radiation monitoring systems and (3) warming systems for fires and criticality, emergency communication and information systems and emergency illuminating lamps.

Guide 17 Considerations to Movement of Metal Cask

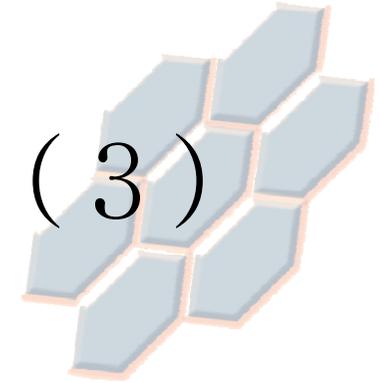
As for the spent-fuel interim storage facility, appropriate measures shall be provided to ensure the basic safety function, against the displacement of metal cask within the storage facility.

Guide 18 Accident Considerations

As for the spent-fuel interim storage facilities, appropriate measures shall be provided for accident response such as alarm systems, communication and evacuation of personnel.



VI. Other Safety Measures (3)



Guide 19 Considerations to Shared Use

It shall be ensured that installations and equipment that are shared with nuclear facilities other than the spent-fuel interim storage facilities or in the relevant facilities do not jeopardize the safety of the storage facility, on the basis of judgment of their functions and structures.

Guide 20 Specifications and Standards

The design, construction, and examination of the facilities that are important from the standpoint of safety shall be conducted in accordance with the specifications and standards recognized as appropriate.

Guide 21 Considerations to Inspection and Repair

In the spent-fuel interim storage facilities, the facilities that are important from the standpoint of safety shall be capable of inspection, examination, and repair, with appropriate procedures scheduled in accordance with their importance.

