Appendix-1

Progression of Events at Each Plant (Chronology)

Form	Fukushima Dai-ichi Unit 1	Fukushima Dai-ichi Unit 2	Fukushima Dai-ichi Unit 3	Fukushima Dai-ichi Unit 4	Fukushima Dai-ichi Unit 5	Fukushima Dai-ichi Unit 6	Fukushima Dai-ni Unit 1	Fukushima Dai-ni Unit 2	Fukushima Dai-ni Unit 3	Fukushima Dai-ni Unit 4	Onagawa Unit 1	Onagawa Unit 2	Onagawa Unit 3	Tokai Dai-ni Unit 2
	Mark 1 (BWR-3)	Mark 1 (BWR-4)	Mark 1 (BWR-4)	Mark 1 (BWR-4)	Mark 1 (BWR-4)	Mark 2 (BWR-5)	Mark 2 (BWR-5)	Improved Mark 2 (BWR-5)	Improved Mark 2 (BWR-5)	Improved Mark 2 (BWR-5)	Mark 1 (BWR-4)	Improved Mark 1 (BWR-5)	Improved Mark 1 (BWR-5)	Mark 2 (BWR-5)
	In operation	In operation	In operation	Stopped (Regular inspection)	Stopped (Regular inspection. Fuel loaded)	Stopped (Regular inspection. Fuel loaded)	In operation	In operation	In operation	In operation	In operation	Under regular inspection, but activated just before the	In operation	In operation
External AC power	×	×	×	×	×	×	○(1/4 lines)	○(1/4 lines)	○(1/4 lines)	○(1/4 lines)	○(1/5 lines)	○(1/5 lines)	○(1/5 lines)	×
DC power (A), (B)	×	×	○(2 systems)	×	○(2 systems)	○(2 systems)	○(2 systems)	○(2 systems)	○(2 systems)	○(2 systems)	○(2 systems)	○(2 systems)	○(2 systems)	○(2 systems)
Emergency DG	×	×	×	×	×	○(1/3 units)	×	×	○(2/3 units)	○(1/3 units)	○(2/2 units)	○(1/3 units)	○(3/3 units)	○(2/3 units)
Sea water system	×	×	×	×	×	×	×	×	○(2/3 systems)	○(1/3 systems)	○(2/2 systems)	○(1/3 systems)	○(3/3 systems)	○(2/3 systems)

2011/3/11

Fukushima Dai-ichi Unit 1: Earthquake occurred (14:46) → Scram → **IC activated (14:52)** → Tsunami hit (1st wave: 15:27／2nd wave: 15:35) → **Core damage begun (18:46). By simulation** → Large quantity of hydrogen generated/accumulated

Fukushima Dai-ichi Unit 2: Earthquake occurred (14:46) → Scram → **RCIC activated (14:50) / stopped (15:28)** → Tsunami hit (1st wave: 15:27／2nd wave: 15:35) → **RCIC activated (15:39)**

Fukushima Dai-ichi Unit 3: Earthquake occurred (14:46) → Scram → **RCIC activated (15:05) / stopped (15:25)** → Tsunami hit (1st wave: 15:27／2nd wave: 15:35) → **RCIC activated (16:03)**

Fukushima Dai-ichi Unit 4: Earthquake occurred (14:46) → Tsunami hit (1st wave: 15:27／2nd wave: 15:35)

Fukushima Dai-ichi Unit 5: Earthquake occurred (14:46) → Tsunami hit (1st wave: 15:27／2nd wave: 15:35)

Fukushima Dai-ichi Unit 6: Earthquake occurred (14:46) → Tsunami hit (1st wave: 15:27／2nd wave: 15:35)

Fukushima Dai-ni Unit 1: Earthquake occurred (14:46) → Scram → Tsunami hit (1st wave : 15:22) → **RCIC activated (15:36)** → **Core depressurized (SRV operation 15:55)** → D/W cooling system activated (17:53)

Fukushima Dai-ni Unit 2: Earthquake occurred (14:46) → Scram → Tsunami hit (1st wave : 15:22) → **Core depressurized (SRV operation 15:41)** → **RCIC activated (15:43)** → D/W cooling system activated (20:02)

Fukushima Dai-ni Unit 3: Earthquake occurred (14:46) → Scram → Tsunami hit (1st wave : 15:22) → **Core depressurized (SRV operation 15:46)** → **RCIC activated (16:06)** → D/W cooling system activated (20:12) → Water injection begun (MUWC system 22:53) → RCIC manually stopped (23:11)

