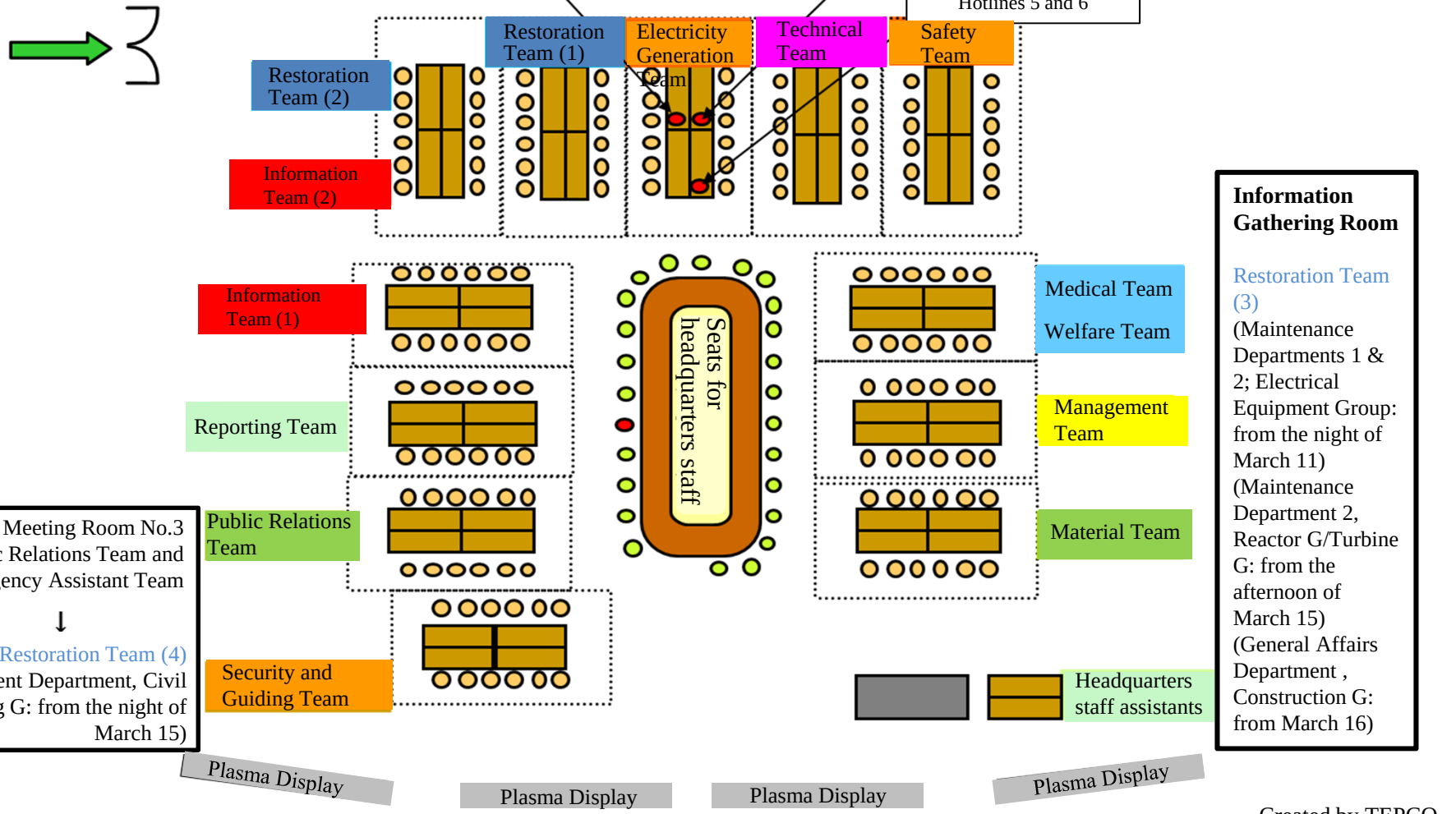
Layout of the Emergency Response Office

Layout of the Emergency Response Office
(At the establishment of the Emergency Response Headquarters on March 11, 2011)

Meeting Rooms No.1 and No.2
The Restoration Team, Operation Team, Engineering Team and Health Physics Team (For Emergency Purpose)

* Actual layout may vary slightly depending on the situation



Information Gathering Room

Restoration Team (3)
(Maintenance Departments 1 & 2; Electrical Equipment Group: from the night of March 11)
(Maintenance Department 2, Reactor G/Turbine G: from the afternoon of March 15)
(General Affairs Department , Construction G: from March 16)

Meeting Room No.3
For Public Relations Team and Emergency Assistant Team

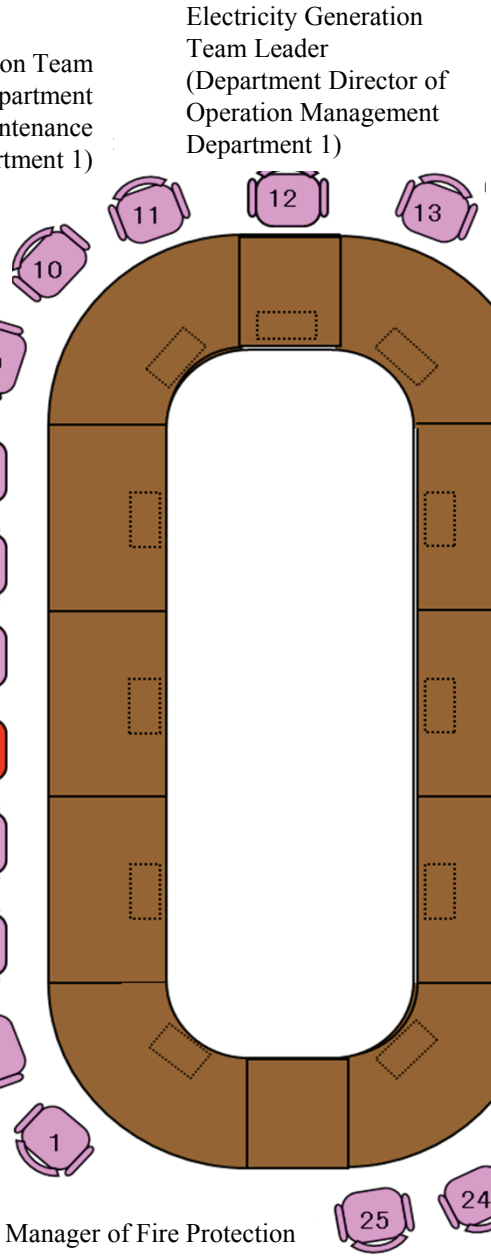
↓

Restoration Team (4)
(Management Department, Civil Engineering G: from the night of March 15)

