March 30, 2011
Nuclear and Industrial Safety Agency

Regarding the Implementation of Emergency Safety Measures for the Other Nuclear Power Stations considering the Accident of Fukushima Dai-ichi and Dai-ni Nuclear Power Stations

The Nuclear and Industrial Safety Agency shall devise thorough safety measures by identifying and elucidating the overall picture of the accident including the mechanism of how this tsunami developed, while at the same time continuing to do its utmost to cope with the accident of Fukushima Dai-ichi Nuclear Power Station (NPS).

On the other hand, as there also exist other NPSs, which are in operation or scheduled to be started up, we shall devise emergency safety measures as spelled out in Attachment 1. These measures are to enable the recovery of the cooling function while avoiding as much as possible the release of radioactive materials, based on the findings identified so far such as the fact that all alternating current power sources and the cooling functions were lost in Fukushima Dai-ichi NPS due to the tsunami.

In view of the fact that in Fukushima Dai-ichi NPS there were failures to secure emergency power sources, to supply in a timely manner coolant water to the Spent Fuel Pools, and so on, the Minister of Economy, Trade and Industry has given directions as spelled out in Attachment 2, regarding the concrete emergency safety measures preventing the recurrence of the similar situation. At the same time, the Ordinance of METI has been amended to ensure the effectiveness of the emergency safety measures.

Expeditious reporting of the implementation status shall be obtained from the utilities and other operator and, by means of inspections, etc., shall be ascertained rigorously.

Attachment 1: Regarding the Implementation of Emergency Safety Measures for the Other Power Stations Considering the Accident of Fukushima Dai-ichi Nuclear Power Station

Attachment 2: Regarding the Implementation of Emergency Safety Measures for the Other Power Stations Considering the Accident of Fukushima Dai-ichi and Dai-ni Nuclear Power Stations in 2011 (Direction)
(Contact Person)

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Regarding the Implementation of Emergency Safety Measures for the Other Power Stations Considering the Accident of Fukushima Dai-ichi Nuclear Power Station

March 30, 2011
Nuclear and Industrial Safety Agency

The accident of the Fukushima Dai-ichi Nuclear Power Station (NPS) caused by the Tohoku District – off the Pacific Ocean Earthquake has resulted in a nuclear emergency of an unprecedented scale in Japan. Intensive efforts to suppress the magnitude of the damage by the accident are currently being made at the site not only by Tokyo Electric Power Co. Inc. (TEPCO) as the operator of the NPS, but also by the national and local governments, other operators and related bodies who are in one united body.

The Nuclear and Industrial Safety Agency (NISA) shall devise thorough safety measures by identifying and elucidating the overall picture of the accident including the mechanism of how this tsunami developed, while at the same time continuing to do its utmost to cope with the accident of Fukushima Dai-ichi NPS.

In the meantime, considering that an extremely large tsunami, such as the one that followed the March 11th huge earthquake, can cause serious damage to NPSs, although its frequency may be significantly small, the emergency safety measures for the NPSs other than Fukushima Dai-ichi and Fukushima Dai-ni NPSs shall be implemented, which enable the recovery of cooling functions while preventing, to the extent possible, the release of radioactive materials, based on the currently available knowledge and experiences. Electricity Utilities and other operator concerned are to appropriately undertake these emergency safety measures that would then be ascertained through NISA’s inspections, etc., thereby preventing the possible damage to the reactor core and so on due to tsunami-induced loss of
all alternating current power sources, etc. and preventing the subsequent nuclear emergency. In addition, NISA will continuously ascertain the status of implementation through inspections and other means, and will urge the utilities and operators to make necessary improvements, so as to constantly enhance the reliability level of the emergency safety measures taken.