Fukushima Dai-ni Unit 4: Earthquake occurred (14:46) → Scram → Tsunami hit (1st wave : 15:22) → **Core depressurized (SRV operation 15:46)** → **RCIC activated (15:54)** → D/W cooling system activated (19:14)

Onagawa Unit 1: Earthquake occurred (14:46) → Scram → Fire started (Arc discharge in regular electrical panel 14:57) → **RCIC manually activated (14:59)** → Tsunami hit (around 15:29 Tide indicator at maximum water level) → **Core depressurized (SRV operation 17:10)** → RCIC automatically stopped (18:29) → Spent fuel pool cooling (FPC pump manually activated 19:30) → Water injection to nuclear reactor begun (CRD pump manually activated 20:20) → **RHR pump manually activated (SHC mode 23:46)**

Onagawa Unit 2: Earthquake occurred (14:46) → Scram (Shutdown cooling) → Tsunami hit (around 15:29 Tide indicator at maximum water level) → Spent fuel pool cooling (FPC pump manually activated 20:29)

Onagawa Unit 3: Earthquake occurred (14:46) → Scram → **RCIC manually activated (15:26)** → Tsunami hit (around 15:29 Tide indicator at maximum water level) → **Core depressurized (SRV operation approx. 16:40)** → RCIC manually stopped (21:45) → Water injection to nuclear reactor begun (MUWC 21:54) → **RHR pump activated (SHC mode 23:51)**

Tokai Dai-ni Unit 2: Earthquake occurred (14:46) → Scram → Tsunami hit (1st wave : 15:32) → **RCIC manually activated (15:36)** → **Core depressurized (SRV operation 21:52)**

2011/3/12

Fukushima Dai-ichi Unit 1: **D/W pressure rise (to 0.84MPa 2:30)** → **Hydrogen explosion(15:36)** (→ Unit 2: Electrical supply vehicle damaged)

Fukushima Dai-ichi Unit 2: Electrical supply vehicle damaged (15:36)

Fukushima Dai-ichi Unit 3: RCIC stopped (11:36) → HPCI activated (12:35)

Fukushima Dai-ichi Unit 5: SRV automatically opened (core pressure 8MPa maintained 1:40) → Top valve of reactor pressure vessel opened (6:06) → Power supply begun from Unit 6 DG (DC recharge 8:13)

Fukushima Dai-ichi Unit 6: Power supply begun to Unit 5 (DC recharge 8:13)

Fukushima Dai-ni Unit 1: Water injection begun (MUWC system 0:00) → Nuclear reactor rapid depressurization begun (3:50) → RCIC manually stopped (4:58) → S/C cooling (MUWC from FCS line 6:20) → S/C cooling stopped (MUWC 7:45) → PCV pressure resistant vent line structure completed

Fukushima Dai-ni Unit 2: Water injection begun (MUWC system 4:50) → RCIC manually stopped (4:53) → S/C cooling (MUWP from FCS line 6:30) → S/C cooling stopped (MUWP 7:52) → PCV pressure resistant vent line structure completed

Fukushima Dai-ni Unit 3: RHR manually activated (SHC cooling mode 2:39) → RHR S/C spray mode begun (2:41) → **RHR manually activated (SHC mode begun 9:37)** → PCV pressure resistant vent line structure completed → **Cold shutdown (12:15)**

Fukushima Dai-ni Unit 4: RCIC automatically stopped (0:16) Water injection begun (MUWC → S/C cooling (from MUWC to FCS7:23) → S/C spray (MUWC system 7:35) → Water injection to nuclear reactor (switch to HPCS 11:17) → PCV pressure resistant vent line structure complete(11:52) → Nuclear reactor water injection stopped (HPCS 13:48)

Onagawa Unit 1: **Cold shutdown (0:58)**

Onagawa Unit 2: Nuclear reactor scram/reset (4:49) → **RHR pump manually activated (SHC mode 12:12)** → **Cold shutdown maintained (12:12～)**

Onagawa Unit 3: **Cold shutdown (1:17)**

Tokai Dai-ni Unit 2: RCIC manually stopped (13:11) transition to HPCS

2011/3/13

Fukushima Dai-ichi Unit 3: HPCI stopped (2:42) → Core exposure begun (Water level ＝TAF attained → **Core damage begun (around 8:46). By simulation** → Large quantity of hydrogen generated/accumulated → **Nuclear reactor depressurized (Release safety valve @ 9:08)** → Fresh water injection from fire trucks begun (with boric acid 9:25) → **SC vent AO valve (large valve) opened (12:30)**