Created by TEPCO

Attachment IV-1

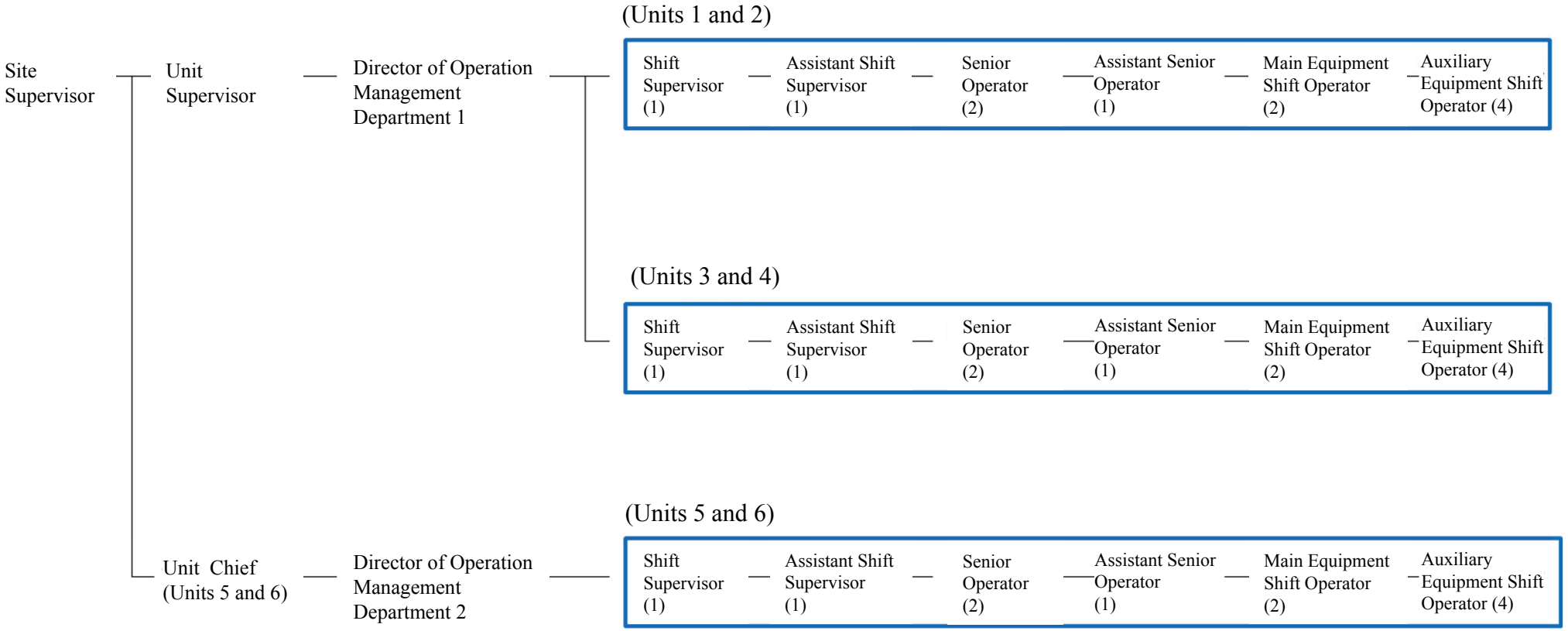
Personnel Positioning of Seats for Headquarters
(At the establishment of the Emergency Response Headquarters on March 11, 2011)



