# 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 16:00, April 8th (Estimated by JAIF)

Power Station		cai power plants in r akus	Fukushima Dai-ichi Nuclear Pov	-		
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)	400 Damaged (70%*)	Damaged (30%*)	Damaged (25%*)	No fuel rods		amaged
Reactor Pressure Vessel structural integrity	Unknown	Unknown	Unknown	Not Damaged		
Containment Vessel structural integrity	Not Damaged (estimation)	Damage and Leakage Suspected	Not damaged (estimation)		Not Damaged  Not Damaged	
Core cooling requiring AC power 1	Not Dallaged (estillation)		Not dalllaged (estillation)	Not Dalllaged	Not Damaged Not Damaged	
(Large volumetric freshwater injection)	Not Functional Not Functional Not Functional Not necessary		Functional			
Core cooling requiring AC power 2 (Cooling through Heat Exchangers)	Not Functional	Not Functional	Not Functional	Not necessary	Functioning (in cold shutdown)	
Building Integrity	Severely Damaged (Hydrogen Explosion)	Slightly Damaged	Severely Damaged (Hydrogen Explosion)	Severely Damaged (Hydrogen Explosion)	Open a vent hole on the ro expl	oftop for avoiding hydroge osion
Water Level of the Rector Pressure Vessel	Fuel exposed partially or fully	Fuel exposed partially or fully	Fuel exposed partially or fully	Safe	Si	afe
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	
Containment Vessel Pressure	Decreased a little after increasing up to 0.4Mpa on Mar. 24th	Stable	Stable	Safe	Si	afe
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 ne	cessary
Water injection to Containment Vessel (AM)	(To be confirmed)	to be decided (Seawater)	(To be confirmed)	Not necessary	Not ne	cessary
Containment Venting (AM)	Temporally stopped	Temporally stopped	Temporally stopped	Not necessary	Not ne	cessary
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		amaged
Cooling of the spent fuel pool	Water spray started (ffreshwater)	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	
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	Status in Fukushima Dai-ichi NPS site Radiation level: 0.67mSv/h at the south side of the office building, 96 µ Sv/h at the Main gate, 42 µ Sv/h at the West gate, as of 09:00. Apr. 8th Radiation dose higher than 1000 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 highly 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 waster mentioned above. Regarding the influence of the low level radioactive waste release, TEPCO evaluated that eating fish and seawed caught near the plant every day for a year would add some 25% of the dose that the general pubic 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 Radioactive material was detected from milk and agricultural products from Fukushima and neighboring prefectures. The government issued order to lim					
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 10km from NPS (issued at 05:44, Mar. 12th) <3> Shall be evacuated for within 20km from NPS (issued at 18:25, 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 *NSC is suggesting the government revise the currrent 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 prevent residents from exposed to a total of 20 mSv a year.					
INES(estimated by NISA)	Level 5	Level 5	Level 5	Level 3		_
Remarks	Progress of the work to recover injection function  Water injection to the reactor pressure vessel by temporally 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 in the basement of the buildings of Unit 1through 3 continue to improve this situation. Water transfer work is being made to secure a place the water to go. Lighting in the turbine buildings became partly available at Unit 1through 4.  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 announced that the reactor pressure vessel of Unit 2 and 3 may have lost air tightness 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.  TEPCO started to inject nitrogen gas into the Unit 1 containment vessel to reduce the possibility of hydrogen explosion on Apr. 6th. The same measure will be taken for Unit 2 and 3.  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.					
[Source]	Prevention of the proliferation of contamir		etic resin to contain contaminated dust b			

[Source]

Government Nuclear Emergency Response Headquarters: News Release (<u>-4/8 08:00</u>), Press conference

NISA: News Release (<u>-4/8 08:00</u>), Press conference

NISA: Nuclear and Industrial Safety Age TEPCO: Press Release (-4/8 09:00), Press Conference

[Abbreviations]

NISA: Nuclear and Industrial Safety Agency TEPCO: Tokyo Electric Power Company, Inc.