1. Outline of the Emergency Safety Measures

Regarding the accident of Fukushima Dai-ichi NPS, due to the tsunami following the huge earthquake, the following factors are identified as the direct causes of the escalation of the accident, leading to a nuclear emergency or expansion of the scale of damage by the accident:

1) Loss of external power supply and the failure to secure emergency power sources.
2) Loss of seawater system facility or its function, to release heat into the ocean, in the end, from the reactor core after shut down.
3) Failure to supply coolant water to Spent Fuel Pools in a timely manner when the cooling functions for the pools and the usual on-site water supply were lost.

In view of this fact, the amendment of the Ministerial Ordinance (Requirements in the Safety Regulations) and so on are immediately carried out and the following safety enhancement measures are required to be taken for all the NPSs (Excluding Fukushima Dai-ichi and Fukushima Dai-ni NPSs).

- Regulatory Requirements

Even in an event where all of the three functions (all alternating current power sources, seawater cooling function and Spent Fuel Pool cooling function) are lost, reactor core damage and spent fuels damage must be prevented, and cooling functions must be recovered while containing the release of radioactive material.
Specific Requirements

1. Implementing Emergency Inspections
   Implementing the emergency inspections of equipments and facilities to ensure the readiness for tsunami-induced emergencies.

2. Implementing Review and Drills of Emergency Preparedness Plan
   Implementing a review of the Emergency Preparedness Plan and conducting drills with the assumption that all alternating current power sources, seawater cooling function and Spent Fuel Pool cooling function have been lost.

3. Ensuring Emergency Power Sources
   Ensuring the alternative power sources that can supply necessary power in a timely manner when both on-site power and emergency power supply are lost.

4. Ensuring Final Heat Removal Function in Emergencies
   Preparing for the measures to recover heat removal function in a timely manner with the assumption of loss of seawater system facility or its function.

5. Ensuring Spent Fuel Pool Cooling Function in Emergencies
   Implementing the measures to supply coolant water to Spent Fuel Pools in a timely manner when cooling function for the pools and usual on-site water supply to the pools are lost.

6. Implementing necessary measures taking into account the structural configuration of each NPS site.

2. Implementation of the Emergency Safety Measures

   Electricity utilities and other operator concerned are required to immediately implement the aforementioned emergency safety measures on all NPSs.

   The utilities and others are required to report to NISA as soon as possible on the status of their implementation (Including their future implementation plans).
3. Ascertainment and so on by NISA

NISA will rigorously ascertain the adequacy of implementation status of the emergency safety measures reported by the utilities and operator.

For this reason, receiving applications for approval of the Safety Regulations that include the emergency safety measures, NISA will rigorously review the contents before granting approval and strictly ascertain the status of implementation of the measures on each NPS through inspections and so on.

The ascertainment process of the status of implementation of the emergency safety measures by NISA is aiming to be completed in approximately one month (within April) after the utilities and operator submit their emergency safety measures reports.
# Measures Considering the Accident of Fukushima Dai-ichi Nuclear Power Station

