Information on Status of Nuclear Power Plants in Fukushima

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, April 27th (Estimated by JAIF)

<table>
<thead>
<tr>
<th>Power Station</th>
<th>Number of Unit</th>
<th>Electric / Thermal Power output (MW)</th>
<th>Operation Status at the earthquake occurred</th>
<th>Core and Fuel Intensity</th>
<th>Reactor Pressure Vessel structural integrity</th>
<th>Core cooling requiring AC power 1 (Large volume of radioactive effect)</th>
<th>Water Level of the Reactor Pressure Vessel</th>
<th>Fuel assemblies loaded in Core</th>
<th>Reactor Vessel Pressure</th>
<th>Water injection to core (Accident Management)</th>
<th>Fuel Intensity in the spent fuel pool</th>
<th>Cooling of the spent fuel pool</th>
<th>Main Control Room Habitability &amp; Operability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fukushima Dai-ichi Nuclear Power Station</strong></td>
<td>1, 2, 3, 4, 5, 6</td>
<td>460 / 1380 784 / 2381 784 / 2381 784 / 2381 1100 / 3293</td>
<td>In Service -&gt; Shutdown  In Service -&gt; Shutdown  In Service -&gt; Shutdown  In Service -&gt; Shutdown  -</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>

#### Power Generation
- **Electric Power Output**: The output values for each unit are provided in the format Electric/Thermal Power output (MW). Each unit is listed with its respective power output values.

#### Operation Status
- **In Service**: The units are operational and functioning normally.
- **Shutdown**: The units are not currently generating power.

#### Core and Fuel Intensity
- **Loaded fuel assemblies in the core**
  - Unit 1: 548
  - Unit 2: 548
  - Unit 3: Not functional
  - Unit 4: Not functional
  - Unit 5: Not functional
  - Unit 6: Not functional

#### Reactor Vessel Pressure
- **Decreased a little after increasing up to 0.4 Mpa on Mar. 24th**

#### Water Level of the Reactor Pressure Vessel
- **Fuel exposed partially or fully**
  - Unit 1: Stable
  - Unit 2: Stable
  - Unit 3: Stable

#### Fuel assemblies loaded in Core
- **Fuel assemblies loaded in Core**
  - Unit 1: 548
  - Unit 2: 548
  - Unit 3: Not loaded
  - Unit 4: Not loaded
  - Unit 5: Not loaded
  - Unit 6: Not loaded

#### Cooling of the spent fuel pool
- **Water spray started (freshwater)**
  - Unit 1: Continued water injection (Switch from seawater to freshwater)
  - Unit 2: Continued water injection (Switch from seawater to freshwater)
  - Unit 3: Continued water spray and injection (Switch from seawater to freshwater)
  - Unit 4: Continued water spray and injection (Switch from seawater to freshwater)

#### Main Control Room Habitability & Operability
- **Level 2**
  - Unit 4: Not damaged (estimate)

#### Radiological Contamination
- **Small amount of strontium was detected from some samples of soil and plants taken in the area that is 20-80 km far from the power station.**

#### Radiological Protection
- **Shall be evacuated for within 3km from NPS**, Shall stay indoors for within 10km from NPS (issued at 21:23, Mar. 11th)  
  - **Shall be evacuated for within 10km from NPS** (issued at 05:44, Mar. 12th)  
  - **Shall be evacuated for within 20km from NPS** (issued at 18:25, Mar. 12th)  
  - **Shall stay indoors (Issued at 11:30, Mar. 25th)**
  - **Shall stay indoors (Issued at 11:00, Mar. 19th)**
  - **Shall stay indoors (Issued at 11:30, Mar. 25th)**
  - **Shall stay indoors (Issued at 11:00, Mar. 19th)**
  - **Shall stay indoors (Issued at 11:30, Mar. 25th)**
  - **Shall stay indoors (Issued at 11:00, Mar. 19th)**

