Countermeasures against Tsunami at Kashiwazaki Kariwa Nuclear Power Station

May 12, 2011
Tokyo Electric Power Company
Kashiwazaki Kariwa Nuclear Power Station
Outline of Emergency Safety Measures at Kashiwazaki-Kariwa Nuclear Power Station

We have completed following emergency safety measures to prevent damages of reactor core and spent fuel, even if three functions such as function of all facilities that supplies AC power, function of all facilities that cools reactor facility and function of all facilities that cools spent fuel pool by seawater are lost by tsunami by April 20th, 2011.

1. Emergency Inspection
   ① Confirmation of critical equipment for safety by periodic inspections
   ② Implementation of emergency inspection of equipments and facilities

2. Implementation of review and training on emergency response plan
   ① Establishment response plan in an emergency
   ② Implementation of training on emergency response plan

3. Securing of power source in emergencies
   ① Establishment of procedure of power supply by power-supply car in case of outage AC power sources
   ② Deployment of necessary power-supply car and equipments

4. Securing of definitive heat removal function in emergencies
   ① Enhancement of water injection and cooling function (deployment of fire truck)
   ② Securing of source of fresh water
   ③ Securing of cooling function by portable submersible pump
   ④ Securing of cooling of spent fuel pool in emergencies
     ① Establishment of procedure to continue inject water and cooling function
     ② Deployment of necessary equipments

5. Securing of cooling of spent fuel pool in emergencies
   ① Establishment of procedure to continue inject water and cooling function
   ② Deployment of necessary equipments

6. Implementation of immediate countermeasures taken in consideration of the configuration of the Nuclear Power Station
   ① Improvement of water proof performance at the building that was installed safety significance equipment
   ② Deployment of heavy equipment to ensure access by the road in the Nuclear Power Station (rubble removal, plow)
<table>
<thead>
<tr>
<th>Emergency countermeasures for safety</th>
<th>Contents</th>
<th>Implementation status</th>
</tr>
</thead>
</table>
| (1) Emergency inspection            | ① Confirmation of critical equipment for safety by periodic inspections  
                                    | ② Implementation of review on emergency response and inspection of facilities | Finished on April 1\textsuperscript{st} |
| (2) Implementation of review and training on emergency response plan | ① Establishment of response plan (manual) in an emergency  
                                    | ② Implementation of training on emergency response plan | Finished on April 20\textsuperscript{th}  
                                    |                                                                 | Finished  
                                    | 1\textsuperscript{st} time: comprehensive training at Unit 1 on April 11\textsuperscript{th}  
                                    | 2\textsuperscript{nd} time: comprehensive training at several Units on April 20\textsuperscript{th}  
                                    | 3\textsuperscript{rd} time: comprehensive training at all the Units on April 28\textsuperscript{th} |
| (3) Securement of power source in emergencies | ① Establishment of procedure to supply power by power-supply cars in case of outage AC power source  
                                    | ② Deployment of necessary power-supply car and equipment  
                                    |  
                                    | • Power-supply car  
                                    | • Generator with engine | Finished on April 20\textsuperscript{th}  
                                    | Deployed 4 cars on March 29\textsuperscript{th}  
<pre><code>                                | Deployed 5 generators on March 31\textsuperscript{st} |
</code></pre>
<table>
<thead>
<tr>
<th>Emergency countermeasures for safety</th>
<th>Contents</th>
<th>Implementation status</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4) Securement of definitive heat removal function in emergencies</td>
<td>①Enhancement of water injection and cooling function in reactor (Deployment of fire engines etc.)</td>
<td>Deployed 5 units on April 7th (Secured 8 units including spars)</td>
</tr>
<tr>
<td></td>
<td>②Establishment of procedure to secure fresh water source</td>
<td>Finished on April 20th</td>
</tr>
<tr>
<td></td>
<td>③Securement of function to supply nitrogen to the air operated valve for depressurization in reactor containment vessel ・Spare cylinder</td>
<td>Deployed 35 units on April 13th</td>
</tr>
<tr>
<td></td>
<td>④Securement of cooling function by portable submersible pump</td>
<td>Deployed 4 units on April 1st</td>
</tr>
<tr>
<td>(5) Securement of the function to cool the spent fuel pool in emergencies</td>
<td>①Establishment of procedure to continue water injection and cooling function</td>
<td>Finished on April 20th</td>
</tr>
<tr>
<td></td>
<td>②Deployment of necessary equipment (Deployment of fire engines etc.)</td>
<td>Deployed 5 units on April 7th (Secured 8 Units including spars)</td>
</tr>
<tr>
<td>(6) Implementation of immediate countermeasures considering the Nuclear Power Station configuration</td>
<td>①Improvement of water proof performance at the building that contains safety significance equipment ・Waterproofing outside door ・Waterproofing building hole</td>
<td>Reactor buildings and heat exchanger buildings at Unit 1 – Unit 7 Implemented at 83 sites on March 30th Implemented at 69 sites on April 4th</td>
</tr>
<tr>
<td></td>
<td>②Deployment of heavy equipment to ensure access by the road in the Nuclear Power Station (debris removal, snow blower)</td>
<td>Deployed 2 units on April 7th</td>
</tr>
</tbody>
</table>
Outline of Countermeasures against Tsunami at Kashiwazaki Kariwa Nuclear Power Station

I. Installation of seawalls
To install seawalls to prevent Tsunami from invading the site and to protect light oil tanks, buildings, and other facilities in the power station.