Fukushima Dai-ichi Unit 4: **Hydrogen back flew (From Unit 3)**

Fukushima Dai-ichi Unit 5: Power supply begun from Unit 6 DG (MUWC system. 18:29)

Fukushima Dai-ichi Unit 6: Nuclear reactor water injection begun (Make Up Water Pump system. 13:20)

Fukushima Dai-ni Unit 1: RHRS, RHRC pump activated (incoming power from makeshift cable 20:17/21:03)

Tokai Dai-ni Unit 2: Supplemental external power recovered (19:37)

2011/3/14

Fukushima Dai-ichi Unit 2: Fire trucks damaged (@11:01) → **Loss of cooling function was determined (RCIC stopped (@13:25))** → **Core depressurized (SRV opened @18:00)** → Fuel rods completely exposed (Water level＝TAF-3700mm 18:22) → **Core damage begun (@19:46). By simulation** → Large quantity of hydrogen generated/accumulated → Sea water injection begun by fire trucks (19:54)

Fukushima Dai-ichi Unit 3: **SC vent AO valve (small valve) opened (5:20)** → Sea water supply began from storage to reverse valve pit (9:20) → Self Defense Force water supply vehicles arrive, supplied fresh water from reverse valve pit (10:53) → **Hydrogen explosion (11:01)**

Fukushima Dai-ichi Unit 5: **Core depressurized (SRV opened 5:00)** → Water injection to nuclear reactor begun (MUWC 5:30) → Water supply to spent fuel pool begun (MUWC 9:27)

Fukushima Dai-ni Unit 1: Emergency auxiliary cooling system activated (EECW. Incoming power from makeshift power 1:44) → **Water injection to nuclear reactor begun (RHR LPCI mode 10:05)** → Water injection to spent fuel pool begun (FPMUW system 16:30) → **Cold shutdown (17:00)**

Fukushima Dai-ni Unit 2: Emergency auxiliary cooling system activated (EECW. Incoming power from makeshift power 3:20) → **Water injection to nuclear reactor begun (RHR LPCI mode 10:48)** → **Cold shutdown (18:00)**

Fukushima Dai-ni Unit 4: EECW manually activated (received power from supply vehicle 11:00) → RHR S/C spray mode begun (16:02) → **Water injection to nuclear reactor begun (RHR LPCI mode 10:50)**

Tokai Dai-ni Unit 2: RHR pump activated (S/C pool cooling begun 3:50) → **RHR pump activated (Shutdown cooling mode 23:43)**

2011/3/15

Fukushima Dai-ichi Unit 2: **Pressure in containment vessel S/C indicated 0MPa (abs) (6:00-6:10)**

Fukushima Dai-ichi Unit 4: **Hydrogen explosion (6:12)**

Fukushima Dai-ni Unit 4: **Cold shutdown (7:15)**

Tokai Dai-ni Unit 2: **Cold shutdown (0:40)**

2011/3/16

2011/3/17

Tokai Dai-ni Unit 2: Switched to normal external power (15:47)

2011/3/18

Fukushima Dai-ichi Unit 5: Passage to roof opened (3 spots 13:30)

Fukushima Dai-ichi Unit 6: Passage to roof opened (3 spots 17:00)

2011/3/19

Fukushima Dai-ichi Unit 5: RHR makeshift sea water pump activated (emergency system 1:55) → RHR manually activated (Fuel pool cooling @5:00)

Fukushima Dai-ichi Unit 6: RHR makeshift sea water pump activated (emergency system 21:26) → RHR manually activated (Fuel pool cooling 22:14)

2011/3/20

Fukushima Dai-ichi Unit 5: **RHR pump activated (Shutdown-cooling mode 12:25)** → **Cold shutdown (14:30)**

Fukushima Dai-ichi Unit 6: **RHR pump activated (Shutdown-cooling mode 18:48)** → **Cold shutdown (19:27)**

Appendix-1

Progression of Events at Each Plant (Chronology)