#### Radioactive Material
- **Nitrogen gas injection into the Unit 1 containment vessel started to prevent hydrogen explosion on Apr. 6th.**
- **TEPCO is considering strengthening the construction plan of adding supports to the pool.**
- **Cooling the spent fuel pool**
  - Water spray started (freshwater)
<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>Level 3</td>
<td>All the units are in cold shutdown.</td>
</tr>
<tr>
<td>Unit 1 - 4</td>
<td></td>
<td></td>
<td>Unit 1, 2, 3 &amp; 4, which were in full operation when the earthquake occurred, all shutdown automatically.</td>
</tr>
<tr>
<td>Electric / Thermal Power output (MW)</td>
<td></td>
<td></td>
<td>External power supply was available after the quake.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>While injecting water into the reactor pressure vessel using make-up water system, TEPCO recovered the core cooling function and made the unit into cold shutdown state one by one.</td>
</tr>
<tr>
<td>Type of Reactor</td>
<td></td>
<td></td>
<td>No parameter has shown abnormality after the earthquake occurred off an shore of Miyagi prefecture at 23:32, Apr. 7th.</td>
</tr>
<tr>
<td>BWR-5</td>
<td></td>
<td></td>
<td>Latest Monitor Indication: 1.9 μSv/h at 09:00, Apr 26th at NPS border</td>
</tr>
<tr>
<td>INES (estimated by NISA) - Level 3</td>
<td>Level 3</td>
<td>Level 3</td>
<td>Monitoring posts' readings have shown no abnormality.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>All SFP cooling systems had been restored after shutting down due to the earthquake.</td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td>Latest Monitor Indication: 1.9 μSv/h at 09:00, Apr 26th 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.</td>
</tr>
<tr>
<td>Unit 1 - 3</td>
<td></td>
<td></td>
<td>All 5 external power lines have become available by Apr. 10th.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monitoring posts' readings have shown no abnormality.</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>

Evacuation Area: 10km from NPS
Parameters in the Table

JANAF picks up these 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 these parameters in the table to nuclear power plant safety.

Nuclear Power Plant Safety and related items

- Reactor Safety
  - Shutdown
  - Cooling
    - Design base cooling capability
  - Containment
    - Design base containment function
      - 5 Barriers
        - Fuel Pellet
        - Cladding Tube
        - Reactor Pressure vessel
      - Containment Vessel
      - Reactor Building
    - Alternative Cooling operation
      - Operation for containment vessel protection against burst

Parameters in the table

- Operation Status at the earthquake
  - Core cooling requiring AC power1 (Large volumetric freshwater injection)
  - Core cooling requiring AC power2 (Cooling through Heat Exchangers)
- Water level of the Reactor Pressure Vessel
- Pressure of the Reactor Pressure Vessel

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

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

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 Openability (Ventilation, Lights, Indicator)

Environmental effect
- Environmental effect (Radiation Monitor, Contamination)

Evacuation
- Evacuation (Order, Evacuated Area)
1. Latest major event and response
Apr. 23rd
12:30-16:44 Some 140 tons of water was sprayed into the SFP using a concrete pump vehicle at Unit 4. The water temperature of the SFP decreased from 83 °C before spraying to 66 °C after spraying.

Apr. 24th
09:05-16:00 Removing of debris was conducted using remote-control heavy equipment.
12:25-17:07 Some 165 tons of water was sprayed into the SFP using a concrete pump vehicle at Unit 4.

Apr. 25th
09:00-16:00 Removing of debris was conducted using remote-control heavy equipment.
18:15-24:26 Some 210 tons of water was sprayed into the SFP using a concrete pump vehicle at Unit 4.

Apr. 26th
12:25-14:03 Some 47.5 ton of freshwater was injected in the SFP at Unit 4.