II. Countermeasure against inundation
(1) Installation of floodwalls
To install floodwalls around reactor buildings containing critical equipment in order to prevent Tsunami from damaging power facilities and diesel generators for emergency and to secure safety of the power station.

(2) Installation of water proofing gates
– To install water proofing gate at reactor buildings and turbine buildings to protect equipment from water.

III. Enhanced heat removal and cooling function
(4) Installation of alternative submerged pump and heat exchanger
– To install alternative submerged pump and other equipment to continue to operate residual heat removal system even if cooling function using seawater is lost.

(5) Installation of top venting on reactor buildings
– To install top venting system to prevent hydrogen from piling up in a reactor building.

(6) Additional environment monitoring cars
– To prepare additional monitoring cars to continuously measure radiation dose at the site, for taking all possible measures to ensure gathering of information in emergency situations.

(7) Installation of water source
– To install a fresh water reservoir in the power station to secure stable supply of coolant water for reactors and spent fuel pools.

III. Enhanced heat removal and cooling function
(1) Installation of water source
– To install a fresh water reservoir in the power station to secure stable supply of coolant water for reactors and spent fuel pools.

(2) Additional installation of gas turbine generation vehicle
– To install large capacity gas turbine generation vehicles to supply electricity to residual heat removal system in case of outage of all AC power.

(3) Installation of medium voltage switchgear for emergency and permanent cables for reactor buildings
– To install medium voltage switchgear for emergency and permanent cables for reactor buildings to secure power supply in case of outage of all AC power, and to supply power to residual heat removal system.

(4) Installation of alternative submerged pump and heat exchanger
– To install alternative submerged pump and other equipment to continue to operate residual heat removal system even if cooling function using seawater is lost.

(5) Installation of top venting on reactor buildings
– To install top venting system to prevent hydrogen from piling up in a reactor building.

(6) Additional environment monitoring cars
– To prepare additional monitoring cars to continuously measure radiation dose at the site, for taking all possible measures to ensure gathering of information in emergency situations.

To Reactor Building
Seawater

Transmission line
Spare line

Floodwall
(new)

Waterproofing Gate (new)

Heat Exchanger Building

Turbine Building

Reactor Building

Fresh Water
Tank

Filtered Water
Tank

Filtered Water
Tank
## Progress Status of Countermeasures against Tsunami

at Kashiwazaki Kariwa Nuclear Power Station

As of May 11, 2011

<table>
<thead>
<tr>
<th>Items</th>
<th>Status</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FY 2011</td>
<td>FY 2012</td>
</tr>
<tr>
<td>I . Installation of Seawalls</td>
<td>Design study</td>
<td>Due to be commenced in the latter half of FY 2011</td>
</tr>
<tr>
<td>II . Countermeasure against inundation</td>
<td>Commencement of construction of Unit 1</td>
<td>Due to be completed in the latter half of FY 2012</td>
</tr>
<tr>
<td>(1) Installation of seawalls (incl. countermeasures against inundation, such as air supply openings)</td>
<td>Detail design study</td>
<td>Due to be commenced in June</td>
</tr>
<tr>
<td>(2) Installation of water proofing gates</td>
<td>Design study</td>
<td>Due to be commenced in the latter half of FY 2011</td>
</tr>
<tr>
<td>III . Enhanced heat removal and cooling function</td>
<td>Design study</td>
<td>Due to be commenced in August</td>
</tr>
<tr>
<td>(1) Installation of water source</td>
<td>One vehicle in place</td>
<td>Due to be arranged in the late May</td>
</tr>
<tr>
<td>(2) Additional installation of gas turbine generation vehicle</td>
<td>Another planned to be arranged</td>
<td>Due to be commenced in August</td>
</tr>
<tr>
<td>(3) Installation of medium voltage switchgear for emergency and permanent cables for reactor buildings</td>
<td>Design/production study</td>
<td>Due to be commenced in August</td>
</tr>
<tr>
<td>(4) Installation of alternative submerged pump and heat exchanger</td>
<td>Detail design study</td>
<td>Due to be commenced in July</td>
</tr>
<tr>
<td>(5) Installation of top venting on reactor buildings</td>
<td>Detail design study</td>
<td>Due to be commenced in July</td>
</tr>
<tr>
<td>(6) Additional environment monitoring cars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Addition of monitoring cars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7) Installation of a warehouse for emergency on a hill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consideration of design conditions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Reliability Improvement on Countermeasures for Tsunami in Kashiwasaki-Kariwa Nuclear Power Station

Countermeasures against water exposure to important facilities in the case of securing of losing all power (Reactor Core Isolation Cooling System, Storage Battery, Emergency Power Panel and Main Control Room) and countermeasures for Tsunami at Unit 1 to gain more reliability are to be taken by the end of May.

1. Reliability improvement against water exposure on air inlet in the reactor building
Countermeasure against water exposure for the air inlet at the height less than 15 meters above sea level in the Reactor Building is to close the void or to install waterstop.

2. (1) Reliability improvement against water exposure on doors into reactor building
Countermeasure against water exposure for doors into reactor building is to install additional reinforcement steel and waterstop around doors.

2. (2) Reliability improvement against water exposure on doors inside reactor building
Countermeasure against water exposure to important facilities is to install additional reinforcement steel and waterstop to some parts of doors.