Status of nuclear power plants in Fukushima as of 22:00 March 24 (Estimated by JAIF)

Power Station	Fukushima Dai-ichi Nuclear Power Station					
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
Core and Fuel Integrity (Loaded fuel assemblies)	Damaged (400)	Damaged (548)	Damaged (548)	No fuel rods	Not Damaged (548)	Not Damaged (764)
Reactor Pressure Vessel Integrity	Unknown	Unknown	Unknown	Not Damaged	Not Damaged	Not Damaged
Containment Vessel Integrity	Not Damaged	Damage Suspected	Not damaged	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 (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 rooftop for avoiding hydrogen explosion	
Water Level of the Rector 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 / Decreasing after Increase	Unknown	Unknown	Safe	Safe	Safe
Containment Vessel Pressure	Gradually Increasing	Stable	Decreasing after increase in Mar., 20th	Safe	Safe	Safe
Water injection to core (Accident Management)	Continuing (Seawater)	Continuing(Seawater)	Continuing(Seawater)	Not necessary	Not necessary	Not necessary
Water injection to Containment Vessel (AM)	(confirming)	to be decided(Seawater)	(confirming)	Not necessary	Not necessary	Not necessary
Containment Venting (AM)	Temporally stopped	Temporally stopped	Temporally stopped	Not necessary	Not necessary	Not necessary
Fuel Integrity in the spent fuel pool (Stored spent fuel assemblies)	Unknown (292)	Unknown (587)	Possibly damaged (514)	Possibly damaged (1331)	Not Damaged (946)	Not Damaged (876)
Cooling of the spent fuel pool	Water injection to be considered	Seawater Injection conducted in Mar. 20th	Water level low, Seawater spray continue and certain effect was confirmed	Water level low, Seawater spray continue Hydrogen from the pool exploded	Pool cooling capability was recovered	Pool cooling capability was recovered
Main Control Room Habitability & Operability	Poor due to loss of AC power (Lighting has been recovered.)		Poor due to loss of AC power (Lighting has been recovered.)		Not damaged (estimate)	
Environmental effect	The Main Gate: 202.0 μ Sv/h at 21:00, Mar. 24 Radioactive nuclides exceeding the legal standard were detected in milk produced in Fukushima and Ibaraki prefectures and spinach and some other vegetables produced in Fukushima, Ibaraki and other prefectures. Also, radioactive Iodine exceeding the standard set by Nuclear Safety Commission was detected in tap water in Fukushima prefecture. Radioactive Iodine exceeding the legal standard for baby was detected in tap water in Tokyo, Ibaraki, Chiba, and Saitama prefectures. The level of the radioactivity detected is low enough not to do harm to the health of people who take those products or water for a limited time. Monitoring results of seawater sampled at coasts in the surrounding area of the station within about 16km from the Fukushima Dai-ichi NPS in Mar. 22nd showed that radioactive Iodine, I-131, exceeding the regulatory limit and Cesium, Cs-134, 137, less than the regulatory limit were detected.					
Evacuation	20km from NPS ＊People who live between 20km to 30km from the Fukushima Dai-ichi NPS are to stay indoors.					
INES (estimated by NISA)	Level 5	Level 5	Level 5	Level 3	—	—
Remarks	Immediate threat is damage of the fuels in the fuel pool outside the containment vessel. The operation for spraying water to the pool is continuing at Unit 3 and 4. Something like steam was seen rising from the reactor building of Unit 1through 4 (as of 7:00, Mar. 24). High-dose rate was measured in Unit 2 turbine building. Work to recover AC power for Unit 1through 6 is in progress. External AC power has reached to Unit 2, 4, 5 and 6 and is now available in all the units. Integrity check of electric equipment is going on in each unit, which must be done before energizing them. Lighting has been recovered at Unit 1 and 3 Main Control Room. External AC power has replaced with the emergency diesel generator in Unit 5 and 6.					

[Source]
Government Nuclear Emergency Response Headquarters: News Release (-3/24 18:00), Press conference
NISA: News Release (-3/24 19:30), Press conference
TEPCO: Press Release (-3/24 21:00), Press Conference

[Abbreviations]
INES: International Nuclear Event Scale
NISA: Nuclear and Industrial Safety Agency
TEPCO: Tokyo Electric Power Company, Inc.