* Actual layout may vary slightly depending on the situation

Created by TEPCO

Shift arrangements at the Fukushima Dai-ichi NPS

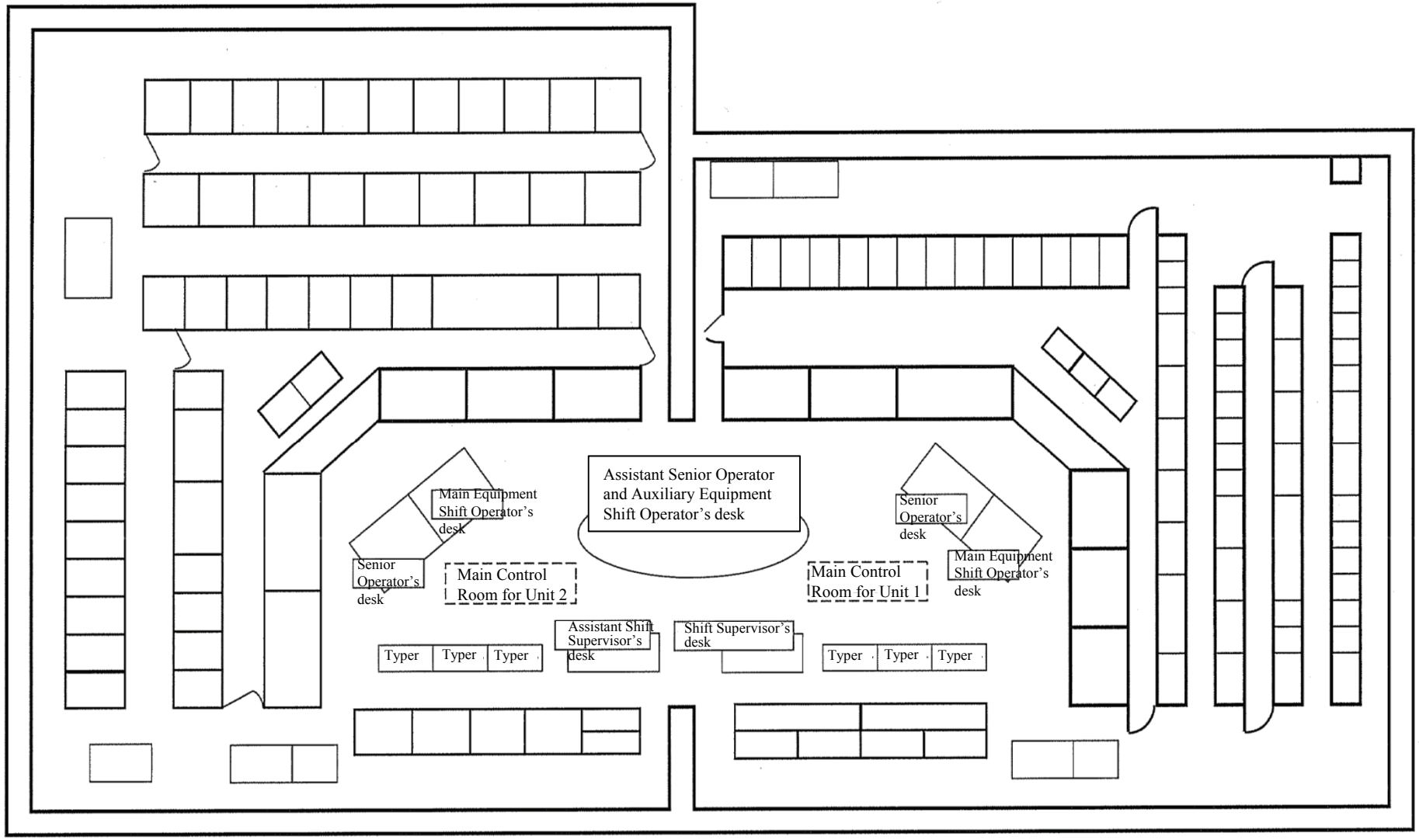


*1 A Senior Operator and a main-equipment shift operator work full time for each Unit.
*2 The number of shift members can vary depending on the situation at the Plant.

Attachment IV-2

Compiled from "Report on the Fukushima Dai-ichi Nuclear Power Station Unit 1 Periodic Safety Review (Number 3)" (November, 2010) by TEPCO

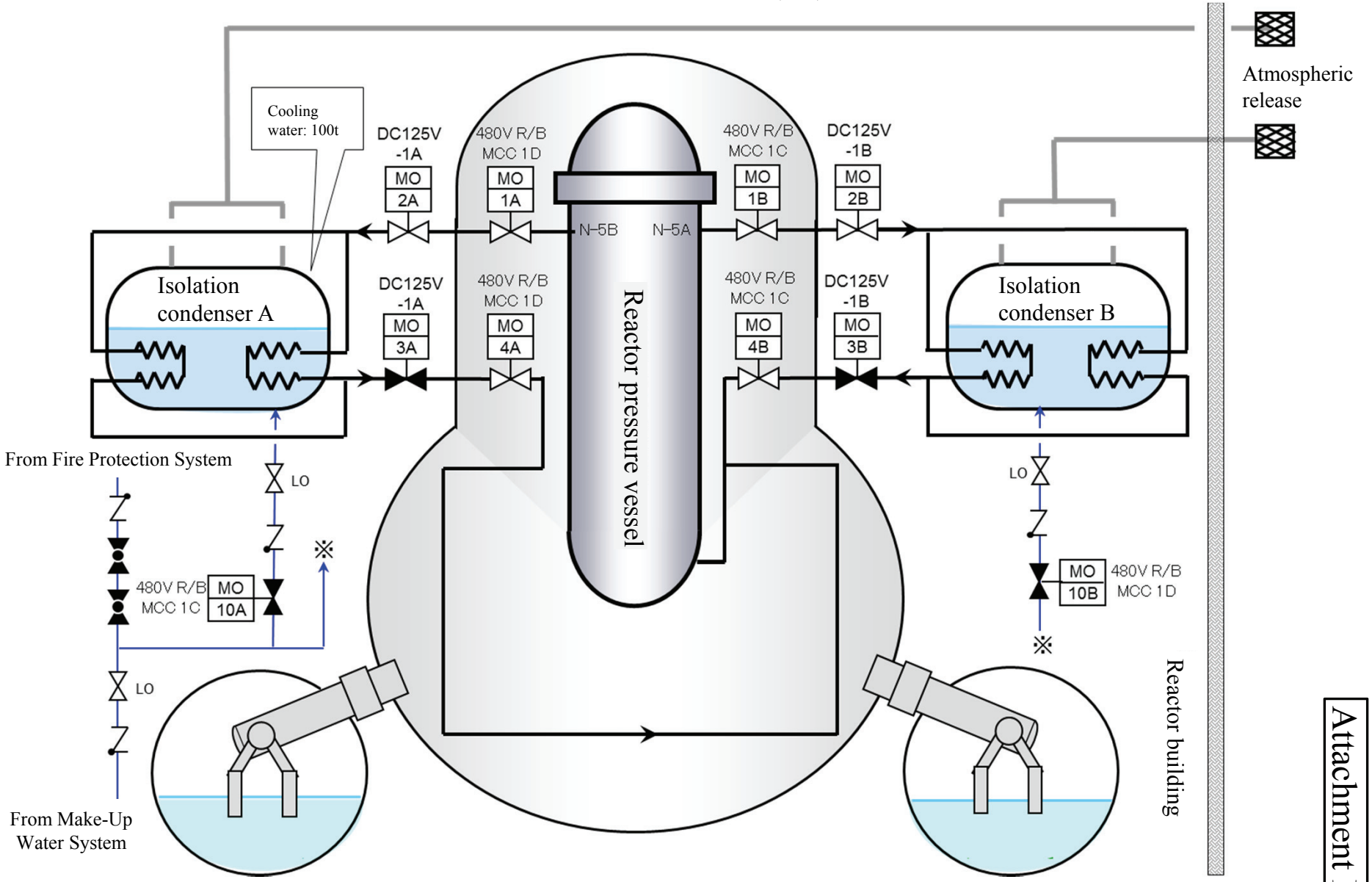
Layout of the main control room for Units 1 and 2



