

# 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, April 23rd (Estimated by JAIF)**

Power Station	Fukushima Dai-ichi Nuclear Power Station					
	1	2	3	4	5	6
Unit	1	2	3	4	5	6
Electric / Thermal Power output (MW)	460 / 1380	784 / 2381	784 / 2381	784 / 2381	784 / 2381	1100 / 3293
Type of Reactor	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BWR-5
Operation Status at the earthquake occurred	In Service → Shutdown	In Service → Shutdown	In Service → Shutdown	Outage	Outage	Outage
Fuel assemblies loaded in Core	400	548	548	No fuel rods	548	764
Core and Fuel Integrity (Loaded fuel assemblies)	Damaged (70%*1)	Damaged (30%*1)	Damaged (25%*1)	No fuel rods	Not Damaged	Not Damaged
Reactor Pressure Vessel structural integrity	Unknown	Unknown	Unknown	Not Damaged	Not Damaged	Not Damaged
Containment Vessel structural integrity	Not Damaged (estimation)	Damage and Leakage Suspected	Not damaged (estimation)	Not Damaged	Not Damaged	Not Damaged
Core cooling requiring AC power 1 (Large volumetric freshwater injection)	Not Functional	Not Functional	Not Functional	Not necessary	Functional	Functional
Core cooling requiring AC power 2 (Cooling through Heat Exchangers)	Not Functional	Not Functional	Not Functional	Not necessary	Functioning (in cold shutdown)	Functioning
Building Integrity	Severely Damaged (Hydrogen Explosion)	Slightly Damaged	Severely Damaged (Hydrogen Explosion)	Severely Damaged (Hydrogen Explosion)	Open a vent hole on the rooftop for avoiding hydrogen explosion	Open a vent hole on the rooftop for avoiding hydrogen explosion
Water Level of the Reactor Pressure Vessel	Fuel exposed partially or fully	Fuel exposed partially or fully	Fuel exposed partially or fully	Safe	Safe	Safe
Pressure / Temperature of the Reactor Pressure Vessel	Gradually increasing / Decreased a little after increasing over 400°C on Mar. 24th	Unknown / Stable	Unknown	Safe	Safe	Safe
Containment Vessel Pressure	Decreased a little after increasing up to 0.4Mpa on Mar. 24th	Stable	Stable	Safe	Safe	Safe
Water injection to core (Accident Management)	Continuing (Switch from seawater to freshwater)	Continuing (Switch from seawater to freshwater)	Continuing (Switch from seawater to freshwater)	Not necessary	Not necessary	Not necessary
Water injection to Containment Vessel (AM)	(To be confirmed)	to be decided (Seawater)	(To be confirmed)	Not necessary	Not necessary	Not necessary
Containment Venting (AM)	Temporarily stopped	Temporarily stopped	Temporarily stopped	Not necessary	Not necessary	Not necessary
Fuel assemblies stored in Spent Fuel Pool	292	587	514	1331	946	876
Fuel Integrity in the spent fuel pool	Unknown	Unknown	Damage Suspected	some of the spent fuel may have been damaged*3	Not 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) Hydrogen from the pool exploded on Mar. 15th	Pool cooling capability was recovered	Pool cooling capability was recovered
Main Control Room Habitability & Operability	Poor due to loss of AC power (Lighting working in the control room at Unit 1 and 2.)		Poor due to loss of AC power (Lighting working in the control room at Unit 3 and 4.)		Not damaged (estimate)	
Environmental effect	<p>● Status in Fukushima Dai-ichi NPS site                      Radiation level: 460 μSv/h at the south side of the office building, 55 μSv/h at the Main gate, 22 μSv/h at the West gate, as of 09:00, Apr. 23rd                      Small amount of plutonium was detected from the soil sampled at Fukushima Daiichi NPS site.(3/21-4/4).                      Radioactive materials were detected from underground water sampled near the turbine buildings. (3/30). The concentration of the radioactive materials has increased and the monitoring of the underground water is to be expanded. (4/16-)                      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. I-131 detected at near the discharge outlet is 1600 times as much as legal limit.(4/14)                      TEPCO and MEXT has expanded the monitoring for the surrounding sea area since Apr 4th.</p> <p>● Influence to the people's life                      Radioactive material was detected from milk and agricultural products from Fukushima and neighboring prefectures. The government issued order to limit shipment (3/21-) and intake (3/23-) for some products.                      Radioactive iodine, exceeding the provisional legal limit, was detected from tap water sampled in some prefectures.                      Small fish(sand lances) caught in the sea near Fukushima have been found to contain radioactive cesium and iodine above the legal limit(4/5~). The government ordered to suspend shipment and warned not to eat them(4/20-).                      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.</p>					
Evacuation	<p>&lt;1&gt; Shall be evacuated for within 3km from NPS, Shall stay indoors for within 10km from NPS (issued at 21:23, Mar. 11th) &lt;2&gt; Shall be evacuated for within 10km from NPS (issued at 05:44, Mar. 12th)                      &lt;3&gt; Shall be evacuated for within 20km from NPS (issued at 18:25, Mar. 12th) &lt;4&gt; 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 &lt;5&gt;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 in the expanded zone are ordered to evacuate within a month or so. 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 (issued on Apr. 11th).</p>					
INES (estimated by NISA)	Level 7*2 ※Cumulative amount of radioactivity from Fukushima Daiichi NPS has reached the level to be classified as level 7. Total amount of radioactive materials released to the environment in this accident is one tenth as much as one in the Chernobyl accident so far.			Level 3 *2		—
Remarks	<p>● Progress of the work to recover injection function                      High radiation circumstance hampering the work to restore originally installed pumps for injection at unit-1,2 and 3. Efforts have been made to remove radioactive water in the basement of the buildings of Unit 1through 3 to improve this situation. Transfer of highly radioactively contaminated water from Unit 2, where about 25,000 tons of such water has accumulated on the basement of its turbine building and in the concrete tunnel outside the building, to the waste processing facility began on Apr. 19th. It is estimated to take 26 days to transfer about 10,000 tons of the water.                      Distribution switchboards for water injection pumps of Unit 1through 3 reactors were moved to heights to avoid tsunami.                      On Apr. 17th, TEPCO announced that that it plans to fill the containment vessels of Unit 1 and 3 with water up to the levels of covering the fuels in the reactors while considering fixing the damaged containment vessel of Unit 2. It will also install heat exchangers to remove the heat from the reactors and lead them into cold shutdown in about 3 to 6 months.</p> <p>● 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, based on radioactive material found outside. NISA estimated that the reactor pressure vessel of Unit 2 and 3 may have lost air tightness although it is unlikely that these are cracks or holes in the reactor pressure vessels.                      Nitrogen gas injection into the Unit 1 containment vessel started to prevent hydrogen explosion on Apr. 6th. On Apr. 17th, TEPCO announced that it plans to install facilities and tanks to process and store the highly radioactive water accumulated in the buildings and tunnels. It will also install huge covers with special filters to enclose the reactor buildings so as to control the release of radioactive materials to the environment.</p> <p>● 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.</p> <p>● Prevention of the proliferation of contaminated dust:</p>					