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

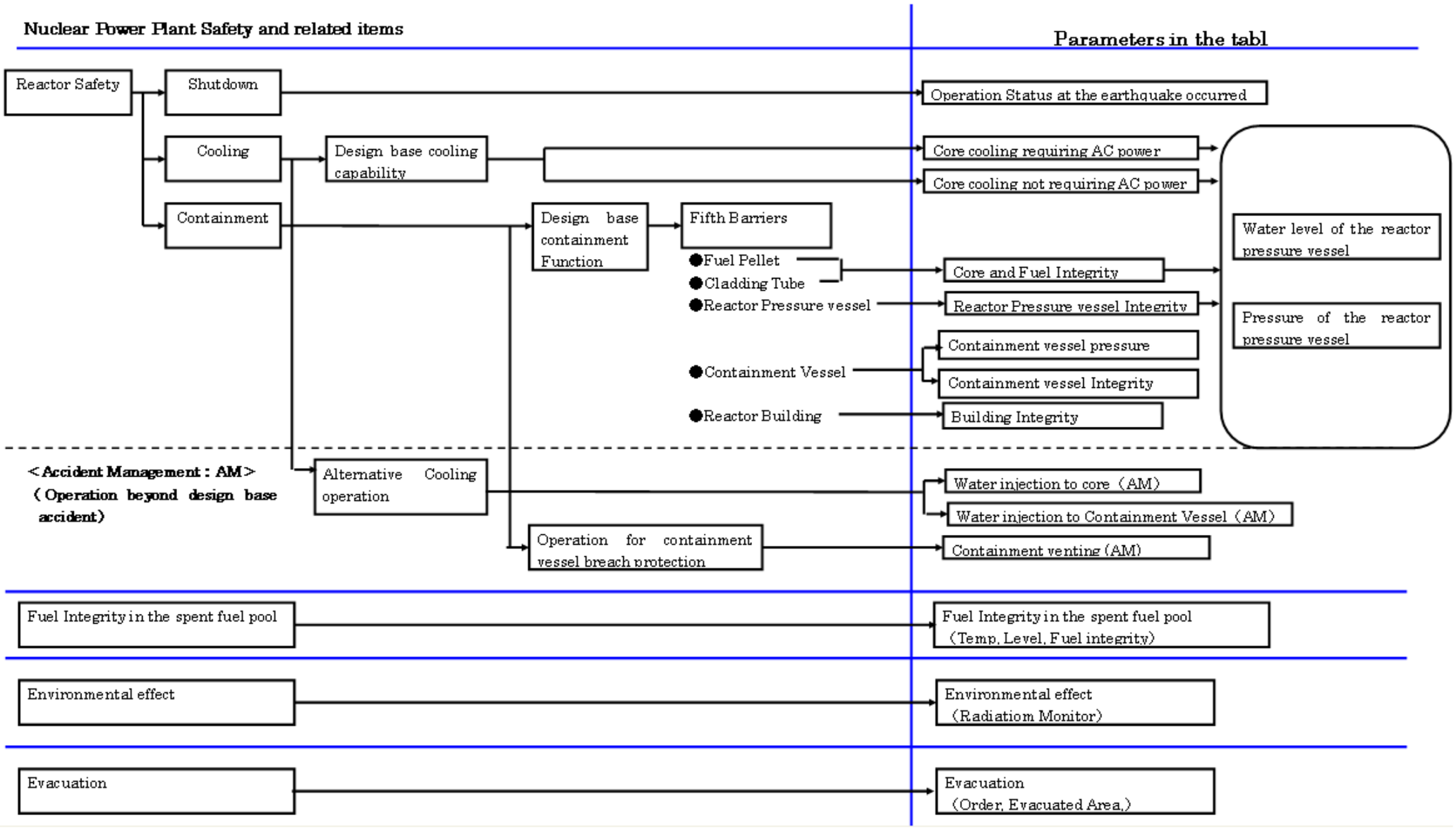
Power Station	Fukushima Dai-ni Nuclear Power Station			
Unit	1	2	3	4
Electric / Thermal Power output (MW)	1100 / 3293			
Type of Reactor	BWR-5	BWR-5	BWR-5	BWR-5
Operation Status at the earthquake occurred	In Service -> Automatic Shutdown			
Status	All the units are in cold shutdown.			
INES (estimated by NISA)	Level 3	Level 3	—	Level 3
Remarks	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: 9.4 μ Sv/h at 21:00, Mar. 24 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

(March 24th, 2011 18:00)

1. Latest Major Incidents and Actions

<March 22nd>
22:46 Lighting has been secured at Unit 3 Main Control Room
<March 23rd>
02:33 Feed Water Line was added to the Fire Extinguish Line to inject water into the Reactor Pressure Vessel in Unit 1.
16:20 Black smoke erupted from Unit 3
17:24 Residual Heat Removal pump stopped automatically as the primary power supply replaced with the temporary power source in Unit 5. Backup pump is to be in service on 24th.
<March 24th>
05:35 Water injection to SFP via reactor water clean up system started in Unit 3.
Around 11:30 Lighting has been recovered at Unit 1 Main Control Room.
16:14 Residual Heat Removal pump of Unit 5, which had stopped automatically, was restarted and then the system was put into shutdown cooling mode.

