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 10:00 April 1 (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>1</td>
</tr>
<tr>
<td>Electric / Thermal Power output (MW)</td>
<td>460 / 1380</td>
</tr>
<tr>
<td>Type of Reactor</td>
<td>BWR-2</td>
</tr>
</tbody>
</table>

#### Operation Status at the earthquake occurred
- In Service
- Shutdown
- Outage

#### Electric / Thermal Power output (MW)
- Unit 1: 460 / 1380
- Unit 2: 784 / 2381
- Unit 3: 784 / 2381
- Unit 4: 784 / 2381
- Unit 5: 784 / 2381
- Unit 6: 1100 / 3293

#### Type of Reactor
- BWR-2
- BWR-4
- BWR-5

#### Fuel assemblies loaded in Core
- Unit 1: 548
- Unit 2: 548
- Unit 3: No fuel rods
- Unit 4: 548
- Unit 5: 764

#### Fuel and Fuel Integrity
- Core and Fuel Integrity
  - Unit 1: Not Damaged
  - Unit 2: Not Damaged
  - Unit 3: Not Damaged
  - Unit 4: Not Damaged
  - Unit 5: Not Damaged

#### Reactor Pressure Vessel structural integrity
- Core cooled requiring AC power 1
- Functioning (in cold shutdown)
- Open a vent hole on the rooftop for avoiding hydrogen explosion

#### Water Level of the Reactor Pressure Vessel
- Gradually increasing / Decreased a little
- Stable
- Gradually increasing / Decreased a little
- Stable
- Gradually increasing / Decreased a little
- Stable

#### Pressure / Temperature of the Reactor Vessel Pressure
- Gradually increasing
- Decreased a little after increasing over 400 °C on 24th
- Stable
- Decreased a little after increasing up to 0.4Mpa on 24th
- Stable
- Decreased a little after increasing up to 0.4Mpa on 24th
- Stable

#### Containment Vessel Pressure
- Decreased a little after increasing up to 0.4Mpa on 24th
- Stable
- Decreased a little after increasing up to 0.4Mpa on 24th
- Stable
- Decreased a little after increasing up to 0.4Mpa on 24th
- Stable

#### Water injection to core (Accident Management)
- To be confirmed
- To be confirmed
- To be confirmed
- To be confirmed
- To be confirmed

#### Water injection to Containment Vessel (AM)
- Temporarily stopped
- Temporarily stopped
- Temporarily stopped
- Temporarily stopped
- Temporarily stopped

#### Fuel assemblies stored in Spent Fuel Pool
- 292
- 587
- 514
- 1331
- 946
- 876

#### Fuel Integrity in the spent fuel pool
- Unknown
- Unknown
- Damage Suspected
- Possibly damaged
- Not Damaged

#### Cooling of the spent fuel pool
- Water spray started (freshwater)
- Continued water injection (Switch from seawater to freshwater)
- Continued water spray and injection (Switch from seawater to freshwater)
- Continued water spray and injection (Switch from seawater to freshwater)
- Continued water spray and injection (Switch from seawater to freshwater)

#### Main Control Room Habitability & Operability
- Poor due to loss of AC power
- Poor due to loss of AC power
- Poor due to loss of AC power

#### Environmental effect
- Radiation level: 148 µSv/h at the south of the office building.
- Radiation dose higher than 1000 mSv was measured at the surface of water accumulated in the basement of Unit 1 turbine building and in the tunnel for laying pipes outside the building on Mar. 27th.
- Plutonium was detected from the soil of the Fukushima Dai-ichi NPS site on Mar. 28th.
- Radioactive iodine, 131I-133I, 4,385 times higher than regulatory limit was detected on Mar. 30th.
- Nuclear Safety Commission of Japan released prediction of radioactive material spread caused by the accident (Mar. 23rd).
- The advice was then lifted by Mar. 28th, except for four cities and villages in Fukushima prefecture.
- Environmental effect.

