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 6th (Estimated by JAIF)

<table>
<thead>
<tr>
<th>Power Station</th>
<th>Electric / Thermal Power output (MW)</th>
<th>Fuel assemblies loaded in Core</th>
<th>Type of Reactor</th>
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</thead>
<tbody>
<tr>
<td>Unit 1</td>
<td>460 / 1380</td>
<td>400</td>
<td>BWR-3</td>
<td>784 / 2391</td>
<td>548</td>
<td>BWR-4</td>
<td>784 / 2391</td>
<td>548</td>
<td>BWR-5</td>
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<tr>
<td>Unit 2</td>
<td></td>
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<td>Unit 3</td>
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<td>Unit 4</td>
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<td>Unit 5</td>
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<td>Unit 6</td>
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</tr>
</tbody>
</table>

## Electric / Thermal Power output (MW)

- **Unit 1**: 460 / 1380
- **Unit 2**: 784 / 2391
- **Unit 3**: 784 / 2391
- **Unit 4**: 784 / 2391
- **Unit 5**: 1100 / 3293
- **Unit 6**: 1100 / 3293

## Fuel assemblies loaded in Core

- **Unit 1**: 400
- **Unit 2**: 548
- **Unit 3**: 548
- **Unit 4**: 548
- **Unit 5**: 764
- **Unit 6**: 764

## Type of Reactor

- **Unit 1**: BWR-3
- **Unit 2**: BWR-4
- **Unit 3**: BWR-4
- **Unit 4**: BWR-4
- **Unit 5**: BWR-5
- **Unit 6**: BWR-5

## Core and Fuel Integrity (Loaded fuel assemblies)

- **Unit 1**: No fuel rods
- **Unit 2**: Damage (55%*)
- **Unit 3**: Damage (35%*)
- **Unit 4**: Damage (30%*)
- **Unit 5**: No fuel rods
- **Unit 6**: No fuel rods

## Core cooling requiring AC power 1

- **Unit 1**: Cooling through Heat Exchangers
- **Unit 2**: Cooling through Heat Exchangers
- **Unit 3**: Cooling through Heat Exchangers
- **Unit 4**: Cooling through Heat Exchangers
- **Unit 5**: Cooling through Heat Exchangers
- **Unit 6**: Cooling through Heat Exchangers

## Building Integrity

- **Unit 1**: Severely Damaged
- **Unit 2**: Sevlerly Damaged
- **Unit 3**: Sevlerly Damaged
- **Unit 4**: Sevlerly Damaged
- **Unit 5**: Sevlerly Damaged
- **Unit 6**: Sevlerly Damaged

## Water Level of the Reactor Pressure Vessel

- **Unit 1**: Fuel exposed partially or fully
- **Unit 2**: Fuel exposed partially or fully
- **Unit 3**: Fuel exposed partially or fully
- **Unit 4**: Fuel exposed partially or fully
- **Unit 5**: Fuel exposed partially or fully
- **Unit 6**: Fuel exposed partially or fully

## Reactor Pressure Vessel structural integrity

- **Unit 1**: Unknown
- **Unit 2**: Unknown
- **Unit 3**: Unknown
- **Unit 4**: Unknown
- **Unit 5**: Unknown
- **Unit 6**: Unknown

## Containment Vessel structural integrity

- **Unit 1**: Not Damaged
- **Unit 2**: Not Damaged
- **Unit 3**: Not Damaged
- **Unit 4**: Not Damaged
- **Unit 5**: Not Damaged
- **Unit 6**: Not Damaged

## Water injection to core (Accident Management)

- **Unit 1**: Not applicable
- **Unit 2**: Not applicable
- **Unit 3**: Not applicable
- **Unit 4**: Not applicable
- **Unit 5**: Not applicable
- **Unit 6**: Not applicable

## Water injection to Containment Vessel (AM)

- **Unit 1**: Feed water to fill up the CV (planned)
- **Unit 2**: Feed water to fill up the CV (planned)
- **Unit 3**: Feed water to fill up the CV (planned)
- **Unit 4**: Feed water to fill up the CV (planned)
- **Unit 5**: Feed water to fill up the CV (planned)
- **Unit 6**: Feed water to fill up the CV (planned)

## Fuel assemblies stored in Spent Fuel Pool

- **Unit 1**: 292
- **Unit 2**: 587
- **Unit 3**: 514
- **Unit 4**: 1331
- **Unit 5**: 946
- **Unit 6**: 876

## Fuel Integrity in the spent fuel pool

- **Unit 1**: Unknown
- **Unit 2**: Unknown
- **Unit 3**: Unknown
- **Unit 4**: Unknown
- **Unit 5**: Unknown
- **Unit 6**: Unknown

