Information on Status of Nuclear Power Plants in Fukushima

Japan Atomic Industrial Forum, Inc.

Policy on information and compilation
This JAIF-compiled information chart represents the situation, phenomena, and operations in which JAIF estimates and guesses the reactors and related facilities are, based on the latest data and information directly and indirectly made available by the relevant organizations when JAIF’s updating works done. Consequently, JAIF may make necessary changes to descriptions in the chart, once (1) new developments have occurred in the status of reactors and facilities and (2) JAIF has judged so needed after reexamining the prior information and judgments. JAIF will do its best to keep tracks on the information on the nuclear power plants quickly and accurately.
**Status of nuclear power plants in Fukushima as of 12:00, May 21st (Estimated by JAIF)**

<table>
<thead>
<tr>
<th>Power Station</th>
<th>Fukushima Dai-ichi Nuclear Power Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td>Electric / Thermal Power output (MW)</td>
</tr>
<tr>
<td>1</td>
<td>460 / 1380</td>
</tr>
<tr>
<td>2</td>
<td>784 / 2381</td>
</tr>
<tr>
<td>3</td>
<td>784 / 2381</td>
</tr>
<tr>
<td>4</td>
<td>784 / 2381</td>
</tr>
</tbody>
</table>

**Environment effect**

- Radiation level: 390μSv/h at the Fukushima site.
- Some radioactive nuclides (I, Cs, Am, Cm and Sr) have been detected in samples and soil collected in the area 20-80 km away from the power plant.
- Small amount of strontium was detected in some data points collected in the area 20-80 km away from the power plant.
- Radioactive iodine and cesium were detected in the samples taken from under the water and sea water at or near the site. Environmental monitoring has been enhanced.
- Radioactive iodine and cesium have been detected in the samples taken from underground water and sea water at or near the site. Environmental monitoring has been enhanced.
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- The walls of the reactor building supporting the spent fuel pool were severely damaged by an explosion on March 15th at unit-4. Work for structural reinforcement to support the spent fuel pool is necessary.
- TEPCO announced the plans to prevent radioactively contaminated water, dust and soil and radioactive material itself from spreading on Apr 17.
- Full operation of spraying synthetic resin to contain contaminated dust started on Apr. 29th and continues.

**Evacuation**

- TEPCO announced its plans to bring the damaged reactors to a stable condition known as a “cold shutdown” in about six to nine months, a situation in which water temperatures inside the reactors have been stably brought below 100°C.
- TEPCO revised its plan to establish a cooling water recirculation system that purifies the pooled water in the building and inject it into the reactor vessel.
- TEPCO estimated that 1100μSv/h was evacuated for within 1km from NPS. The government issued an order to limit intake of some products.
- TEPCO announced its plan to bring the damaged reactors to a stable condition known as a “cold shutdown” in about six to nine months, a situation in which water temperatures inside the reactors have been stably brought below 100°C.
- TEPCO announced its tentative assessment on the status of the core of Unit 1.
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**INES (estimated by NISA)**

- Level 3: Highest level in the International Nuclear and Radiological Event Scale. The event in question is one that has the level 3 category and occurs in a reactor of any type.
<table>
<thead>
<tr>
<th>Power Station</th>
<th>Operation Status at the earthquake occurred</th>
<th>Status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fukushima Dai-ii Nuclear Power Station</strong></td>
<td>In Service -&gt; Automatic Shutdown</td>
<td>All the units are in cold shutdown.</td>
<td>Unit-1, 2, 3 &amp; 4, which were in full operation when the earthquake occurred, all shutdown automatically. No parameter has shown abnormality after the earthquake occurred off an shore of Miyagi prefecture at 23:32, Apr. 7th. Latest Monitor Indication: 1.6μSv/h at 09:00, May 21st at NPS border.</td>
</tr>
<tr>
<td><strong>Onagawa Nuclear Power Station</strong></td>
<td>In Service -&gt; Automatic Shutdown</td>
<td>All the units are in cold shutdown.</td>
<td>3 out of 4 external power lines in service with another line under construction broke down after an earthquake occurred off the shore of Miyagi prefecture at 23:32, Apr. 7th. All SFP cooling systems had been restored after shutting down due to the earthquake.</td>
</tr>
<tr>
<td><strong>Tokai Dai-ii</strong></td>
<td>In Service -&gt; Automatic Shutdown</td>
<td>In cold shutdown.</td>
<td>No abnormality has been found after an earthquake occurred off the shore of Miyagi prefecture at 23:32, Apr. 7th.</td>
</tr>
</tbody>
</table>
Parameters in the Table

JAIP picks up those parameters to evaluate safety condition of the nuclear plants during this accident from the viewpoint of the principles of nuclear power plant safety, which are "Shutdown", "Cooling" and "Containment". Then we create the chart. The following diagram is to show the correspondence relation of those parameters in the table to nuclear power plant safety.