#### Environmental effect
- Influence to the people's life
- Radioactive material was detected from milk and agricultural products from Fukushima and neighboring prefectures.
- The government issued orders to limit shipment (21st-23rd) and intake (23rd-30th) for some products.
- Radioactive iodine, exceeding the provisional legal limit, was detected from tap water sampled in some prefectures from Mar. 21 to 27. It was advised not to drink the water in those regions.
- The advice was then lifted by Mar. 28th, except for four cities and villages in Fukushima prefecture.

#### Remarks
- Progress of the work to recover injection function
- Water injection to the reactor pressure vessel by temporarily installed pumps were switched from seawater to freshwater at Unit 1, 2, and 3.
- High radiation circumstance hampering the work to restore originally installed pumps for injection. Discharging radioactive water to the basement of the buildings of Unit 1 through 3 continue to improve this situation. To find a place the water to go become a problem.
- Function of containing radioactive material
- It is presumed that radioactive material inside the reactor vessel may leaked outside at Unit 1, 2 and Unit 3. NISA announced that the reactor pressure vessel of Unit 2 and 3 may lost airtightness because of low pressure inside the pressure vessel. NISA told that it is unlikely that these are cracks or holes in the reactor pressure vessels at the same occasion.
- Cooling the spent fuel pool
- Steam like substance rose intermittently from the reactor building at Unit 1, 2, 3 and 4 has been observed. Injecting and/or spraying water to the spent fuel pool has been conducted.
- Prevention of the proliferation of contaminated dust: there is a plan to spray syntetic resin to contain contaminated dust.

### Source
- Government Nuclear Emergency Response Headquarters: News Release (-4/10 7:30)
- TEPCO: Press Release (-4/10 21:00)

### Abbreviations
- INES: International Nuclear Event Scale
- NISA: Nuclear and Industrial Safety Agency
- TEPCO: Tokyo Electric Power Company, Inc.
<table>
<thead>
<tr>
<th>Power Station</th>
<th>Electric / Thermal Power output (MW)</th>
<th>Type of Reactor</th>
<th>Status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>BWR-5</td>
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<td>BWR-5</td>
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<td></td>
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<tr>
<td>Operation Status at the earthquake occurred</td>
<td>In Service ⇒ Automatic Shutdown</td>
<td>Level 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Status</td>
<td>All the units are in cold shutdown</td>
<td>Level 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INES (estimated by NISA)</td>
<td>Level 3</td>
<td>Level 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks</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. Latest Monitor Indication: 4.9 μSv/h at 21:00, Mar. 31 at NPS border Evacuation Area: 10km from NPS</td>
<td>Safe</td>
<td></td>
<td></td>
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</tbody>
</table>

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<table>
<thead>
<tr>
<th>Power Station</th>
<th>Onagawa Nuclear Power Station</th>
<th>Unit</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
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<tbody>
<tr>
<td>Operation Status at the earthquake occurred</td>
<td>In Service ⇒ Automatic Shutdown</td>
<td>All the units are in cold shutdown.</td>
<td>Safe</td>
<td></td>
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<td>Remarks</td>
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<th>Power Station</th>
<th>Tokai Dai-ri</th>
<th>Unit</th>
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<th>3</th>
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<td>In cold shutdown.</td>
<td>Safe</td>
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</table>
Parameters in the Table
JAIP picks up these 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 correspondences relation of these parameters in the table to nuclear power plant safety.

Nuclear Power Plant Safety and related items

- Reactor Safety y
- Cooling
  - Design base cooling capability
- Containment

Parameters in the tabl

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

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

- Design base containment Function
  - 1) Fuel Pellet
  - 2) Cladding Tube
  - 3) Reactor Pressure vessel
- Containment Vessel
- Reactor Building
- Alternative Cooling operation
  - Operation for containment vessel protection against burst

- 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
  - (ventilation, Lights, Indicator)
- Environmental effect
  - (Radiation Monitor, Contamination)
- Evacuation
  - (Order, Evacuated Area)
1. Latest Major Incidents and Actions
Mar. 31st 08:51 High level of radioactive iodine, I-131, which is 4,385 times higher than criterion, was detected in the seawater sampled in the vicinity of the south discharge outlet of Fukushima Dai-ichi NPS at 13:55, Mar. 30th.