Fukushima Dai-ichi

		Unit 1 Electrical panel	Unit 1 Usability	Unit 2 Electrical panel	Unit 2 Usability	Unit 3 Electrical panel	Unit 3 Usability	Unit 4 Electrical panel	Unit 4 Usability	Unit 5 Electrical panel	Unit 5 Usability	Unit 6 Electrical panel	Unit 6 Usability
Emergency DG		DG1A	×	DG2A	×	DG3A	×	DG4A	×	DG5A(※2)	×	DG6A	×(※2)
		DG1B	×	DG2B (Air cooling)	×(※1)	DG3B	×	DG4B (Air cooling)	×(※1)	DG5B(※2)	×	DG6B (Air cooling)	○
												HPCS DG	×(※2)
M/C	Emergency	M/C 1C	×	M/C 2C	×	M/C 3C	×	M/C 4C	×	M/C 5C	×	M/C 6C	○
		M/C 1D	×	M/C 2D	×	M/C 3D	×	M/C 4D	×	M/C 5D	×	M/C 6D	○
				M/C 2E	×			M/C 4E	×			HPCS DG M/C	○
	Normal	M/C 1A	×	M/C 2A	×	M/C 3A	×	M/C 4A	×	M/C 5A	×	M/C 6A-1	×
												M/C 6A-2	×
		M/C 1B	×	M/C 2B	×	M/C 3B	×	M/C 4B	×	M/C 5B	×	M/C 6B-1	×
												M/C 6B-2	×
		M/C 1S	×	M/C 2SA	×	M/C 3SA	×			M/C 5SA-1	×		
										M/C 5SA-2	×		
				M/C 2SB	×	M/C 3SB	×			M/C 5SB-1	×		
										M/C 5SB-2	×		
P/C	Emergency	P/C 1C	×	P/C 2C	○	P/C 3C	×	P/C 4C	-	P/C 5C	×	P/C 6C	○
		P/C 1D	×	P/C 2D	○	P/C 3D	×	P/C 4D	○	P/C 5D	×	P/C 6D	○
				P/C 2E	×			P/C 4E	×			P/C 6E	○
	Normal	P/C 1A	×	P/C 2A	○	P/C 3A	×	P/C 4A	-	P/C 5A	×	P/C 6A-1	×
				P/C 2A-1	×					P/C 5A-1	○	P/C 6A-2	×
		P/C 1B	×	P/C 2B	○	P/C 3B	×	P/C 4B	○	P/C 5B	×	P/C 6B-1	×
										P/C 5B-1	○	P/C 6B-2	×
		P/C 1S	×			P/C 3SA	×			P/C 5SA	×		
										P/C 5SA-1	×		
				P/C 2SB	×	P/C 3SB	×			P/C 5SB	×		
DC power	125VDC A/B	DC125V main&transfer bus 1A	×	DC125V main&transfer bus 2A	×	DC125V main&transfer bus 3A	○	DC125V main&transfer bus 4A	×	DC125V main&transfer bus 5A	○	DC125V DIST CENTER 6A	○
		DC125V main&transfer bus 1B	×	DC125V main&transfer bus 2B	×	DC125V main&transfer bus 3B	○	DC125V main&transfer bus 4B	×	DC125V main line board 5B	○	DC125V DIST CENTER 6B	○
Sea water system	A	CCS A	×	RHRS A	×	RHRS A	×	RHRS A	×	RHRS A	×	RHRS A	×
	B	CCS B	×	RHRS B	×	RHRS B	×	RHRS B	×	RHRS B	×	RHRS B	×
												HPCS DGSW	×
External power		× All 6 lines were lost due to the earthquake											
Remarks													

