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 10th (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>2</td>
</tr>
<tr>
<td>Type of Reactor</td>
<td>BWR-3 BWR-4 BWR-4 BWR-4 BWR-5 BWR-5</td>
</tr>
<tr>
<td>Electric / Thermal Power output (MW)</td>
<td>480 / 1380 764 / 2381 764 / 2381 764 / 2381 764 / 2381 1100 / 2993</td>
</tr>
<tr>
<td>Operation Status at the earthquake occurred</td>
<td>In Service → Shutdown In Service → Shutdown In Service → Shutdown Outage Outage Outage</td>
</tr>
<tr>
<td>Fuel assemblies loaded in Core</td>
<td>400 548 548 548 764</td>
</tr>
<tr>
<td>Core and Fuel Integrity (Loaded fuel assemblies)</td>
<td>Damaged (10%) Damaged (30%) Damaged (30%) Damaged (50%) Damaged (50%)</td>
</tr>
<tr>
<td>Reactor Pressure Vessel structural integrity</td>
<td>No data No data</td>
</tr>
<tr>
<td>Containment Vessel structural integrity</td>
<td>Damage and Leakage Suspected Not damaged</td>
</tr>
<tr>
<td>Core cooling requiring AC power</td>
<td>Large volumetric freshwater injection</td>
</tr>
<tr>
<td>Coolability during heat exchangers</td>
<td>Functional</td>
</tr>
<tr>
<td>Building Integrity</td>
<td>Severely Damaged Severely Damaged Severely Damaged Open a vent hole on the rooftop for avoiding hydrogen explosion</td>
</tr>
<tr>
<td>Water Level of the Reactor Pressure Vessel</td>
<td>1,040Pa on Mar. 24th 1,040Pa on Mar. 24th 1,040Pa on Mar. 24th 1,040Pa on Mar. 24th</td>
</tr>
<tr>
<td>Pressure / Temperature of the Reactor Pressure Vessel</td>
<td>Gradually increasing / Decreased a little after increasing over 400°C on Mar. 24th</td>
</tr>
<tr>
<td>Containment Vessel Pressure</td>
<td>Decreased a little after increasing up to 0.4MPa on Mar. 24th</td>
</tr>
<tr>
<td>Water injection to core (Accident Management)</td>
<td>Continuously (Switch from seawater to freshwater) Continuously (Switch from seawater to freshwater) Continuously (Switch from seawater to freshwater)</td>
</tr>
<tr>
<td>Water injection to Containment Vessel (AM)</td>
<td>To be confirmed</td>
</tr>
<tr>
<td>Containment Venting (AM)</td>
<td>Temporarily stopped</td>
</tr>
<tr>
<td>Containment integrity in Spent Fuel Pool</td>
<td>Not damaged</td>
</tr>
<tr>
<td>Fuel Integrity in the spent fuel pool</td>
<td>Pool cooling capability was recovered</td>
</tr>
<tr>
<td>Cooling of the spent fuel pool</td>
<td>Water spray started (freshwater) Continued water injection (Switch from seawater to freshwater) Continued water spray and injection (Switch from seawater to freshwater)</td>
</tr>
<tr>
<td>Main Control Room Habitability &amp; Operability</td>
<td>Poor due to loss of AC power Poor due to loss of AC power Poor due to loss of AC power</td>
</tr>
</tbody>
</table>

Environmental effect
- Radiation level: 0.028μSv/h at the south side of the office building. 86 μSv/h at the Main gate. 38 μSv/h at the West gate. as of 15:00, Apr. 9th
- Radiation dose higher than 100 mSv was measured at the surface of water accumulated on the basement of Unit 2 turbine building and in the tunnel for laying piping outside the building on Mar. 27th.
- Plutonium was detected from the soil sampled at Fukushima Dai-ichi NPS site on Mar. 21st, 22nd, 25th and 28th. The amount is so small that the Pu is not harmful to human body.
- Radioactive materials exceeding the regulatory limit have been detected from seawater sample collected in the sea surrounding the Fukushima Dai-ichi NPS since Mar. 21st. On Apr. 5th, 7.5 million times the legal limit of radioactive iodine, I-131, was detected from the seawater, which had been sampled near the water intake of Unit 2 on Apr. 2nd. It was found on Apr. 2nd that there was a high radioactive (more than 1000mSv/hr) water in the concrete pit housing electrical cables and this water was leaking into the sea through cracks on the concrete wall. It was confirmed on Apr. 6th that the leakage of water stopped after injecting a hardening agent into holes drilled around the pit. Release of some 10,000 tons of low level radioactive wastewater into the sea began on Apr. 4th, in order to make room for the highly radioactive water mentioned above. Regarding the influence of the low level radioactive waste release, TEPCO evaluated that eating fish and seaweed caught near the plant every day for a year would add some 25% of the dose that the general public receive from the environment for a year.
- TEPCO and MEXT has expanded the monitoring for the surrounding sea area since Apr. 4th.
- Radioactive materials were detected from underground water sampled near the turbine buildings on Mar. 30th.
- Influence to the people's life
- Influence on the radioactivity level in the area
- Radiation level in the area
- Radiation level in the surrounding area
- Radioactive materials detected from milk and agricultural products from Fukushima and neighboring prefectures. The government issued order to limit shipment (21st-) and intake (23rd-) for some products.
- Radioactive iodine, exceeding the provisional legal limit, was detected from tap water sampled in some prefectures from Mar. 21st to 27th. Small fish caught in waters off the coast of Iwaki and Minamisoma on Apr. 4 have been found to contain radioactive cesium above the legal limit on Apr. 5th. It was decided on Apr. 5th that as a legal limit of radioactive iodine, the same amount for vegetables should be applied to fishery products for the time being.