2. Chronology of Nuclear Power Stations

(1) Fukushima Dai-ichi NPS

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5, 6
Major Incidents and Actions **The Act on Special Measures Concerning Nuclear Emergency Preparedness*	11th 15:42 Report IAW Article 10* (Loss of power)	11th 15:42 Report IAW Article 10* (Loss of power)	11th 15:42 Report IAW Article 10* (Loss of power)	14th 04:08 Water temperature in Spent Fuel Storage Pool increased at 84℃	Water temperature in SF Storage Pool is increasing
	11th 16:36 Event falling under Article 15* occurred (Incapability of water injection by core cooling function)	11th 16:36 Event falling under Article 15* occurred (Incapability of water injection by core cooling function)	13th 05:10 Event falling under Article 15* occurred (Loss of reactor cooling functions)	15th 09:38 Fire occurred on 3rd floor (extinguished spontaneously)	18th Vent hole was opened on the rooftop for avoiding hydrogen explosion
	12th 00:49 Event falling under Article 15* occurred (Abnormal rise of CV pressure)	14th 13:25 Event falling under Article 15* occurred (Loss of reactor cooling functions)	13th 08:41 Start venting	16th 05:45 Fire occurred (extinguished spontaneously)	19th 05:00 RHR-pump in the Unit-5 restarted. 19th 22:14 RHR-pump in the Unit-6 restarted
	12th 14:30 Start venting	14th 16:34 Seawater injection to RPV	13th 13:12 Seawater injection to RPV	Since 20th, operation of spraying water to the spent fuel pool continues.	20th 14:30 Reactor cold shutdown at Unit-5 20th 19:27 Reactor cold shutdown at Unit-6
	12th 15:36 Hydrogen explosion	14th 22:50 Report IAW Article 15* (Abnormal rise of CV pressure)	14th 07:44 Event falling under Article 15* occurred (Abnormal rise of CV pressure)		23rd 17:24 Residual Heat Removal pump stopped automatically
	12th 20:20 Seawater injection to RPV	15th 00:00 Start venting	14th 11:01 Hydrogen explosion		16:14 Residual Heat Removal pump of Unit 5, which had stopped automatically, was restarted and then the system was put into shutdown cooling mode.
	22nd 11:20 RPV temperature increased	15th 06:10 Sound of explosion, Suppression Pool damaged	15th 10:22 Radiation dose 400mSv/h		
	Since 23rd, the RPV temperature has been gradually declining. (179.5℃ as of 24th 13:00)	15th 08:25 White smoke reeked	16th 06:40, 08:47 Radiation Dose 400mSv		
	24th 10:55 White, steam-like smoke emerged	20th 15:05, operation of seawater injection to the spent fuel pool was conducted	16th 08:34, 10:00 White smoke reeked		
		21st 18:22 White, steam-like smoke erupted from the top of the rector building.	Since 17th, operation of spraying water to the spent fuel pool continues.		
		22nd 16:07-17:01 Warder injection to SFP was conducted (about 18 tons).	21 15:55 Slightly gray smoke erupted (18:02 settled)		
			23rd 16:20 Black smoke erupted from Unit 3 (It was confirmed that the smoke had settled around 23:30)		
	Work to recover external AC power is in progress. External AC power has reached to Unit 2. External AC power is to be recovered on 24th in Unit 2 and by 26th in Unit 1, which is to receive the power from Unit 2. Integrity check of electric equipment is going on in both units. Lighting has been recovered at Unit 1 Main Control Room at around 11:30, Mar. 24th.		Work to recover external AC power is in progress. External AC power has reached to Unit 4. Unit 3 is to receive the power from Unit 4. Integrity check of electric equipment is going on in both units. Lighting has been recovered at Unit 3 Main Control Room at 22:46, Mar. 22.		External AC power has replaced with the power from EDG.
Major Data	Water level (24th 13:00) (A) -1700mm (B) -1650mm	Water level (24th 13:00) -1150mm	Water level (24th 10:20) (A) -1900mm, (B) -2300mm	Water temperature of SFP (24th 13:00) (immeasurable)	Water temperature of SFP Unit 5 42.6℃ (23rd 22:00) 47.7℃ (24th 13:00) Unit 6 23.5℃ (24th 05:00) 27.0℃ (24th 13:00)
	Reactor pressure (24th 13:00) (A) 0.423MPaG, (B) 0.387MPaG	Reactor pressure (24th 13:00) (A) -0.023MPaG, (B) -0.025MPaG	Reactor pressure (24th 10:20) (A) 0.036MPaG, (B) -0.099MPaG		
	CV pressure (24th 13:00) 0.390MPaabs	CV pressure (24th 13:00) 0.110MPaabs	CV pressure (24th 10:20) 0.107MPaabs		Water temperature of RPV Unit 5 50.7℃ (23rd 22:00) 92.0℃ (24th 13:00)
		Water temperature of SFP (24th 13:00) 45℃			

*SFP: Spent Fuel Storage Pool
EDG: Emergency Diesel Generator
RPV: Reactor Pressure Vessel

(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)

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
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

Status of the Nuclear Power Plants after the Earthquake

The accident that brings environmental impact is going on at several units in Fukushima Daiichi nuclear power Station after the earthquake occured on March 11th. Other nuclear power plants in Japan are in normal operation or safely shutdown.