Created by TEPCO

Attachment IV-3

Isolation condenser (IC)

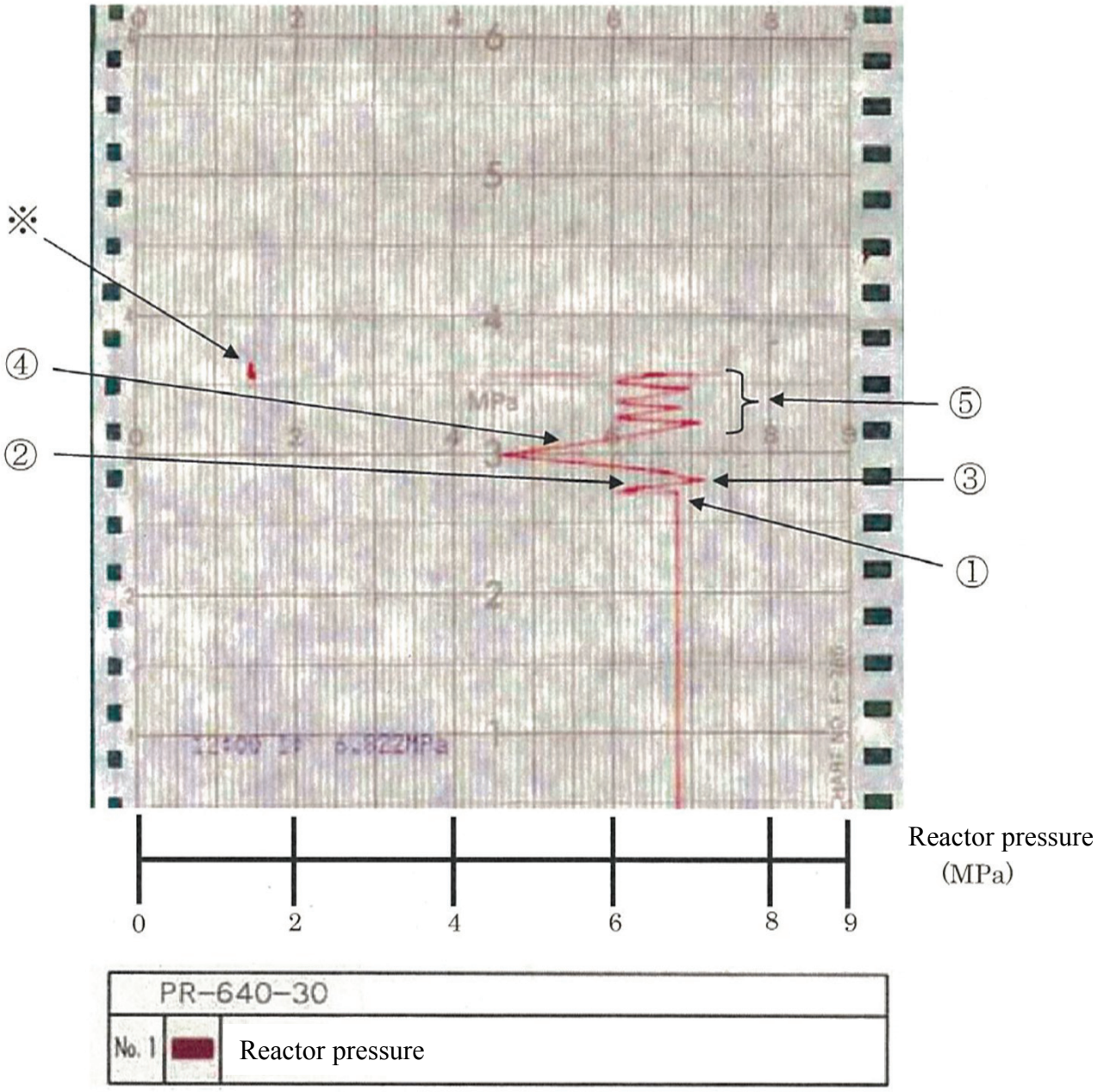


Created by TEPCO

Attachment IV-4

Attachment IV-5

Unit 1 reactor pressure



① Scram by the earthquake at 14:46

② Pressure increase associated with the closing of the main steam isolation valve

③ Actuation of isolation condenser and associated pressure decrease at 14:52

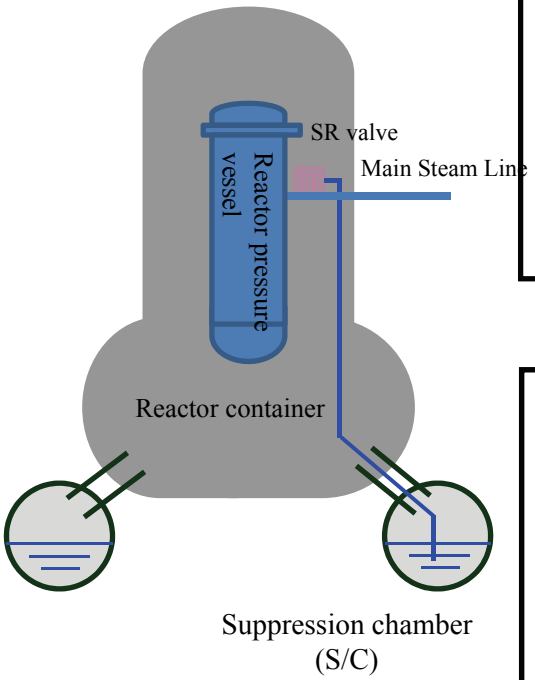
④ Pressure increase associated with stoppage of the isolation condenser