<table>
<thead>
<tr>
<th>Phase</th>
<th>Emergency Safety Measures</th>
<th>Thorough Safety Measures</th>
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<tr>
<td></td>
<td>Short term</td>
<td>Medium-to-Long term</td>
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<tr>
<td>Expected completion</td>
<td>Approx. 1 month</td>
<td></td>
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<td></td>
<td>(around mid-April)</td>
<td>Deciding in response to the discussion in the Accident Investigation Commission, etc.</td>
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<tr>
<td>Target (Required standard)</td>
<td>Preventing the occurrence of core damage and spent fuel damage even when 1) all alternating current power sources, 2) seawater cooling function and 3) Spent Fuel Pool cooling function are lost due to tsunami.</td>
<td>Preventing occurrence of nuclear emergency taking into account “anticipated tsunami height” to be set by referencing the tsunami that caused this nuclear emergency.</td>
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<tr>
<td>Examples of specific measures</td>
<td>Ensuring equipments:</td>
<td>Ensuring equipments</td>
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<tr>
<td></td>
<td>· Deploying power supply vehicles (to cool reactors and Spent Fuel Pools).</td>
<td>· Building seawalls.</td>
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<td></td>
<td>· Deploying fire engines (to supply coolant water).</td>
<td>· Installing watertight doors.</td>
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<td>· Deploying fire hoses (to secure water feeding path from fresh water tank, seawater pit, etc.).</td>
<td>· Devising other necessary equipment related measures.</td>
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<tr>
<td></td>
<td>Developing manual, etc.:</td>
<td>*To be followed by implementation of equipment related improvements (e.g.: Ensuring spare air cooled diesel generators, sea water pump motors, etc.).</td>
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<td></td>
<td>· Establishing implementation procedures for emergency response utilizing the above mentioned equipments.</td>
<td>Developing manuals Emergency Response Training</td>
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<td>Emergency Response Training:</td>
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<td></td>
<td>· Implementing drills on emergency measures based on the implementation procedures manual.</td>
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<td>Ascertainment by NISA, etc.</td>
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<td></td>
<td>· Amending the Ministerial Ordinance to ensure effectiveness of the emergency safety measures and approving the Safety Regulations that incorporate those measures.</td>
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<td></td>
<td>· Ascertaining rigorously the implementation status of emergency safety measures by means of inspections, etc.</td>
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<tr>
<td>Utilities and operator’s response</td>
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<td></td>
<td>· Efforts are under way to procure equipments. (Locations to set them up are also being ensured.)</td>
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<td></td>
<td>· The procedures manual was compiled anew considering this accident and a drill was implemented.</td>
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<tr>
<td></td>
<td>· Striving to improve emergency safety measures continuously to raise their reliability, even after the measures are confirmed.</td>
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</table>
Series of Events and Countermeasures in case of Tsunami, for BWR

[Before Implementation of the Emergency Safety Measures]

The flow indicates the flow of events encountered at Fukushima Daiichi Nuclear Power Station (NPS) (Includes assumptions for some events)

- Loss of External Power Supply
- Loss of Sea Water System Functions (Immediately after the Arrival of Tsunami)
- Loss of D/G Functions
- Loss of AC Power Sources (Immediately after the Arrival of Tsunami)
- Loss of Motor Driven Water Injection System Functions (Simultaneous with Loss of All AC Power Source)
- Loss of DC Power Source (Recharger / Battery) (For over 8hrs)
- Loss of Monitoring / Control System Functions
- Delay in switch to alternative water injection
- Damage inflicted on the Core (Few hours after the loss of RCIC Function)
- Generation of Hydrogen
- Damage Inflicted on the Primary Containment Vessel
- Damage Inflicted on the Reactor Building
- Spent Fuel Pool Damage inflicted on the spent fuel as the pool water level lowered

[After Implementation of the Emergency Safety Measures]

- Loss of D/G Functions
- Loss of AC Power Sources (Immediately After the Arrival of Tsunami)
- Loss of Motor Driven Water Injection System Functions
- Loss of Heat Removal Functions
- Maintaining Monitoring / Control System Functions (Immediately After the Arrival of Tsunami)
- Loss of External Power Supply (Immediately After the Arrival of Tsunami)

(1) Preventing battery from being exhausted by supplying electricity to Recharger from Power Supply Vehicles. (To be executed within 8 hrs from the loss of all AC power Sources)

(2) Ensuring water source by supplying sea water, etc. using Fire Engines or switching to Suppression Pool water supply. (After 3 to 4 days)

(3) Supplying electricity to water supply pumps and other devices from Power Supply Vehicles, or injecting water by Fire Engines, etc.

(4) Supplying electricity to Vent Valve and other devices from Power Supply Vehicle. Developing manual and implementing drills on the procedures of vent manipulation, etc. in case of loss of AC power supply in the NPS.

(5) Spent Fuel Pool Maintaining water level in Spent Fuel Pool, through alternative water injection (after a few days thereafter) (Using Power Supply Vehicles to prevent loss of monitoring function due to battery exhaustion, and conducting alternative water injection by Fire Engines and other means.)