Evacuation
- (1) Shall be evacuated for within 3km from NPS. Shall stay indoors for within 10km from NPS (issued at 21:23, Mar. 11th)
- (2) Shall be evacuated for within 20km from NPS (issued at 18:25, Mar. 12th)
- (3) Shall be evacuated for within 10km from NPS (issued at 05:44, Mar. 12th)
- (4) Shall stay indoors (issued at 11:00, Mar. 15th). Should consider leaving (issued at 11:30, Mar. 25th) for from 20km to 30km from NPS
- The government is suggesting the government revise the current radioactive standards for evacuation, according to which evacuation is only considered when radiation levels reach 50 mSv about one week after any accidents, such that evacuation advisory should be issued to residents from exposed to a total of 20 mSv a year.

Remarks
- Progress of the work to recover injection function
- Function of containing radioactive material
- Influence on the radioactivity level in the area
- Evaluation of the effect of the evacuation
- Progress of the work to recover injection function
- Function of containing radioactive material
- Evaluation of the effect of the evacuation

Abbreviations:
INES: International Nuclear Event Scale
NISA: Nuclear and Industrial Safety Agency
TEPCO: Tokyo Electric Power Company, Inc.
NSC: Nuclear Safety Commission of Japan
MEXT: Ministry of Education, Culture, Sports, Science and Technology

Source:
Government Nuclear Emergency Response Headquarters: News Release (-4/8 19:00), Press conference
NSA: News Release (-4/9 09:00), Press conference
TEPCO: Press Release (-4/9 15:00), Press Conference

*TEPCO's estimation based on the radiation level in the core
*Significance judged by JAIF
LOW
High
Severe (Need immediate action)
<table>
<thead>
<tr>
<th>Power Station</th>
<th>type</th>
<th>Electric / Thermal Power output (MW)</th>
<th>Operation Status at the earthquake occurred</th>
<th>Status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fukushima Dai-ichi Nuclear Power Station</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
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<tr>
<td>BWR-5</td>
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<tr>
<td>1100 / 3293</td>
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<tr>
<td><strong>Remarks</strong></td>
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<tr>
<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: 3.0μSv/h at 15:00, Apr. 8th at NPS border. Evacuation Area: 10km from NPS.</td>
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<tr>
<td><strong>Onagawa Nuclear Power Station</strong></td>
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<tr>
<td>Unit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>In Service</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td><strong>Remarks</strong></td>
<td></td>
<td></td>
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<tr>
<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. Now 2 external power lines are available. Monitoring posts’ readings have shown no abnormality. SFP cooling systems had been restored after shutting down due to the earthquake.</td>
<td></td>
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<tr>
<td><strong>Tokai Dai-ichi</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Operation Status at the earthquake occurred</td>
<td>In Service</td>
<td>Automatic Shutdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Status</td>
<td></td>
<td></td>
<td>In cold shutdown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks</td>
<td>No abnormality has been found after an earthquake occurred off the shore of Miyagi prefecture at 23:32, Apr. 7th.</td>
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</tbody>
</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 correspondence relation of these parameters in the table to nuclear power plant safety.

**Nuclear Power Plant Safety and related items**

- **Shutdown**
- **Cooling**
  - Design base cooling capability
- **Containment**
  - Design base containment function
  - 6 Barriers
    - 1. Fuel Pellet
    - 2. Cladding Tube
    - 3. 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 Exchanger)

- 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 (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
  - Environmental effect (Radiation Monitor, Contamination)

- Evacuation
  - Evacuation (Order, Evacuated Area)
Accidents of Fukushima Dai-ichi and Fukushima-Dai-ni Nuclear Power Stations (as of 10:00, April 10th)

1. Latest Major event and response
   April 7th:
   01:31 Injection of Nitrogen gas started after opening all valves through the line.

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

   1. Latest Major event and response
      A01:31 Injection of Nitrogen gas started through the line.
      Injection of Nitrogen gas through the line.
      Injection of Nitrogen gas started through the line.
      Injection of Nitrogen gas through the line.

   2. Chronology of Nuclear Power Stations
      (1) Fukushima Dai-ichi NPS
      11th 16:36 Event falling under Article 15* occurred (Loss of reactor cooling function)
      12th 00:49 Event falling under Article 15* occurred (Abnormal rise of CV pressure)
      12th 14:30 Start venting
      12th 55:136 Hydrogen explosion
      12th 20:20 Seawater injection to RPV
      20th 14:30 Cold shutdown achieved at Unit 5.

   3. Major Data
      Reactor Water level (Apr. 09 12:00) (A) -1650mm (B) -1650mm
      Reactor Water level (Apr. 09 12:00) (A) -1500mm (B) -250mm
      Reactor Water level (Apr. 09 12:00) (A) -1700mm, (B) -225mm
      Thermography (Apr. 08 07:30) SFP: 46℃
      Water temperature of SFP
      Unit 5: 34.7℃ (Apr. 08 14:00)
      Unit 6: 30.5℃ (Apr. 08 08:00)

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

   5. 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 I 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

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

6. Fukushima Dai-ni NPS
   All units are closed down (Unit-1, 2, 4 have been recovered from a event falling under Article 15*)

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

8. 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 I 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.