⑤ Pressure fluctuation probably caused by the isolation condenser

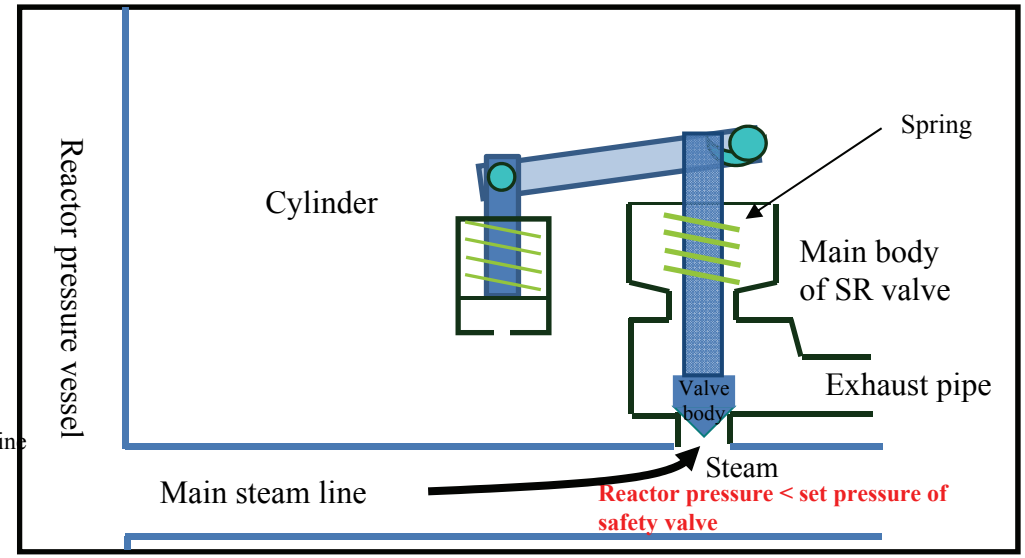
※ It is estimated that the tsunami hit after 15:30. Recording probably stopped due to the impact of the tsunami.

Adopted from "The Impact of the Tohoku District – off the Pacific Ocean Earthquake on Nuclear Reactor Facilities at the Fukushima Dai-ichi Nuclear Power Station" (September, 2011) by TEPCO.

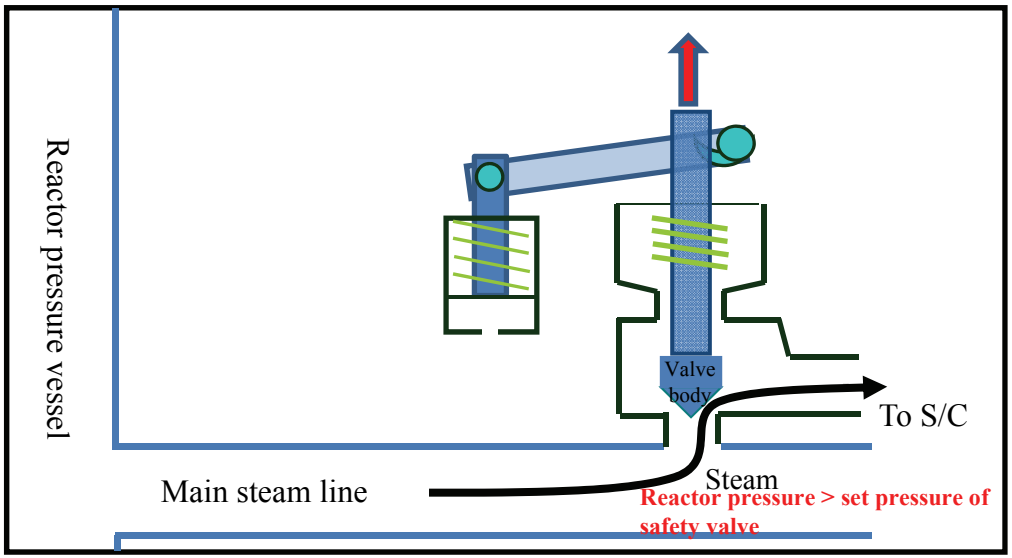
Illustrated overview of the safety relief valve (SRV) operating principle (safety valve function)



In times of normal operation



In the case of abnormal pressure increase



Explanation of the operating principle

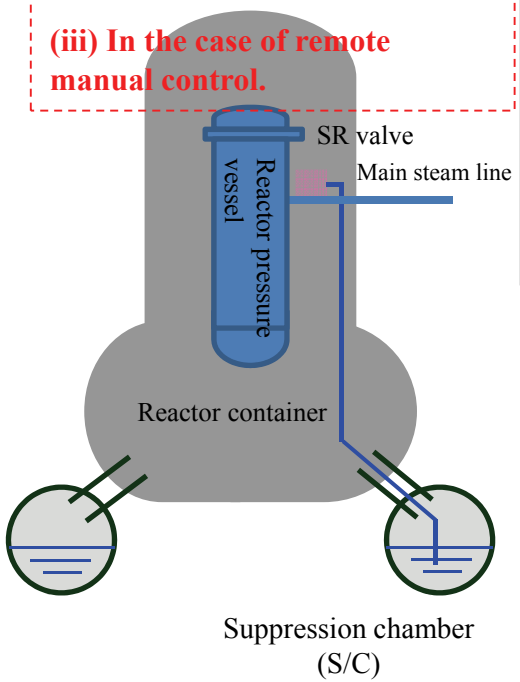
(i) The reactor pressure increases with the closing of the main steam isolation valve, etc.
(ii) When the reactor pressure exceeds the set pressure of the safety valve (spring force), steam pushes the valve body of the SR valve up.
(iii) A steam flow channel is formed after the valve body has been pushed up and the steam is released into the S/C through the exhaust pipe.