Fukushima Dai-ni

		Unit 1 Electrical panel	Unit 1 Usability	Unit 2 Electrical panel	Unit 2 Usability	Unit 3 Electrical panel	Unit 3 Usability	Unit 4 Electrical panel	Unit 4 Usability
Emergency DG		DG1A	×	DG2A	×(※2)	DG3A	×(※2)	DG4A	×(※2)
		DG1B	×	DG2B	×(※2)	DG3B	○	DG4B	×(※2)
		DG1H	×	DG2H	×(※2)	DG3H	○	DG4H	○
M/C	Emergency	M/C 1C	×	M/C 2C	○	M/C 3C	○	M/C 4C	○
		M/C 1D	○	M/C 2D	○	M/C 3D	○	M/C 4D	○
		M/C 1H	×	M/C 2H	○	M/C 3H	○	M/C 4H	○
	Normal	M/C 1A-1	○	M/C 2A-1	○	M/C 3A-1	○	M/C 4A-1	○
		M/C 1A-2	○	M/C 2A-2	○	M/C 3A-2	○	M/C 4A-2	○
		M/C 1B-1	○	M/C 2B-1	○	M/C 3B-1	○	M/C 4B-1	○
		M/C 1B-2	○	M/C 2B-2	○	M/C 3B-2	○	M/C 4B-2	○
		M/C 1SA-1	○			M/C 3SA-1	○		
		M/C 1SA-2	○			M/C 3SA-2	○		
		M/C 1SB-1	○			M/C 3SB-1	○		
		M/C 1SB-2	○			M/C 3SB-2	○		
P/C	Emergency	P/C 1C-1	×	P/C 2C-1	○	P/C 3C-1	○	P/C 4C-1	○
		P/C 1C-2	○	P/C 2C-2	×	P/C 3C-2	×	P/C 4C-2	×
		P/C 1D-1	○	P/C 2D-1	○	P/C 3D-1	○	P/C 4D-1	○
	Normal	P/C 1D-2	×	P/C 2D-2	×	P/C 3D-2	○	P/C 4D-2	×
		P/C 1A-1	○	P/C 2A-1	○	P/C 3A-1	○	P/C 4A-1	○
		P/C 1A-2	○	P/C 2A-2	○	P/C 3A-2	○	P/C 4A-2	○
		P/C 1B-1	○	P/C 2B-1	○	P/C 3B-1	○	P/C 4B-1	○
		P/C 1B-2	○	P/C 2B-2	○	P/C 3B-2	○	P/C 4B-2	○
		P/C 1SA	○			P/C 3SA	○		
		P/C 1SB	○			P/C 3SB	○		
DC power	125VDC A/B	DC125V main line boardA	○	DC125V main&transfer bus A	○	DC125V main&transfer bus A	○	DC125V main&transfer bus A	○
		DC125V main line board B	○	DC125V main&transfer bus B	○	DC125V main&transfer bus B	○	DC125V main&transfer bus B	○
Sea water system	A	RHRS A	×	RHRS A	×	RHRS A	×	RHRS A	×
	B	RHRS B	×	RHRS B	×	RHRS B	○	RHRS B	×
		HPCSS	×	HPCSS	×	HPCSS	○	HPCSS	○
External power		○ 3/4 lines were lost due to earthquake (Tomioka line 1L only 500kV continued to receive power)							
Remarks									

Information on DC power of system-H was omitted.

Onagawa (Tohoku Electric Power Co)

		Unit 1 Electrical panel	Unit 1 Usability	Unit 2 Electrical panel	Unit 2 Usability	Unit 3 Electrical panel	Unit 3 Usability
Emergency DG		DG A	○	DG A	○ (non-load standby)	DG A	○ (standby)
		DG B	○	DG B (※2)	× Sea water pump	DG B	○ (standby)
				HPCS D/G (※2)	×Sea water pump	HPCS D/G	○ (standby)
M/C	Emergency	M/C6−1C	○	M/C6−2C	○	M/C6−3C	○
		M/C6−1D	○	M/C6−2D	○	M/C6−3D	○
				M/C6−2H	○	M/C6−3H	○
	Normal	M/C6−1A	×Damaged by earthquake	M/C6−2A	○	M/C6−3A	○
		M/C6−1B	×	M/C6−2B	○	M/C6−3B	○
		M/C6−1S	×	M/C6−2SA-1	○	M/C6−3SA-1	○
		M/C6−1E	×	M/C6−2SB-1	○	M/C6−3SB-1	○
				M/C6−2SA-2	○	M/C6−3SA-2	○
				M/C6−2SB-2	○	M/C6−3SB-2	○
P/C	Emergency	P/C 4-1C	○	P/C 4-2C	○	P/C 4-3C-1	○
		P/C 4-1D	○	P/C 4-2D	○	P/C4- 3C-2	○
						P/C 4-3D-1	○
	Normal	P/C 4-1A	×	P/C 4-2A	○	P/C 4-3D-2	○
		P/C 4-1B	×	P/C 4-2B	○	P/C 4-3A-1	○
		P/C 4-1S	×	P/C 4-2SA	○	P/C 4-3A-2	○
				P/C 4-2SB	○	P/C 4-3B-1	○
						P/C 4-3B-2	○
						P/C 4-3SA-1	○
						P/C 4-3SB-1	○
						P/C 4-3SA-2	○
						P/C 4-3SB-2	○
DC power	125VDC A/B	125VDC main&transfer bus 1A	○	125VDC main&transfer bus 2A	○	125VDC main&transfer bus 3A	○
		125VDC main&transfer bus 1B	○	125VDC main&transfer bus 2B	○	125VDC main&transfer bus 3B	○
Sea water system	A	RHRS A	○	RSW A	○	RSW A	○
	B	RHRS B	○	RSW B	× RCW/RSW submerged	RSW B	○
				HPSW	× HPCW submerged	HPSW	○
External power		○ 4/5 lines were lost due to earthquake (Matsushima Main line 1L Only 275 kV survived)					
Remarks							