Nuclear Power Plant Safety and related items

- **Shutdown**
  - Design base cooling capability

- **Cooling**
  - Design base containment function
  - 5 Barriers
    - Fuel Pellet
    - Cladding Tube
    - Reactor Pressure vessel
    - Containment Vessel
    - Reactor Building

- **Containment**
  - Alternating Cooling operation

<Accident Management : AM>
( Operation beyond design base accident)

- **Injection to core (AM)**
- **Injection to Containment Vessel (AM)**
- **Containment Venting (AM)**

- **Operation for containment vessel protection against burst**

- **Safety of the spent fuel pool**
  - Fuel integrity in the spent fuel pool
    - (Fuel Damage)
  - Cooling of the spent fuel pool
    - (Water injection, pool temp, water level)

- **Work environment in main control room**
  - Main Control Room Habitability and Operability
    - (temperature, lights, indicator)

- **Environmental effect**
  - Environmental effect (Radiation, Monitor, Contamination)

- **Evacuation**
  - Evacuation (Order, Evacuated Area)
May 17th
11:15-12:00 Report IAW Article 10* (Loss of power)
12:10-16:30 Event falling under Article 15* occurred (Incapability of power supply to the core cooling function)
16:30-17:41 Event falling under Article 15* occurred (Loss of reactor cooling functions)
17:41-17:50 Start venting
19:00-20:00 Event falling under Article 15* occurred (Incapability of water injection by core cooling function)
19:20-20:30 Seawater injection to RPV
20:30-22:00 Operation of spraying water to the spent fuel pool continues.
22:00-22:30 RPV temperature increased
22:30-23:30 Seawater injection through feed water line started in addition to fire extinguish line
24th 11:30 lights in the main control room becomes available
25th 15:37 Freshwater injection to the reactor started.
26th 10:00 Sound of suppression, Suppression Pool damage suspected
29th 07:34, 08:34, 10:00 White smoke reeked
31st 10:00 The operation of transferring water accumulated in Turbine bldg of unit-6 to the makeshift tank conducted.
Apr. 9th 13:10 Transfer of water from the main condenser to the CST completed.
Apr. 13th 17:04 Transfer of silt fences in front of the Unit 1 and 2 seawater screen and intake completed.
Apr. 17th 16:30 Start investigation of the inside of R/B using a remote-controlled robot.
Apr. 29th 11:36 The inside of the building was inspected. It was confirmed that there is no water significant leakage from the CV.
May 1st 12:58 Water feeding was temporarily switched from the reactor injection pump to the fire pump to install alarm device to the reactor injection pump.
May 6th 15:00 Water injection by temporarily installed motor driven pump conducted.
May 14th 10:00 The operation of transferring water accumulated in Turbine bldg of unit-6 to the makeshift tank conducted.
Major Data *1

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 6 09:36</td>
<td>Water injection to the SFP was conducted</td>
</tr>
<tr>
<td>May 7 09:22</td>
<td>Operation of discharging water accumulated in the concrete tunnel outside turbine builtg to the waste processing facility temporarily stopped while piping work for feeding water into the reactor being conducted</td>
</tr>
<tr>
<td>May 10 13:09</td>
<td>Water injection of the SFP was conducted</td>
</tr>
<tr>
<td>May 12 15:20</td>
<td>Operation of discharging water accumulated in the concrete tunnel outside turbine builtg to the waste processing facility temporarily restarted,</td>
</tr>
<tr>
<td>May 14 13:00</td>
<td>Water injection to the SFP was done</td>
</tr>
</tbody>
</table>

Reactor Water level (May 19 11:00)

(A) -1500mm, (B) -2150mm

Reactor pressure (May 19 11:00)

(A) 0.528MPaG, (B) 1.408MPaG

CV pressure (May 19 11:00) 0.1391MPaabs

RPV temperature (May 19 11:00) 121.2°C at feed water line nozzle

Water temperature in SFP (May 19 11:00) 70.0°C

Thermography (Apr. 26 07:30)

Top of R/B: 24°C

Thermography (Apr. 26 07:30)

CV: 25°C, SFP: 23°C

Thermography (Apr. 26 23:00)

CV: 25°C, SFP: 23°C

Water temperature of SFP

Unit 5: 43.4°C (May 19 12:00)

Unit 6: 39.0°C (May 19 12:00)

Abbreviations:

SFP: Spent Fuel Storage Pool
EDG: Emergency Diesel Generator
RPV: Reactor Pressure Vessel
R/B: Reactor Building
RHR: Residual Heat Removal system
CST: Condensate water Storage Tank
T/B: Turbine Building

The accident that brings environmental impact is going on at several units in Fukushima Daiichi nuclear power stations after the earthquake occurred on March 11th. Other nuclear power plants in Japan are in normal operation or safely shutdown.

Status of the Nuclear Power Plants after the Earthquake

- Accident with Nuclear Fuel Damage Suspected
- Accident without Nuclear Fuel Damage Suspected
- Safe
- Safe (Not affected by the quake)