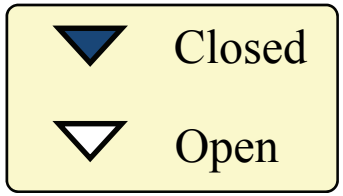
Compiled from documents by TEPCO

Attachment IV-6

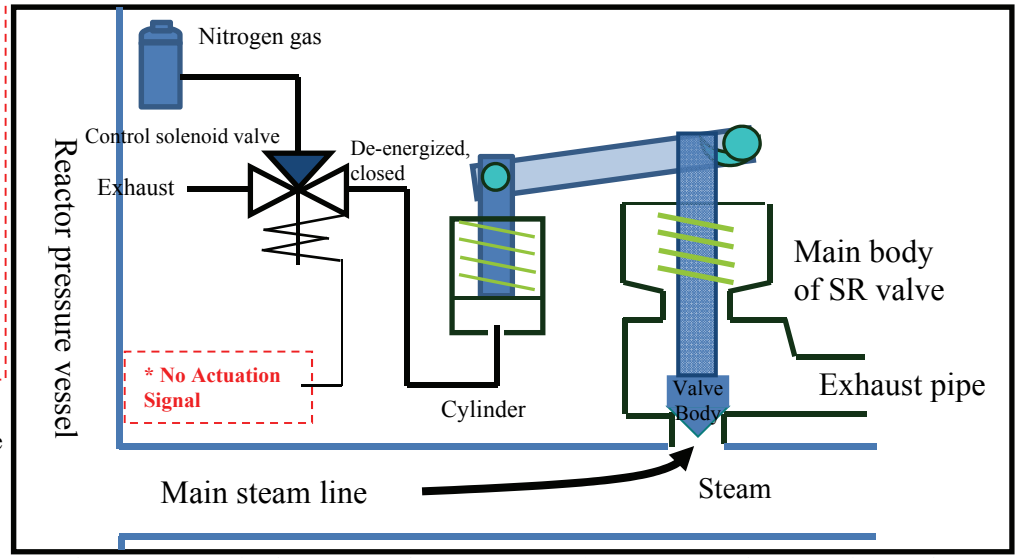
Illustrated overview of the safety relief valve (SRV) operating principle (in the case of relief valve actuation, ADS actuation or remote manual operation)

***SR valve actuation signal is given:**
(i) When the pressure reaches the relief valve setting pressure;
(ii) When the Automatic Depressurization System (ADS) is actuated; and
(iii) In the case of remote manual control.

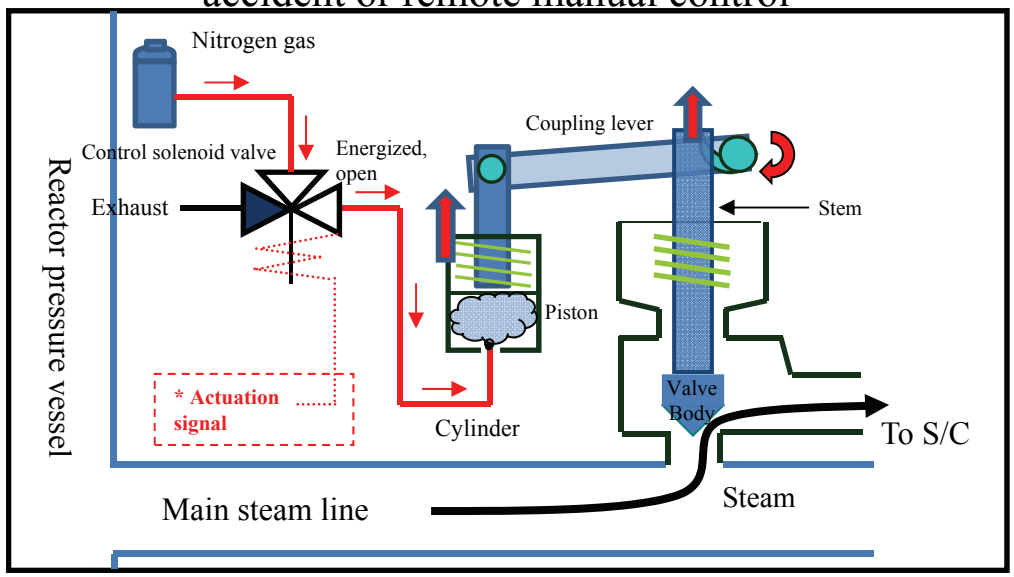




In times of normal operation



In the case of abnormal pressure increase, loss of coolant accident or remote manual control