## Water spray and injection continues (Switch from seawater to freshwater)

- **Unit 1**: Water spray continues (freshwater)
- **Unit 2**: Water spray continues (freshwater)
- **Unit 3**: Water spray continues (freshwater)
- **Unit 4**: Water spray continues (freshwater)
- **Unit 5**: Water spray continues (freshwater)
- **Unit 6**: Water spray continues (freshwater)

## Main Control Room Habitability & Operability

- **Unit 1**: Not damaged (estimate)
- **Unit 2**: Not damaged (estimate)
- **Unit 3**: Not damaged (estimate)
- **Unit 4**: Not damaged (estimate)
- **Unit 5**: Not damaged (estimate)
- **Unit 6**: Not damaged (estimate)

## Environmental effect

- **Status in Fukushima Dai-ichi NPS site**: Radiation level: 412 μSv/h at the south side of the office building, 46 μSv/h at the Main gate, 18 μSv/h at the West gate, as of 9:00, May 8th.

## Influenza

- **Radioactive material**: Detected from milk, agricultural products, and seafood from Fukushima and neighboring prefectures. The government issued order to limit shipment and intake of some products.

## Evacuation

- **Unit 1**: Shall be evacuated for within 3km from NPS, shall stay indoors for within 10km from NPS.
- **Unit 2**: Shall be evacuated for within 20km from NPS.
- **Unit 3**: Shall be evacuated for within 10km from NPS.
- **Unit 4**: Shall be evacuated for within 10km from NPS.
- **Unit 5**: Shall be evacuated for within 20km from NPS.
- **Unit 6**: Shall be evacuated for within 20km from NPS.

## Remarks

- **Nitrogen gas injection into the Unit 1 containment vessel to prevent hydrogen explosion**: Started on April 6th and continues.

## Progress of the work to restore cooling function

- **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.

## Post cooling capability was recovered

- **Ventilators**: Installed at Unit 1 on April 19 and counties.

## Total amount of radioactive materials released to the environment in this accident

- **Total amount of radioactive materials**: One tenth as much as one in the Chernobyl accident so far.

# Source

- **Government Nuclear Emergency Response headquarters**: News Release (-5/1 17:00)
- **TEPCO**: Tokyo Electric Power Company, Inc.
- **NSC**: Nuclear Safety Commission of Japan
- **MEXT**: Ministry of Education, Culture, Sports, Science and Technology
- **NISA**: News Release (-5/3 15:00)
- **JAFI**: Japan Agency for Nuclear Fuel Cycle Technology
- **MEXT**: Ministry of Education, Culture, Sports, Science and Technology

# Abbreviations

- **NSC**: Nuclear Safety Commission of Japan
- **TEPCO**: Tokyo Electric Power Company, Inc.
- **NISA**: News Release (-5/3 15:00)
- **NSC**: Nuclear Safety Commission of Japan
### Power Station: Fukushima Dai-ii Nuclear Power Station

<table>
<thead>
<tr>
<th>Unit</th>
<th>Electric / Thermal Power output (MW)</th>
<th>Type of Reactor</th>
<th>Operation Status at the earthquake occurred</th>
<th>INES (estimated by NISA)</th>
<th>Status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1100 / 3293</td>
<td>BWR-5</td>
<td>In Service -&gt; Automatic Shutdown</td>
<td>Level 3</td>
<td>Level 3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>BWR-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>BWR-5</td>
<td>In Service -&gt; Automatic Shutdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>BWR-5</td>
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</tr>
</tbody>
</table>

**Remarks**
- Unit 1, 2, 3 & 4, which were in full operation when the earthquake occurred, all shutdown automatically.
- External power supply was available after the quake. 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.
- No parameter has shown abnormality after the earthquake occurred off the shore of Miyagi prefecture at 23:32, Apr. 7th.
- Latest Monitor Indication: 20 μSv/h at 09:00, May 6th at NPS border
- Evacuation Area: 3km from NPS(3/12 7:45), 10km from NPS(3/12 17:39), 8km from NPS(4/21)

### Power Station: Onagawa Nuclear Power Station

<table>
<thead>
<tr>
<th>Unit</th>
<th>Operation Status at the earthquake occurred</th>
<th>Status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In Service -&gt; Automatic Shutdown</td>
<td>All the units are in cold shutdown.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks**
- 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 5 external power lines have become available by Apr. 10th. Monitoring posts' readings have shown no abnormality. All SFP cooling systems had been restored after shutting down due to the earthquake.

