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 29th (Estimated by JAIF)

#### Power Station

| Unit | Electric / Thermal Power output (MW) | Type of Reactor | Operation Status at the earthquake occurred | Fuel assemblies loaded in Core | Core and Fuel Integrity (Loaded fuel assemblies) | Reactor Pressure Vessel structural integrity | Containment Vessel structural integrity | Core cooling requiring AC power 1 (Large volumetric freshwater injection) | Core cooling requiring AC power 2 (Cohuming through Heat Exchangers) | Building Integrity | Water Level of the Reactor Pressure Vessel | Pressure / Temperature of the Reactor Pressure Vessel | Water injection to core (Accident Management) | Water injection to Containment Vessel (AM) | Containment Venting (AM) | Fuel assemblies stored in Spent Fuel Pool | Fuel Integrity in the spent fuel pool | Cooling of the spent fuel pool | Main Control Room Habitability & Operability | Environmental effect | Evacuation | INES (estimated by NISA) |
|------|-----------------------------------|-----------------|---------------------------------|-------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| 1    | 460 / 1380                        | BWR-3           | In Service -> Shutdown          | 400                           | Damaged (estimation)           | Damage and Leakage Suspected    | Not Damaged                      | Not Functional                  | Not Functional                  | Severely Damaged                | Fuel exposed partially or fully  | Gradually increasing / Decreased a little after increasing over 400℃ on Mar. 24th | Continuing (Switch from seawater to freshwater)! | Feed water to fill up the CV (started 4/27) | Temporarily stopped | 292                           | Unknown                        | Water spray continues (freshwater) | Not damaged (estimate) | Prior due to loss of AC power | Lighttime and parameter monitoring restored in the control room at Unit 1 and 3 on Mar. 24th, at Unit 2 on Mar. 26th, at Unit 4 on Mar. 28th |
| 2    | 784 / 2381                        | BWR-4           | In Service -> Shutdown          | 548                           | Damaged (estimation)           | Damage and Leakage Suspected    | Not Damaged                      | Not Functional                  | Not Functional                  | Severely Damaged                | Fuel exposed partially or fully  | Stable                           | Continuing (Switch from seawater to freshwater)! | Feed water to fill up the CV (planned) | Temporarily stopped | 587                           | Unknown                        | Water injection continues (Switch from seawater to freshwater)! | Not necessary                  | — | — |
| 3    | 784 / 2381                        | BWR-5           | Outage                          | 548                           | Damage and Leakage Suspected    | Damage and Leakage Suspected    | Not Damaged                      | Not Functional                  | Not Functional                  | Severely Damaged                | Fuel exposed partially or fully  | Unknown                         | Continuing (Switch from seawater to freshwater)! | Feed water to fill up the CV (planned) | Temporarily stopped | 514                           | Unknown                        | Water injection continues (Switch from seawater to freshwater)! | Not necessary                  | — | — |
| 4    | 784 / 2381                        | BWR-4           | Outage                          | 1100 / 3293                   | Unknown                        | Unknown                         | Not Damaged                      | Not Functional                  | —                               | —                               | Fuel exposed partially or fully  | Unknown                         | Damaged (estimation)            | Water spray and injection continues (Switch from seawater to freshwater)! | Not necessary                  | — | — |
| 5    | 784 / 2381                        | BWR-4           | Outage                          | 548                           | Unknown                        | Unknown                         | Not Damaged                      | —                               | —                               | —                               | Fuel exposed partially or fully  | Unknown                         | —                               | —                               | Not necessary                  | — | — |
| 6    | 1100 / 3293                       | BWR-5           | Outage                          | 764                           | Unknown                        | Unknown                         | Not Damaged                      | —                               | —                               | —                               | Fuel exposed partially or fully  | Unknown                         | —                               | —                               | Not necessary                  | — | — |

#### Environmental effect

- Status in Fukushima Dai-ich Nuclear Power Station
- Radiation level: 438μSv/h at the south side of the office building, 49μSv/h at the Main gate, 19μSv/h at the West gate, as of 09:00, Apr. 29th
- Radioactive materials has been detected at the site before now are L. Ca, Pu, Am and Cm(3/27)
- Radioactive materials continues to be detected in samples collected from underground water and sea water at or near the site. Environmental monitoring has been enhanced.
- Radioactive materials has been detected from milk, agricultural products and seafood from Fukushima and neighboring prefectures. The government issued order to limit intake of foodstuffs and intake of some products.
- Radioactive iodine, exceeding the provisional legal limit, was detected from tap water sampled in some prefectures.
- Small amount of strontium was detected in some samples of soil and plants corrective in the area that is 20-80 km far from the power station.