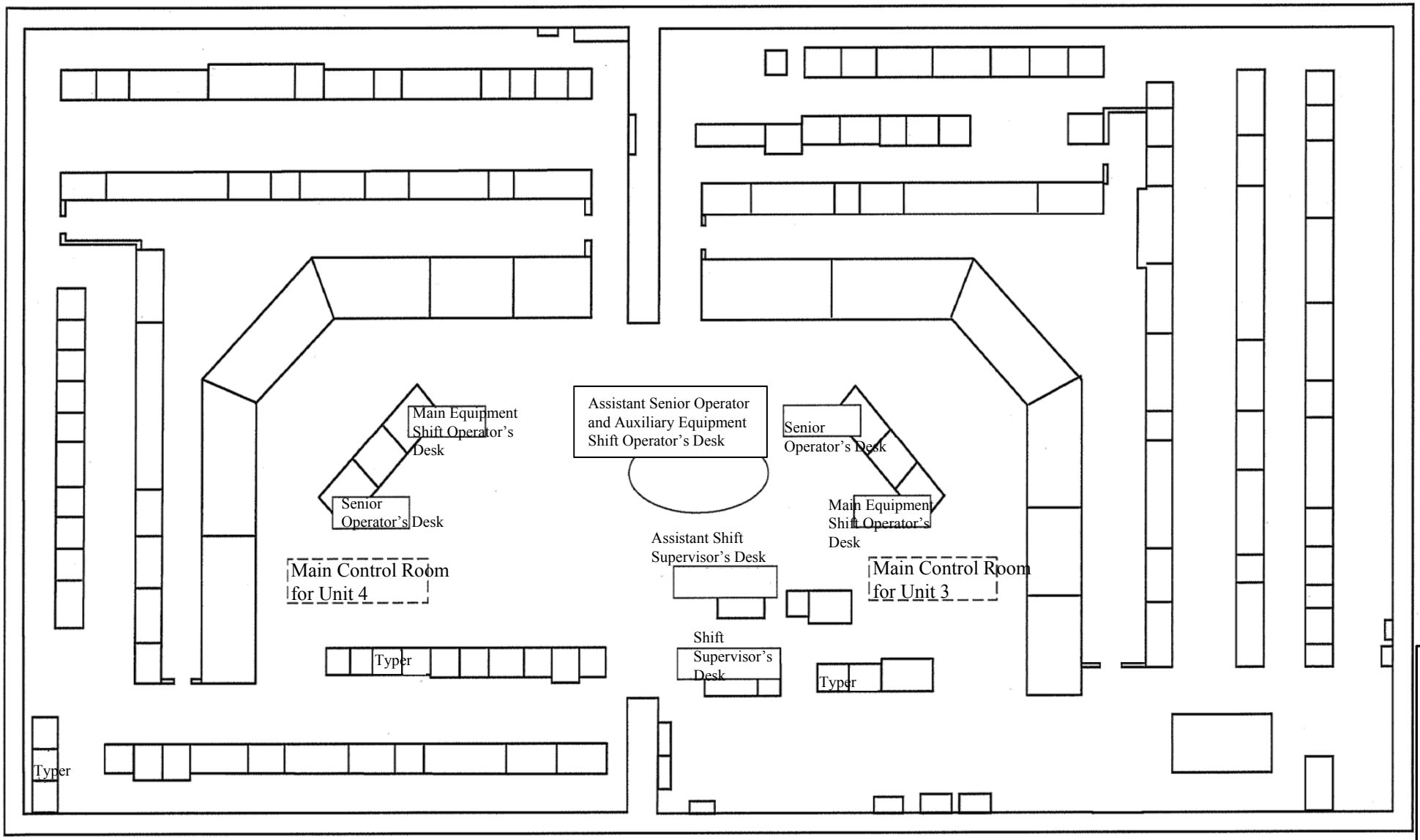
Explanation of the operating principle

The relief valve:
(i) The reactor pressure increases with the closing of the main steam isolation valve, etc.
(ii) When the reactor pressure reaches the set pressure of the relief valve, a signal is sent to the control solenoid valve in the nitrogen supply line.
(iii) The flow channel is altered with the opening and closing of the control solenoid valve and nitrogen gas is fed into the SR valve cylinder.
(iv) When nitrogen gas is fed into the cylinder, the piston and the stem are pushed up by the coupling lever.
(v) The valve body is then in a free state after the stem has been pushed up. When the valve body is pushed up by the steam pressure in this state, a steam flow channel is formed and steam is released into the S/C through the exhaust pipe.

*In the case of ADS, an actuation signal is sent when there is a loss of coolant accident (LOCA) instead of procedures (i) and (ii), but the following procedures, (iii) to (v), are the same.
* In the case of remote manual control, an actuation signal is sent according to manual control from the main control room instead of procedures (i) and (ii), but the following procedures, (iii) to (v), are the same.

Compiled from documents by TEPCO

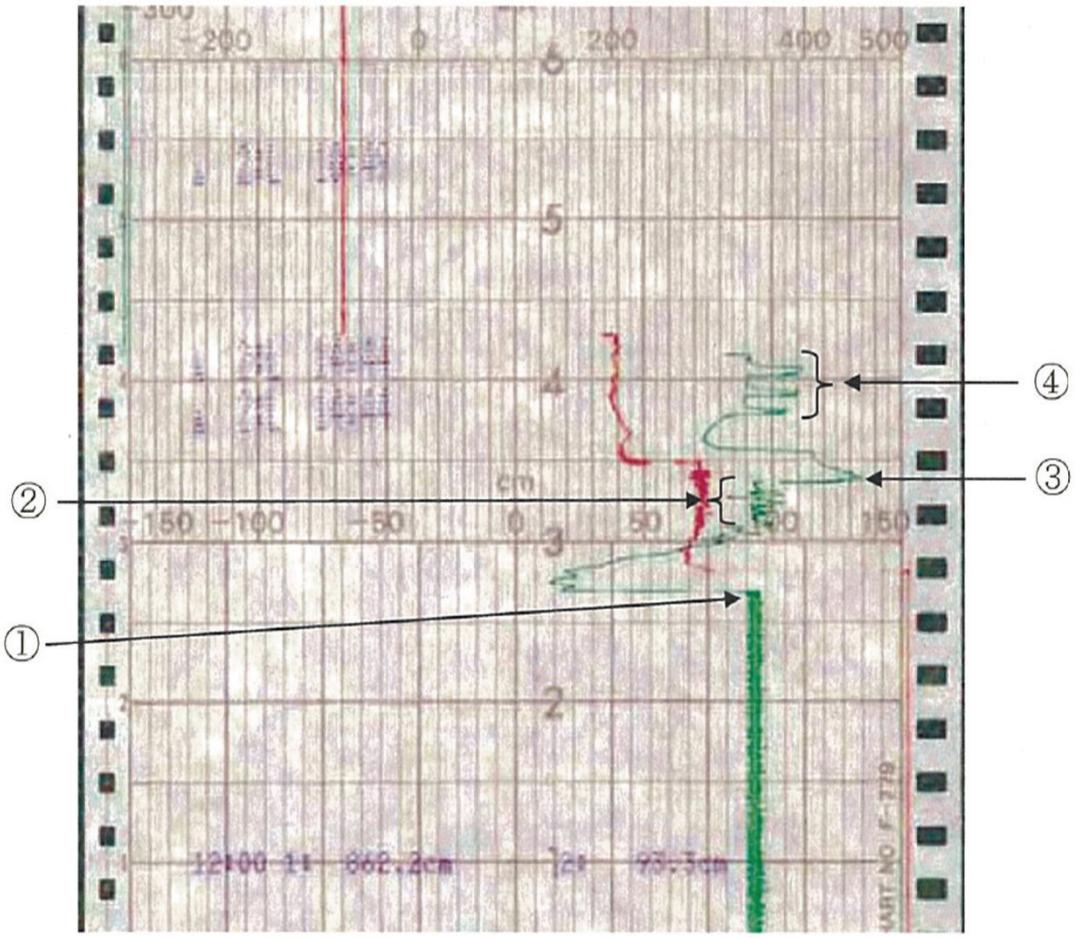
Layout of the Main Control Room for Units 3 and 4