### Power Station: Tokai Dai-ii

<table>
<thead>
<tr>
<th>Operation Status at the earthquake occurred</th>
<th>Status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Service -&gt; Automatic Shutdown</td>
<td>In cold shutdown.</td>
<td></td>
</tr>
</tbody>
</table>

**Remarks**
- No abnormality has been found after an earthquake occurred off the shore of Miyagi prefecture at 23:32, Apr. 7th.
Parameters in the Table

JAIP picks up those parameters to evaluate safety condition of the nuclear plants during this accident from the view point 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

Parameters in the tabl

- 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
- Core and Fuel Integrity
- Reactor Pressure Vessel Integrity
- Containment Vessel pressure
- Containment Vessel Integrity
- Building Integrity
- Injection to core (AM)
- Injection to Containment Vessel (AM)
- Containment Venting (AM)
- Fuel Integrity in the spent fuel pool (Fuel Damage)
- Cooling of the spent fuel pool (Water injection, pool temp, water level)
- Main Control Room Habitability and Operability (Operation, lights, indicator)
- Environmental effect (Radiation Monitor, Contamination)
- Evacuation (Order, Evacuation Area)
### 1. Latest major event and response

**May 2nd**
09:00-16:00 The operation of spraying synthetic resin to prevent contaminated dust and soil from spreading was conducted.

**Work for setting up a local ventilation unit to improve the work environment in the Unit 1 R/B was started.**

**May 3rd**
14:00-17:00 The operation of transferring water accumulated in the Unit 6 T/B to the makeshift tank was conducted.

**May 5th**
16:36 Ventilators to clean the highly radioactive air inside the reactor building were installed at Unit 1.

### 2. Chronology of Nuclear Power Stations

#### (1) Fukushima Daiichi NPS

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11th 15:42</td>
<td>Report IAW Article 10* (Loss of power)</td>
</tr>
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<td>Report IAW Article 10* (Loss of power)</td>
</tr>
<tr>
<td>11th 16:36</td>
<td>Event falling under Article 15* occurred (Incapacity of water injection by core cooling function)</td>
</tr>
<tr>
<td>11th 05:00</td>
<td>Start venting</td>
</tr>
<tr>
<td>14th 16:34</td>
<td>Start venting</td>
</tr>
<tr>
<td>19th 00:49</td>
<td>Start venting</td>
</tr>
<tr>
<td>22nd 19:41</td>
<td>Start injecting concrete to stop water leakage from the pit</td>
</tr>
</tbody>
</table>

#### 2.1 Reactor Pressure (May 5 11:00)

<table>
<thead>
<tr>
<th>Reactor Pressure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV:</td>
<td>600</td>
</tr>
<tr>
<td>SFP:</td>
<td>600</td>
</tr>
</tbody>
</table>

#### 2.2 Reactor Water Level (May 5 11:00)

<table>
<thead>
<tr>
<th>Reactor Water Level</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV:</td>
<td>-2200</td>
</tr>
<tr>
<td>SFP:</td>
<td>-560</td>
</tr>
</tbody>
</table>

#### 2.3 Thermography (Apr. 26 07:30)

<table>
<thead>
<tr>
<th>Thermography</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV</td>
<td>29℃</td>
</tr>
<tr>
<td>SFP</td>
<td>29℃</td>
</tr>
<tr>
<td>BPR</td>
<td>24℃</td>
</tr>
</tbody>
</table>

#### 2.4 Major Data *1

<table>
<thead>
<tr>
<th>Reactor Water Level</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV:</td>
<td>-2200</td>
</tr>
<tr>
<td>SFP:</td>
<td>-560</td>
</tr>
</tbody>
</table>

#### 2.5 Reactor Water Level (May 5 11:00)

<table>
<thead>
<tr>
<th>Reactor Water Level</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV:</td>
<td>-2200</td>
</tr>
<tr>
<td>SFP:</td>
<td>-560</td>
</tr>
</tbody>
</table>

### Major Data *1

- **Reactor Water level (May 5 11:00)**
  - CV: -2200 mm, SFP: -560 mm
- **Reactor Pressure (May 5 11:00)**
  - CV: 600 MPa, SFP: 600 MPa
- **Thermography (Apr. 26 07:30)**
  - CV: 29℃, SFP: 29℃, BPR: 24℃
- **Water temperature of SFP**
  - Unit 5: 40.3℃ (May 5 12:00)
  - Unit 6: 34.6℃ (May 5 12:00)
Fukushima Dai-ni NPPs
All units are cold shutdown (Unit-1, 2, 4 have been recovered from an event falling under Article 15*)

3. 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)

4. Evacuation Order
11th 21:23 PM direction: for the residents within 3km radius from Fukushima I to evacuate, within 10km radius from Fukushima I to stay in-house
12th 05:44 PM direction: for the residents within 10km radius from Fukushima I to evacuate
12th 17:39 PM direction: for the residents within 10km radius from Fukushima II to evacuate
12th 18:25 PM direction: for the residents within 20km radius from Fukushima I to evacuate
15th 11:06 PM direction: for the residents within 20-30km radius from Fukushima I to stay in-house
25th Governmental advise: for the residents within 20-30 km radius from Fukushima I to voluntarily evacuate

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

*1 Trend data of primary parameters are available at Japan Nuclear Technology Institute’s Home Page; "http://www.gengikyo.jp/english/shokai/special_4.html".
*2 Data trend is continuously monitored.

Status of the Nuclear Power Plants after the Earthquake

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.