#### Evacuation

- (1) Shall be evacuated for within 3km from NPS, stay shall indoors for within 10km from NPS (issued at 21:23, Mar. 11th)
- (2) Shall be evacuated for within 3km from NPS, stay shall indoors for within 10km from NPS (issued at 05:44, Mar. 12th)
- (3) Shall be evacuated for within 3km from NPS (issued at 18:25, Mar. 12th)
- (4) Shall be evacuated for within 5km from NPS (issued at 11:00, Mar. 15th)
- (5) The 20km evacuation zone around the Fukushima Daiichi NPS is to be expanded so as to include the area, where annual radiation exposure is expected to be above 20mSv. People living in the 20 to 30km and other than the expanded evacuation area mentioned above, are asked to get prepared for staying indoors or evacuation in an emergency (announced on Apr. 11th and issued on Apr. 22nd)

#### INES (estimated by NISA)

- Level 3 *2 - -
- Level 7 *2

#### Total amount of radioactive materials released to the environment in this accident is one tenth as much as one in the Chernobyl accident as far.
### Power Station

<table>
<thead>
<tr>
<th>Power Station</th>
<th>Unit</th>
<th>Electric / Thermal Power output (MW)</th>
<th>Type of Reactor</th>
<th>Operation Status at the earthquake occurred</th>
<th>Status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fukushima Dai-ri Nuclear Power Station</strong></td>
<td>1, 2, 3, 4</td>
<td><strong>1100 / 3293</strong></td>
<td>BWR-5</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. 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 an shore of Miyagi prefecture at 23:32, Apr. 7th. Latest Monitor Indication: 1.9 μSv/h at 09:00, Apr. 28th at NPS border</td>
</tr>
<tr>
<td><strong>Onagawa Nuclear Power Station</strong></td>
<td>1, 2, 3</td>
<td></td>
<td></td>
<td>In Service -&gt; Automatic Shutdown</td>
<td></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 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</td>
</tr>
<tr>
<td><strong>Tokai Dai-ni</strong></td>
<td></td>
<td></td>
<td></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 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

5 Barriers
1. Fuel Pellet
2. Cladding Tube
3. Reactor Pressure vessel
4. Containment vessel
5. Reactor Building

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
- 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)

Safety of the spent fuel pool
- Fuel Integrity in the spent fuel pool (Pool 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 (ventilation, Lights, Indicator)

Environmental effect
- Environmental effect (Radiation Monitor, Contamination)

Evacuation
- Evacuation (Order, Evacuated Area)
### Major Incidents and Actions

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11th 10:42</td>
<td>Report IAW Article 10* (Loss of power)</td>
</tr>
<tr>
<td>11th 10:42</td>
<td>Event falling under Article 15* occurred (Loss of power)</td>
</tr>
<tr>
<td>13th 05:10</td>
<td>Event falling under Article 15* occurred (Loss of water injection by core cooling function)</td>
</tr>
<tr>
<td>14th 04:08</td>
<td>Water temperature in Spent Fuel Storage Pool increased at 86°C</td>
</tr>
<tr>
<td>15th 09:38</td>
<td>Fire occurred on 3rd floor (extinguished spontaneously)</td>
</tr>
<tr>
<td>18th 14:30</td>
<td>Cooling SPF with RHR-pump started at Unit 6</td>
</tr>
</tbody>
</table>

### Reactor Water Level

- **Unit 4**: April 27th, 12:00: 230 mm
- **Unit 6**: April 27th, 12:00: 230 mm

### Reactor Pressure

- **Unit 4**: April 27th, 12:00: 0.155 MPa abs
- **Unit 6**: April 27th, 12:00: 0.155 MPa abs