NSC: Nuclear Safety Commission of Japan

MEXT: Minstry of Education, Culture, Sports, Science and Technology

\*TEPCO's estimation based on the radiation level in the CV

[Significance judged by JAIF]

Low High

■ Severe (Need immediate action)

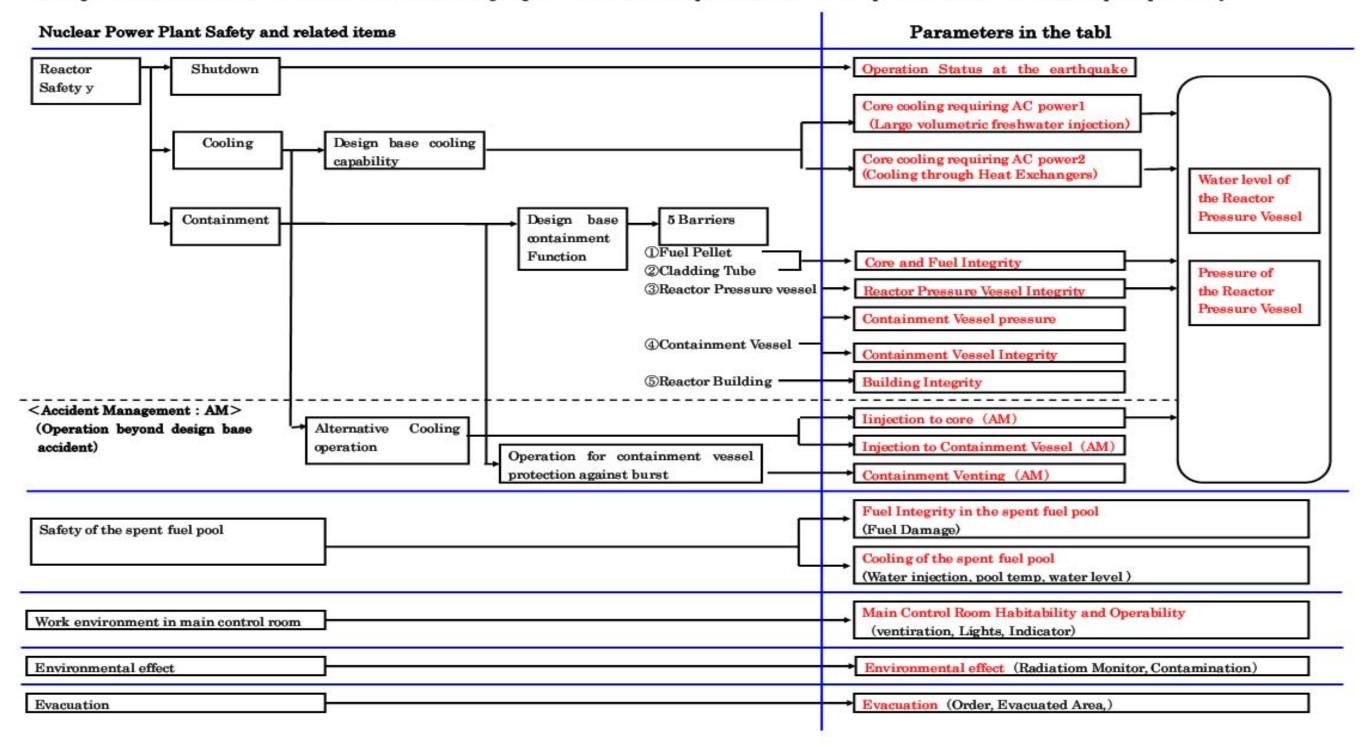
Power Station	Fukushima Dai-ni Nuclear Power Station				
Unit	1	2	3	4	
Electric / Thermal Power output (MW)	1100 / 3293				
Type of Reactor	BWR-5	BWR-5	BWR-5	BWR-5	
Operation Status at the earthquake occurred	In Service -> Automatic Shutdown				
Status	All the units are in cold shutdown.				
INES (estimated by NISA)	Level 3	Level 3	<del>-</del>	Level 3	
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. Latest Monitor Indication: 3.0 \( \psi \text{ Sv/h} \) at 09:00, Apr. 8th at NPS border Evacuation Area: 10km from NPS				

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	Safe				

Power Station	Tokai Dai-ni		
Operation Status at the earthquake occurred	In Service -> Automatic Shutdown		
Status	In cold shutdown.		
Remarks	Safe		

#### Parameters in the Table

JAIF 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.