[Source]  
 Government Nuclear Emergency Response Headquarters:  
 News Release (-4/22 17:00), Press conference  
 NISA: News Release (-4/22 15:30), Press conference

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

\*1 TEPCO's estimation based on the radiation level in the CV  
 \*2 Correction: Rating was raised from 5 to 7 for the accident of Unit 1 through 3  
 \*3 It is presumed that some of the spent fuel may have been damaged based on radioactive substance detected from the water sample taken from the pool of Unit 4.

[Significance judged by JAIF]  
 ■ Low  
 ■ High  
 ■ Severe (Need immediate action)

Power Station	Fukushima Dai-ni Nuclear Power Station			
Unit	1	2	3	4
Electric / Thermal Power output (MW)	1100 / 3293			
Type of Reactor	BWR-5	BWR-5	BWR-5	BWR-5
Operation Status at the earthquake occurred	In Service → Automatic Shutdown			
Status	All the units are in cold shutdown.			
INES (estimated by NISA)	Level 3	Level 3	—	Level 3
Remarks	<p>Unit-1, 2, 3 &amp; 4, which were in full operation when the earthquake occurred, all shutdown automatically.</p> <p>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.</p> <p>No parameter has shown abnormality after the earthquake occurred off an shore of Miyagi prefecture at 23:32, Apr. 7th.</p> <p>Latest Monitor Indication: 2.1 <math>\mu</math> Sv/h at 09:00, Apr. 22nd at NPS border</p> <p>Evacuation Area: 10km from NPS</p>			

Power Station	Onagawa Nuclear Power Station		
Unit	1	2	3
Operation Status at the earthquake occurred	In Service → Automatic Shutdown		
Status	All the units are in cold shutdown.		
Remarks	<p>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.</p>		

Power Station	Tokai Dai-ni	
Operation Status at the earthquake occurred	In Service → Automatic Shutdown	
Status	In cold shutdown.	
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**

JALIF 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**

**Parameters in the tabl**