2. Chronology of Nuclear Power Stations

<table>
<thead>
<tr>
<th>Unit 1</th>
<th>Unit 2</th>
<th>Unit 3</th>
<th>Unit 4</th>
<th>Unit 5 and 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>11th 16:36 Event falling under Article 15* occurred (Incapability of water injection by core cooling function)</td>
<td>11th 16:36 Event falling under Article 15* occurred (Incapability of water injection by core cooling function)</td>
<td>12th 20:41 Start venting</td>
<td>14th 05:20 Start venting</td>
<td>15th 00:02 Cooling SFP with RHR-pump started at Unit 5 and 6.</td>
</tr>
<tr>
<td>11th 16:44 Report IAW Article 10* (Loss of power)</td>
<td>11th 15:42 Report IAW Article 10* (Loss of power)</td>
<td>12th 20:41 Start venting</td>
<td>15th 00:02 Cooling SFP with RHR-pump started at Unit 5 and 6.</td>
<td>16th 05:45 Fire occurred (stabilized spontaneously)</td>
</tr>
<tr>
<td>12th 02:33 Seawater injection through feed water line started in addition to fire extinguishing</td>
<td>13th 08:31 Start venting</td>
<td>16th 05:45 Fire occurred (stabilized spontaneously)</td>
<td>20th 14:30 Cold shutdown achieved at Unit 6.</td>
<td>22nd 02:33 Seawater injection through feed water line started in addition to fire extinguishing</td>
</tr>
<tr>
<td>22nd 11:20 RPV temperature increased</td>
<td>14th 05:20 Start venting</td>
<td>20th 14:30 Cold shutdown achieved at Unit 6.</td>
<td>24th 11:30 Start to transfer the water in the CST to the surge tank</td>
<td>22nd 02:33 Seawater injection through feed water line started in addition to fire extinguishing</td>
</tr>
<tr>
<td>23rd 03:32 Seawater injection through feed water line started in addition to fire extinguishing</td>
<td>14th 11:01 Hydrogen explosion</td>
<td>20th 14:30 Cold shutdown achieved at Unit 6.</td>
<td>24th 11:30 Start to transfer the water in the CST to the surge tank</td>
<td>23th 03:32 Seawater injection through feed water line started in addition to fire extinguishing</td>
</tr>
<tr>
<td>24th 11:30 lights in the main control room becomes available</td>
<td></td>
<td>20th 14:30 Cold shutdown achieved at Unit 6.</td>
<td></td>
<td>24th 11:30 Start to transfer the water in the CST to the surge tank</td>
</tr>
<tr>
<td>Some 140 tons of water was sprayed into the SFP using a concrete pump vehicle at Unit 4. Water temperature of the SFP decreased from 83 °C before spraying to 66 °C after spraying.</td>
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3. Major Incidents and Actions

11th 19:03 State of nuclear emergency was declared (Fukushima Dai-ni NPS)
12th 07:45 State of nuclear emergency was declared (Fukushima Dai-ichi NPS)

4. Evacuation Order

Apr. 13 13:03 Order: for the residents within 10km radius from Unit 2 to evacuate
Apr. 16 18:30 Order: for the residents within 20-30 km radius from Unit 2 to evacuate

5. State of Emergency Declaration

11th 19:03 State of nuclear emergency was declared (Fukushima Dai-ni NPS)
12th 07:45 State of nuclear emergency was declared (Fukushima Dai-ichi NPS)

6. Nuclear Power Stations

Fukushima Dai-ichi NPS

7. Water temperature measured with a concrete pump vehicle

Apr. 26: 10.4°C (Apr. 26 12:00)
Apr. 19: 14.0°C (Apr. 19 12:00)

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

#1 Trend data of primary parameters are available at Japan Nuclear Technology Institute’s Home Page: "http://www.gengiyo.jp/english/shokai/special4.html". 
#2 Data trend is continuously monitored.
The accident that brings environmental impact is going on at several units in Fukushima Daiichi nuclear power station after the earthquake occurred on March 11th. Other nuclear power plants in Japan are in normal operation or safely shutdown.