Mar. 31st 09:20 Water level in the trench, tunnel for laying piping, decreased by one meter at Unit 1 after transferring the water using a temporary pump.

11th 15:42 Report IAW Article 10* (Loss of power)
11th 15:42 Event falling under Article 15*
12th 00:49 Event falling under Article 15* (Incapability of water injection by core cooling function)
12th 00:49 Event falling under Article 15* (Incapability of water injection by core cooling function)
12th 14:30 Event falling under Article 15* (Abnormal rise of CV pressure)
12th 15:36 Hydrogen explosion
12th 20:20 Seawater injection to RPV
22nd 11:20 RPV temperature increased
22nd 02:33 Seawater injection through feedwater line started in addition to fire extinguish
24th 11:30 lights in the main control room continue.
25th 10:37 Freshwater injection to the reactor started.
27th 08:30 Continuing to transfer the water in the condenser storage tank to the surge tank becomes available
31st 02:00 Work to remove the water in the condenser storage tank to the surge tank becomes available
31st 12:00 Start to transfer the water in the condensate storage tank to the surge tank
26th 16:46 lights in the main control room becomes available
31st 16:45 Start to transfer the water in the condensate storage tank to the surge tank
31st 16:45 Start to transfer the water in the condensate storage tank to the surge tank becomes available

2. Chronology of Nuclear Power Stations
(1) Fukushima Dai-ichi NPS

<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>Major Incidents and Actions</td>
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<td></td>
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<tr>
<td>*The Act on Special Measures Concerning Nuclear Emergency</td>
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<td>11th 15:42 Report IAW Article 10* (Loss of power)</td>
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<tr>
<td>14th 04:08 Water temperature in Spent Fuel Storage Pool increased at 84°C</td>
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<tr>
<td>19th 05:00 Cooling SFP with RHR-pump started at Unit 5 and 6</td>
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<tr>
<td>10th 05:10 Start venting</td>
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<tr>
<td>12th 20:41 Start venting</td>
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<tr>
<td>15th 09:36 Fire occurred on 3rd floor (extinguished spontaneously)</td>
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<tr>
<td>20th 14:30 Cold shutdown achieved at Unit 5.</td>
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<tr>
<td>20th 19:27 Cold shutdown achieved at Unit 6.</td>
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<tr>
<td>12th 05:45 Fire occurred (extinguished spontaneously)</td>
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</tr>
</tbody>
</table>

(2) Fukushima Dai-ni NPPs

Accidents of Fukushima Dai-ichi and Fukushima-Dai-ni Nuclear Power Stations

April 01st, 2011 07:30

2. Chronology of Nuclear Power Stations
(1) Fukushima Dai-ichi NPS

3. Major Data

Reactor Water level (Apr. 01st 00:00) (Unit 1, 2, 4 have been recovered from a event falling under Article 15*)

<table>
<thead>
<tr>
<th>Reactor Water level (Apr. 01st 00:00)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) -1650mm (B) -1650mm</td>
</tr>
<tr>
<td>(A) -1500mm (B) -2250mm</td>
</tr>
</tbody>
</table>

Water temperature of SFP (24th 11:00) (immeasurable)

Water temperature of SFP

<table>
<thead>
<tr>
<th>Water temperature of SFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Unit 5) 35.1°C (Apr. 01st 02:00)</td>
</tr>
<tr>
<td>(Unit 6) 24.0°C (Apr. 01st 02:00)</td>
</tr>
</tbody>
</table>

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

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 20km 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
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.