: Emergency Safety Measures
Series of Events and Countermeasures in case of Tsunami, for BWR

1. DC Power Supply (Battery)
2. External Power Supply
3. Sea Water Pump
4. Reactor Core Isolation Cooling System
5. Fuel Pool

Stack

Power Supply Vehicle

Fire Engine

Alternative Water Injection

Power Supply Vehicle

Stack
Series of Events and Countermeasures in case of Tsunami for PWR

Before the Emergency Safety Actions

- Tsunami
  - Loss of Sea Water System Functions (Instantaneous)
  - Loss of Emergency Diesel Generator Function (Instantaneous)
  - Loss of All AC Power Sources (Instantaneous)
  - Water supply and cooling of Steam Generator secondary side by Turbine Driven Auxiliary Feedwater Pump (Approx. 1 min)
  - Exhaustion of Water Supply Sources (Condensate Tank, Pure Water Tank) (Approx. 8 days)
  - Loss of Heat Removal Function of Steam Generator
  - Rise of Pressure and Temperature in the Reactor
  - Activation of Pressurizer Safety Valve
  - Exposure of the Core (after 8 days)

After the Emergency Safety Actions

- Tsunami
  - Loss of Sea Water System Functions (Instantaneous)
  - Loss of Emergency Diesel Generator Function (Instantaneous)
  - Loss of All AC Power Sources (Instantaneous)
  - Water supply and cooling of Steam Generator secondary side by Turbine Driven Auxiliary Feedwater Pump (Within approx. 5 hours)
  - Automatic injection of boric acid from Accumulator (Maintain sub-criticality) (Approx. 1 min)
  - Shut off of Exit Valve of the Accumulator (Within approx. 5 hours)
  - Water supply to Water Supply Sources (Condensate Tank) (Using Fire Engines, etc.) (Within approx. 8 days)
  - Continuous Cooling of the Reactor (approx. 171°C, 0.7MPa)
  - Injecting Water to Spent Fuel Pit (Fire hydrant, Fire Engines, etc.)
  - Cooling Spent Fuel

Emergency Safety Measures
Series of Events and Countermeasures in case of Tsunami, for PWR

1. Loss of External Power Supply
   - External Power Supply
   - Emergency Diesel Generator

2 & 5. Water supply and cooling of Steam Generator through supplying water to Condensate Tank
   - Main Steam
   - Fire Engine, etc.
   - Water Supply
   - Turbine Driven Auxiliary Feedwater Pump
   - Condensate Tank

3 & 4. Injection of Boric Acid Water from Accumulator, shut-off of the valve
   - Injection of Boric Acid Water
   - Reactor Vessel
   - Accumulator
   - Steam Generator

6. Connection of Power Supply Vehicle
   - Water Tank for Refueling
   - Fresh Water Tank
   - To Fire Extinguisher Water System

7. Water Injection to Spent Fuel Pit
   - Component of Cooling Water
   - Containment Spray
   - Reactor
   - Primary Coolant Pump
   - Spent Fuel Pit
   - Auxiliary Electrical Water Supply Pump
   - Condensate Tank

- Diesel Generator
- Sea Water Pump
- To the Sea

Primary Containment Vessel
- High Pressure Injection Pump
- Reactor
- Primary Coolant Pump
- Containment Sump
Ministry of Economy, Trade and Industry

03.28.2011 Nuclear Number 7
March 30, 2011

To (respective addressees on the attached list)

Minister of Economy, Trade and Industry Banri Kaieda

Regarding the Implementation of Emergency Safety Measures for the Other Power Stations Considering the Accident of Fukushima Dai-ichi and Dai-ni Nuclear Power Stations in 2011 (Directions)

The accident of the Fukushima Dai-ichi Nuclear Power Station (NPS) caused by the 2011 Tohoku District – off the Pacific Ocean Earthquake has resulted in a nuclear emergency of an unprecedented scale in Japan. Intensive efforts to suppress the magnitude of the damage by the accident and to recover from it are currently being made at the site not only by Tokyo Electric Power Co. Inc. (TEPCO) as the operator of the NPS, but also by the national and local governments, other related organizations who are in one united body.