Loss of functions below were based on the estimation by the project;
- Onagawa's M/C, P/C, and Tokai Dai-ni's P/C electrical panels

Tokai Dai-ni

		Electrical panel	Usability
Emergency DG		DG2C (※2)	×Sea water pump stopped (DGS)
		DG2D	○
		DG2H	○
M/C	Emergency	M/C−2C	×
		M/C−2D	○
		M/C−HPCS	○
	Normal	M/C−2A-1	×
		M/C−2A-2	×
		M/C−2B-1	×
		M/C−2B-2	×
		M/C−2E	×
P/C	Emergency	P/C 2C	×
		P/C 2D	○
	Normal	P/C 2A	×
		P/C 2B	×
		P/C 2S	×
DC power	125VDC A/B	DC125V main&transfer bus 2A	○
		DC125V main&transfer bus 2B	○
Sea water system	A	RHRS A	×
	B	RHRS B	○
		HPCS DGS	○
External power		× Both lines were lost due to earthquake	
Remarks			

:Lost functions
:Unable to activate due to electrical board and/or cooling system were lost
:Incoming power was inaccessible due to the loss of electrical supply source

Appendix-1 Progression of Events at Each Plant (Chronology)

Item	Content	Fukushima Dai-ichi 1	Fukushima Dai-ichi 2	Fukushima Dai-ichi 3	Fukushima Dai-ichi 4	Fukushima Dai-ichi 5	Fukushima Dai-ichi 6	Fukushima Dai-ni 1	Fukushima Dai-ni 2	Fukushima Dai-ni 3	Fukushima Dai-ni 4	Onagawa 1	Onagawa 2	Onagawa 3	Tokai Dai-ni
External power	External power secured?	×	×	×	×	×	×	○	○	○	○	×Due to damage of M/C	○	○	×
Emergency electrical board	Emergency M/C board secured (not-	×	×	×	×	×	○	○	○	○	○	○	○	○	○
	Emergency P/C board secured（not-submerged）?	×	○ Emergency electrical board available	×	○	×	○	○	○	○	○	○	○	○	○
DC electrical board	DC power board secured (not-submerged)?	×	×	○	×	○	○	○	○	○	○	○	○	○	○
	DC board battery maintained?	–	–	× Run out	–	○ Shared from unit 6	○ Recharged by DG	○	○	○	○	○	○	○	○
Emergency DG	Emergency DG function maintained (not-submerged)?	×	○（1 unit）	×	○(1 unit）	○(2 units）	○(3 units）	×	○(3 units）	○(3units）	○(3 units）	○(2 units）	○(3 units）	○(3 units）	○(3 units）
	Emergency DG function maintained (cooling water secured）?	–	× Pump submerged	–	× Pump submerged	× Pump submerged	○（1unit）2 units submerged	–	× Pump submerged	○(2 units）1 unit submerged	○(1 unit）2 units submerged	○(2 units）	○(1 unit）2 units submerged	○(3 units）	○(2 units）1 unit submerged
High pressure cooling system	HPCI/HPCS	× Function lost	× Function lost	× Stopped after depletion of DC power	NA (under shutdown cooling)	NA (under shutdown cooling)	NA (under shutdown cooling)	× Sea water pump lost due to submergence	× Fresh water cooling pump function lost	○	○	○	× Pump function lost due to submergence	○	○
	IC／RCIC	× IC function incomplete and lost function later	× Functioned at first (reason unknown), then lost after as-is condition maintained.	× Stopped after DC power depletion	NA (under shutdown cooling)	NA (under shutdown cooling)	NA (under shutdown cooling)	○	○	○	○	○	○	○	○
	SLC function maintained?	× Power lost	× Power lost. Electric supply vehicle destroyed by explosion	× Power lost	× Power lost	× Power lost	○	○（1/2 systems）	○	○	○	○	○	○	○(1/2 systems）
	CRD function maintained?	× Power lost	× Power lost. Electric supply vehicle destroyed by explosion	× Power lost	× Power lost	× Power lost	○	○(1/2 systems）	○	○	○	× External power lost due to M/C damage	○（1/2 systems）	○	○(1/2 systems）
Low pressure alternative cooling system	FP	× Recovery of D/DFP failed. Water supplied from fire truck to FP line	× Power lost	×D/D Injection from FP failed (core pressure too high), water supplied from fire trucks to FP line	× Power lost	× Power lost	○ Recharged by DG	○	○	○	○	－(unconfirmed）	－(unconfirmed）	－(unconfirmed）	－(unconfirmed）
	MUWC／MUWP	× Power lost (pump submerged)	× Power lost (pump submerged)	× Power lost (pump submerged)	× Power lost (pump submerged)	○ Shared from unit 6	○ Recharged by DG	○	○	○	○	○	○	○	○