### Radiator Water Level

- **Unit 1**: April 27th, 12:00: 298 mm
- **Unit 2**: April 27th, 12:00: 298 mm

### Water temperature

- **Unit 4**: April 27th, 12:00: 23.0°C
- **Unit 6**: April 27th, 12:00: 23.0°C

### Current water temperature

- **Unit 4**: April 27th, 12:00: 23.0°C
- **Unit 6**: April 27th, 12:00: 23.0°C

### Major Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 13</td>
<td>Investigation of the inside of R/B using a remote-controlled robot</td>
</tr>
<tr>
<td>April 17</td>
<td>Start transferring highly radioactive water accumulated in the turbine building to the waste processing facility</td>
</tr>
</tbody>
</table>

### Chronology of Nuclear Power Stations

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 12</td>
<td>Start transferring pooled water in the Unit 6 radioactive waste process facility to the Unit 5 condenser</td>
</tr>
</tbody>
</table>

### Latest Major event and response

- **April 23rd**: 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.
- **April 24th**: Removing of debris was conducted using remote-control heavy equipment.
- **April 26th**: Some 110 tons of water was sprayed into the SFP using a concrete pump vehicle at Unit 4.
- **April 27th**: Water spraying into the SFP using a concrete pump vehicle was started at Unit 4.

### Current water temperature

- **Unit 4**: April 27th, 12:00: 23.0°C
- **Unit 6**: April 27th, 12:00: 23.0°C

### Reactor Water Level

- **Unit 1**: April 27th, 12:00: 298 mm
- **Unit 2**: April 27th, 12:00: 298 mm

### Reactor Pressure

- **Unit 1**: April 27th, 12:00: 0.155 MPa abs
- **Unit 2**: April 27th, 12:00: 0.155 MPa abs

### Radiator Water Level

- **Unit 3**: April 27th, 12:00: 298 mm
- **Unit 4**: April 27th, 12:00: 298 mm

### Water temperature

- **Unit 3**: April 27th, 12:00: 23.0°C
- **Unit 4**: April 27th, 12:00: 23.0°C

### Current water temperature

- **Unit 3**: April 27th, 12:00: 23.0°C
- **Unit 4**: April 27th, 12:00: 23.0°C

### Major Incidents and Actions

- **April 23rd**: 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.
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- **April 27th**: Water spraying into the SFP using a concrete pump vehicle was started at Unit 4.

### Current water temperature

- **Unit 3**: April 27th, 12:00: 23.0°C
- **Unit 4**: April 27th, 12:00: 23.0°C

### Reactor Water Level

- **Unit 3**: April 27th, 12:00: 298 mm
- **Unit 4**: April 27th, 12:00: 298 mm

### Reactor Pressure

- **Unit 3**: April 27th, 12:00: 0.155 MPa abs
- **Unit 4**: April 27th, 12:00: 0.155 MPa abs

### Radiator Water Level

- **Unit 5**: April 27th, 12:00: 298 mm
- **Unit 6**: April 27th, 12:00: 298 mm

### Water temperature

- **Unit 3**: April 27th, 12:00: 23.0°C
- **Unit 4**: April 27th, 12:00: 23.0°C

### Current water temperature

- **Unit 3**: April 27th, 12:00: 23.0°C
- **Unit 4**: April 27th, 12:00: 23.0°C

### Major Incidents and Actions

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### Current water temperature

- **Unit 3**: April 27th, 12:00: 23.0°C
- **Unit 4**: April 27th, 12:00: 23.0°C

### Reactor Water Level

- **Unit 3**: April 27th, 12:00: 298 mm
- **Unit 4**: April 27th, 12:00: 298 mm

### Reactor Pressure

- **Unit 3**: April 27th, 12:00: 0.155 MPa abs
- **Unit 4**: April 27th, 12:00: 0.155 MPa abs

### Radiator Water Level

- **Unit 5**: April 27th, 12:00: 298 mm
- **Unit 6**: April 27th, 12:00: 298 mm

### Water temperature

- **Unit 3**: April 27th, 12:00: 23.0°C
- **Unit 4**: April 27th, 12:00: 23.0°C

### Current water temperature

- **Unit 3**: April 27th, 12:00: 23.0°C
- **Unit 4**: April 27th, 12:00: 23.0°C
2. Fukushima Dai-ni NPPs
   All units are cold shutdown (Unit-1, 2, 4 have been recovered from a event falling under Article 15*)

3. State of Emergency Declaration
   11th 19:03 State of nuclear emergency was declared (Fukushima Dai-ni NPP)
   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
   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

*2 Data trend is continuously monitored.