The Nuclear and Industrial Safety Agency (NISA) shall investigate to determine the causes of the accident and devise thorough safety measures by identifying and elucidating the overall picture of the accident including the mechanism of how this tsunami developed, while at the same time continuing to do its utmost to cope with the accident of Fukushima Dai-ichi NPS.

In the meantime, considering that an extremely large tsunami, such as the one that followed the March 11th huge earthquake, can cause serious damage to NPSs, although its frequency is considered to be significantly small, the emergency safety measures for the NPSs other than
Fukushima Dai-ichi and Fukushima Dai-ni NPSs shall be implemented, which enable the recovery of cooling functions while preventing the release of radioactive materials even when power source function, etc. are lost due to tsunami, based on the currently available knowledge and experiences. Electricity Utilities and other operator concerned are to appropriately undertake these emergency safety measures that would then be ascertained through NISA's inspections, etc., thereby preventing the possible damage to the reactor core and so on due to tsunami-induced loss of power source function, etc. and preventing the subsequent nuclear emergency.

Therefore, in accordance with the Rules for Commercial Power Reactors concerning the Installation, Operation, etc. as amended, which requires the development of the system and accompanying Safety Regulations to conduct activities in case of tsunami occurred to ensure the safety and to maintain the conditions of the nuclear reactor facilities, it is required to promptly work on the emergency safety measures shown below and to expeditiously report on the implementation status of the emergency safety measures.

DIRECTIONS

Measures listed below should be taken as the emergency safety measures, and the Safety Regulations, based on the Rules for Commercial Power Reactors concerning the Installation, Operation, etc. and others as amended this time, should be developed and then be applied for the approval of the change, in order to prevent the reactor core damage and the spent fuel damage, and to recover the cooling function of the reactor facilities whilst suppressing the release of radioactive materials even when the three functions (functions of all facilities providing alternating current power source, functions of all facilities to cool the nuclear reactor facilities using seawater, and functions of all facilities to cool the Spent Fuel Pools) were lost due to tsunami.

① Implementing Emergency Inspections
   Implementing the emergency inspections of equipments and facilities to
ensure the readiness for tsunami-induced emergencies.

② Implementing Review and Drills of Emergency Preparedness Plan
Implementing a review of the Emergency Preparedness Plan and conducting drills with the assumption that functions of all facilities providing alternating current power source, functions of all facilities to cool the nuclear reactor facilities using seawater and functions of all facilities to cool the Spent Fuel Pools have been lost.

③ Ensuring Emergency Power Sources
Ensuring the alternative power sources that can supply necessary power in a timely manner when both on-site power and emergency power supply are lost.

④ Ensuring Final Heat Removal Function in Emergencies
Preparing for the measures to recover heat removal function in a timely manner with the assumption of loss of seawater system facility or its function.

⑤ Ensuring Spent Fuel Pool Cooling Function in Emergencies
Implementing the measures to supply coolant water to Spent Fuel Pools in a timely manner when cooling function for the pools and usual on-site water supply to the pools are lost.

⑥ Implementing necessary measures taking into account the structural configuration of each NPS site.
(Attached List of addressees)

President of Hokkaido Electric Power Co., Inc.  Yoshitaka Sato
President of Tohoku Electric Power Co., Inc.  Makoto Kaiwa,
President of Tokyo Electric Power Co., Inc.  Masataka Shimizu
President and Director of Chubu Electric Power Co., Inc.  Akihisa Mizuno
President of Hokuriku Electric Power Co., Inc.  Susumu Kyuwa
President of Kansai Electric Power Co., Inc.  Makoto Yagi
President of Chugoku Electric Power Co., Inc.  Takashi Yamashita
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President of Incorporated Administration Agency, Japan Atomic Energy Agency  Atsuyuki Suzuki