Low pressure cooling system	CS/CCS/RHR/LPCS	× Power & sea water pump lost	× Power & sea water pump lost	× Power & sea water pump lost	× Power & sea water pump lost	× Power & sea water pump lost（recovered by makeshift equipment）	× Power & sea water pump lost（recovered by makeshift equipment）	× Power & sea water pump lost（recovered by makeshift equipment）	× Power & sea water pump lost（recovered by makeshift equipment）	○（1/2 systems）	× Power & sea water pump lost（recovered by makeshift equipment）	○	○(1/2 systems）As was right after activation, there's no problem	○	○(1/2 systems）
Sea water pump	CCS, RSW, RHRS, HPSW function maintained (not-submerged）?	×	×	×	×	×	×	×	×	○（2/3 systems）	○(1/3 systems）	○	○(1/3 systems）	○	○（2/3 systems）
Plant condition	Cold shutdown accomplished?	× Explosion	× Zero pressure in S/C	× Explosion	× Explosion	○	○	○	○	○	○	○	○	○	○
Remarks		Even if the LPCI was set up, had it been able to inject sufficient water to cool down the core? (Further research needed)	If an electric supply vehicle was available, HPCI could have been maintained even after battery depletion. But the explosion at Unit 1 destroyed ongoing line-up and never recovered before core damage began.	If an electric supply vehicle and ultimate heat sink were prepared till the run-out of batteries, the worst could have been avoided.	As it was under regular inspection, recovery of FPC was important. The water in spent fuel pool was estimated to last for about a week. Explosion due to the back-flow of hydrogen from Unit 3 was not expected at all.	Pressure in RPV was high as it was testing reactor leakage of regular inspection. Depressurized by opening the top vent of the RPV.	In regular inspection.					Cold shutdown achieved as emergency DG and sea water pump functioned even though external power lost. Important to notice DG easily lose its function as its sea water pump is very weak even to small tsunami as this.		Turbine driven auxiliary sea water cooling system lost due to submergence. Cold shutdown achieved by RHR after depressurization and cool-down by RCIC/MUWC/SRV.	As one DG and all the external powers lost, power supply to emergency M/C was lost, making one set of emergency cooling function lost. 2 days later cold shutdown achieved with recovered external power. Important to notice DG easily lose its function as its sea water pump is very weak even to small tsunami.
Lesson		Loss of all AC power disabled control room's function such as monitoring and operation, and delayed recovery actions. Very important to conduct training for extreme conditions like this.		As securing DC power provides more time for recovery, it is very important to prevent submergence of batteries and DC panels.	Based on the understanding that hydrogen is light and easily leak anywhere, countermeasures to release into the air or to decrease its density (e.g. recombiner) would be essential	Cooling shutdown was performed by sharing power from Unit 6. It would be effective for all the reactors to be able to share with power sources each other. There was no accommodation between 1-4 and 5-6.	Cold shutdown was achieved because air cooling DG was not submerged and ultimate heat sink was not the sea. Diversity and multiplicity of power source would be effective.	Important to notice that if even one external power source were available, cold shutdown will be achieved.				Even if external power is lost, as long as power on-site is available, there is no problem.			Even if external power is lost, as long as power on-site is available, there is no problem.