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

(as of 08:00, April 8th)



01:31 Injection of Nitrogen gas started after opening all valves through the line.

As of 23:52 At Fukushima Dai-ichi NPS, instruments readings of Units 1 through 6 and monitoring posts have shown no abnormality after the earthquake occurred off the shore of Miyagi prefecture at 23:32.

As of 00:00 At Fukushima Dai-ichi NPS, instruments readings of Units 1 through 6 and monitoring posts have shown no abnormality after the earthquake occurred off the shore of Miyagi prefecture at 23:32.

#### 2. Chronology of Nuclear Power Stations

(1) Fukushima Dai-ichi NPS	Unit 1	Unit 2	Unit 3	Unit 4	Unit-5 and 6	
	11th 15:42 Report IAW Article 10* (Loss of		11th 15:42 Report IAW Article 10* (Loss of	14th 04:08 Water temperature in Spent Fuel	19th 05:00 Cooling SFP with RHR-pump started at Unit 5	
Major Incidents and Actions	power)	11th 15:42 Report IAW Article 10* (Loss of power)	power)	Storage Pool increased at 84°C	19th 22:14 Cooling SFP with RHR-pump started at Unit 6	
*The Act on Special	11th 16:36 Event falling under Article 15*	441, 40,00 F and falling a law Adiaba 45* and and	power,			
*The Act on Special Measures Concerning	occurred (Incapability of water injection by core	11th 16:36 Event falling under Article 15* occurred	12th 20:41 Start venting	15th 09:38 Fire occurred on 3rd floor	20th 14:30 Cold shutdown achieved at Unit 5.	
Nuclear Emergency	cooling function)	(Incapability of water injection by core cooling function)		(extinguished spontaneously)	20th 19:27 Cold shutdown achieved at Unit 6.	
Nuclear Emergency Preparedness	12th 00:49 Event falling under Article 15*	13th 11:00 Start venting	13th 05:10 Event falling under Article 15*	16th 05:45 Fire occurred (extinguished	22nd 19:41 All power source was switched to external AC	
	occurred (Abnormal rise of CV pressure)		occurred (Loss of reactor cooling functions)	spontaneously)	power at Unit 5 and 6.	
	12th 14:30 Start venting	14th 13:25 Event falling under Article 15* occurred	13th 08:41 Start venting	Since 20th, operation of spraying water to the		
		(Loss of reactor cooling functions)	Tour our Clark romany	spent fuel pool continues.	Apr. 1st 13:40 Start transferring pooled water in the Unit 6	
	12th 15:36 Hydrogen explosion	14th 16:34 Seawater injection to RPV	13th 13:12 Seawater injection to RPV	29th 11:50 lights in the main control room becomes available	radioactive waste process facility to the Unit 5 condenser.	
		14th 22:50 Report IAW Article 15* (Abnormal rise of CV		becomes available		
	12th 20:20 Seawater injection to RPV	pressure)	14th 05:20 Start venting			
	22nd 11:20 RPV temperature increased	15th 00:02 Start venting	14th 07:44 Event falling under Article 15*			
	•	15th 00.02 Start venting	occurred (Abnormal rise of CV pressure)			
	22nd 02:33 Seawater injection through feed	15th 06:10 Sound of explosion,	14th 11:01 Hydrogen explosion			
	water line started in addition to fire extinguish line	Suppression Pool damage suspected	THAT THO THY GOOD ON			
	24th 11:30 lights in the main control room	15th 08:25 White smoke reeked	15th 10:22 Radiation dose 400mSv/h			
	becomes available	Cines 20th appretion of approximate water to the append				
	25th 15:37 Freshwater injection to the reactor started.	Since 20th, operation of spraying water to the spent fuel pool continues.	16th 08:34, 10:00 White smoke reeked			
		21st 18:22 White, steam-like smoke erupted from the	Since 17th, operation of spraying water to the			
	basement of the turbine building	top of the rector building.	spent fuel pool continues.			
	9	top of the rector building.	• • • • • • • • • • • • • • • • • • • •			
	31st 09:20-11:25 Work to remove the water in the trench	26th 10:10 Freshwater injection to the reactor started.	21st 15:55 Slightly gray smoke erupted (18:02 settled)			
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	31st 12:00 Start to transfer the water in the CST	26th 16:46 lights in the main control room becomes available	22nd 22:46 lights in the main control room			
	to the surge tank (- 15:27, Apr. 2)		becomes available			
!	31st 13:03 Start water injection to SFP	29th 16:45 Start to transfer the water in the CST to the	25th 18:02 Freshwater injection to the reactor			
	Ann 7th 04:04 laineting of Nitrogram and started	surge tank	started.			
1	Apr. 7th 01:31 Injection of Nitrogen gas started after opening all valves through the line.	Apr. 2nd 16:25 Start injecting concrete to stop water	28th 17:40 Start to transfer the water in the CST			
	after opening all valves through the line.	leakage from the pit near the intake	to the surge tank			
		2nd 17:10 Start transferring water in the condenser to the CST				
		Apr. 5th 15:07 Regarding leakage from the pit that is				
		closed to discharge outlet of unit-2, hardening agent				
		was injected to hole dug surrounding the pit. (Apr. 6				
		05:38 It was confirmed that the highly radioactive water				
		flow mentioned above stopped.)				
	Apr. 3rd 12:18 Switch power supply for water injection pumps to the RPV from power supply vehicles to originally equipped power source					
	1 117					
Major Data	Reactor Water level ( <u>Apr. 08 00:00</u> )	Reactor Water level (Apr. 08 03:00)	Reactor Water level ( <u>Apr. 08 01:30</u> )	Thermography (Apr. 06 07:30)	Water temperature of SFP	
	(A) -1650mm (B) -1650mm	-1500mm	(A) <u>-2000mm</u> , (B) -2250mm	SFP: 57°C	Unit 5 34.8°C (Apr. 08 06:00)	
	Reactor pressure (Apr. 08 00:00)	Reactor pressure (Apr. 08 03:00)	Reactor pressure (Apr. 08 01:30)		Unit 6 28.0°C (Apr. 08 06:00)	
	(A) <u>0.390MPaG</u> , (B) <u>0.788MPaG</u>	(A) <u>-0.011MPaG</u> , (B) <u>-0.016MPaG</u>	(A) <u>0.002MPaG</u> , (B) <u>-0.081MPaG</u>			
	CV pressure ( <u>Apr. 08 03:00</u> )	CV pressure ( <u>Apr. 08 03:00</u> )	CV pressure ( <u>Apr. 08 01:30</u> )			
	0.180MPaabs	0.100MPaabs	0.1061MPaabs		4	
	RPV temperature (Apr. 08 00:00)	RPV temperature (Apr. 08 03:00)	RPV temperature (Apr. 08 01:30)			
	260.7°C at feed water line nozzle	143°C at feed water line nozzle	88.2°C at feed water line nozzle (under repair)		-	
	Thermography (Apr. 06 07:30) CV: 29°C, SFP: 24°C	Water temperature in SFP (Apr. 08 03:00) 63.0°C	Thermography (Apr. 06 07:30) CV: 32°C, SFP: 60°C			
	<u> </u>	Thermography (Apr. 06 07:30)	UV. 32 U, 3FF. 00 U		_	
		Top of R/B: 32°C				
(2) Fukushima Dai-ni NPPs	1	1 OP 0: 11/D. 02 O		*SEP: Spent Fuel Storage Pool		

#### (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 NPS)

12th 07:45 State of nuclear emergency was declared (Fukushima Dai-ichi NPS)

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

\*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

## Status of the Nuclear Power Plants after the Earthquake