Attachment IV-7

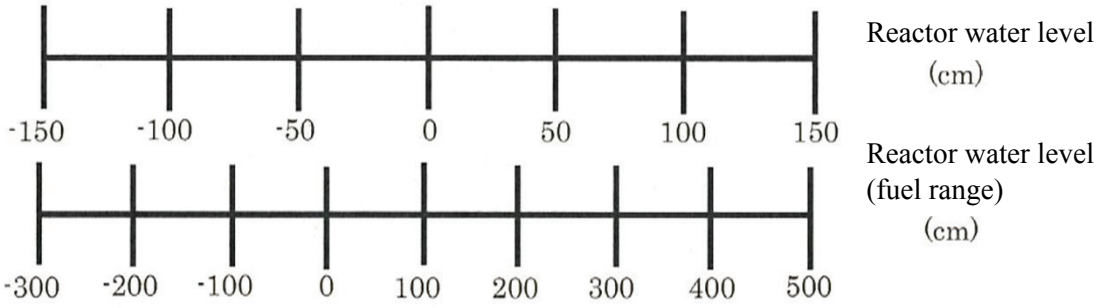
Prepared by TEPCO

Unit 1 reactor water level



Green = reactor water level

Red = reactor water level (fuel range)



① Scram due to the earthquake at 14:46 (Fast-forwarding of chart: 60 times faster, a minute for an hour)

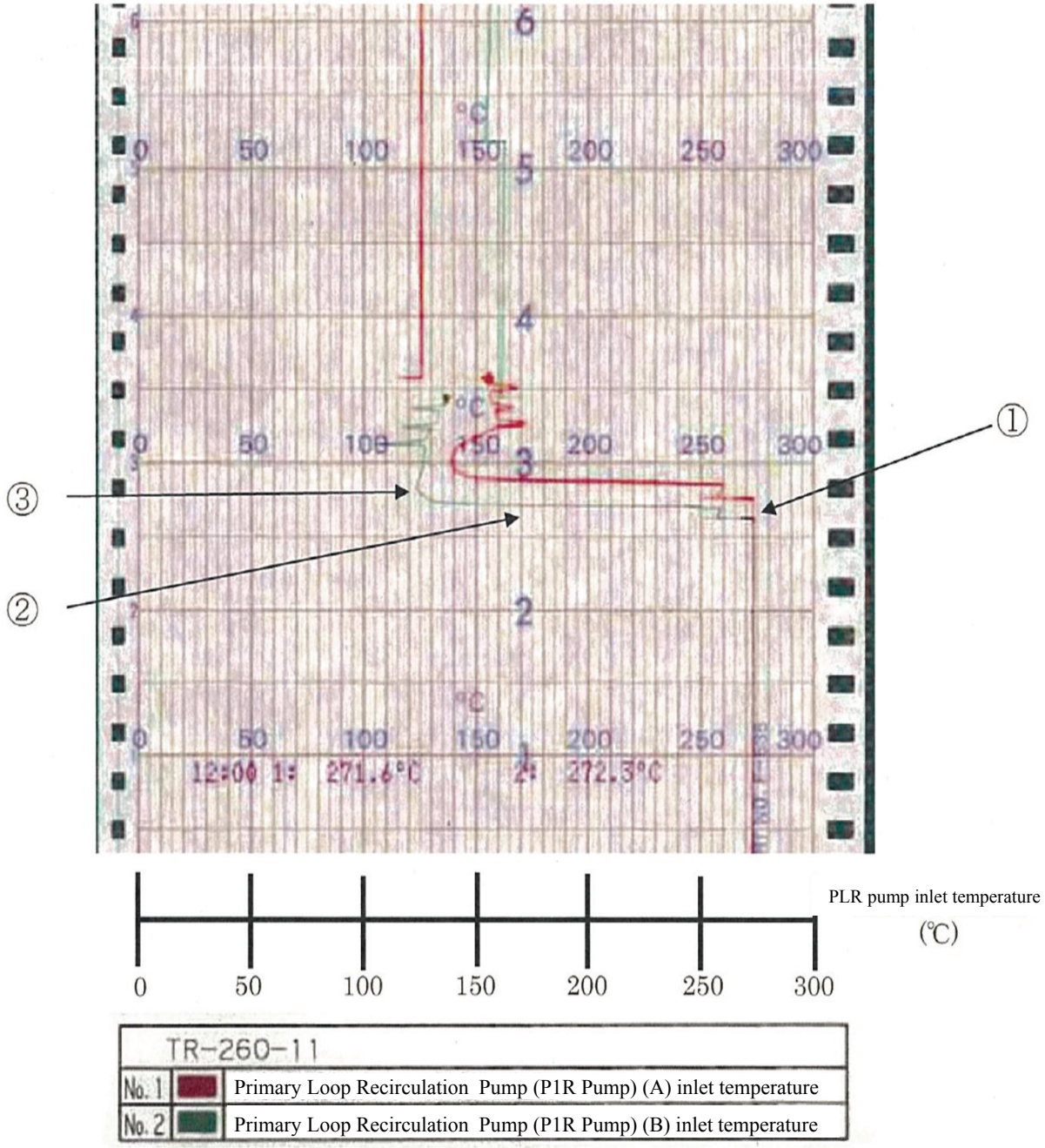
② Loss of power and closing of the main steam isolation valve around this time (Fast-forwarding of chart reset by the loss of power)

③ Automatic startup of the isolation condenser

④ Possible fluctuation of water level due to the operation of the isolation condenser

Extracted from "The Impact of the Tohoku District – off the Pacific Ocean Earthquake on Nuclear Reactor Facilities at the Fukushima Dai-ichi Nuclear Power Station" (September, 2011) by TEPCO

Unit 1 reactor recirculation pump inlet temperature



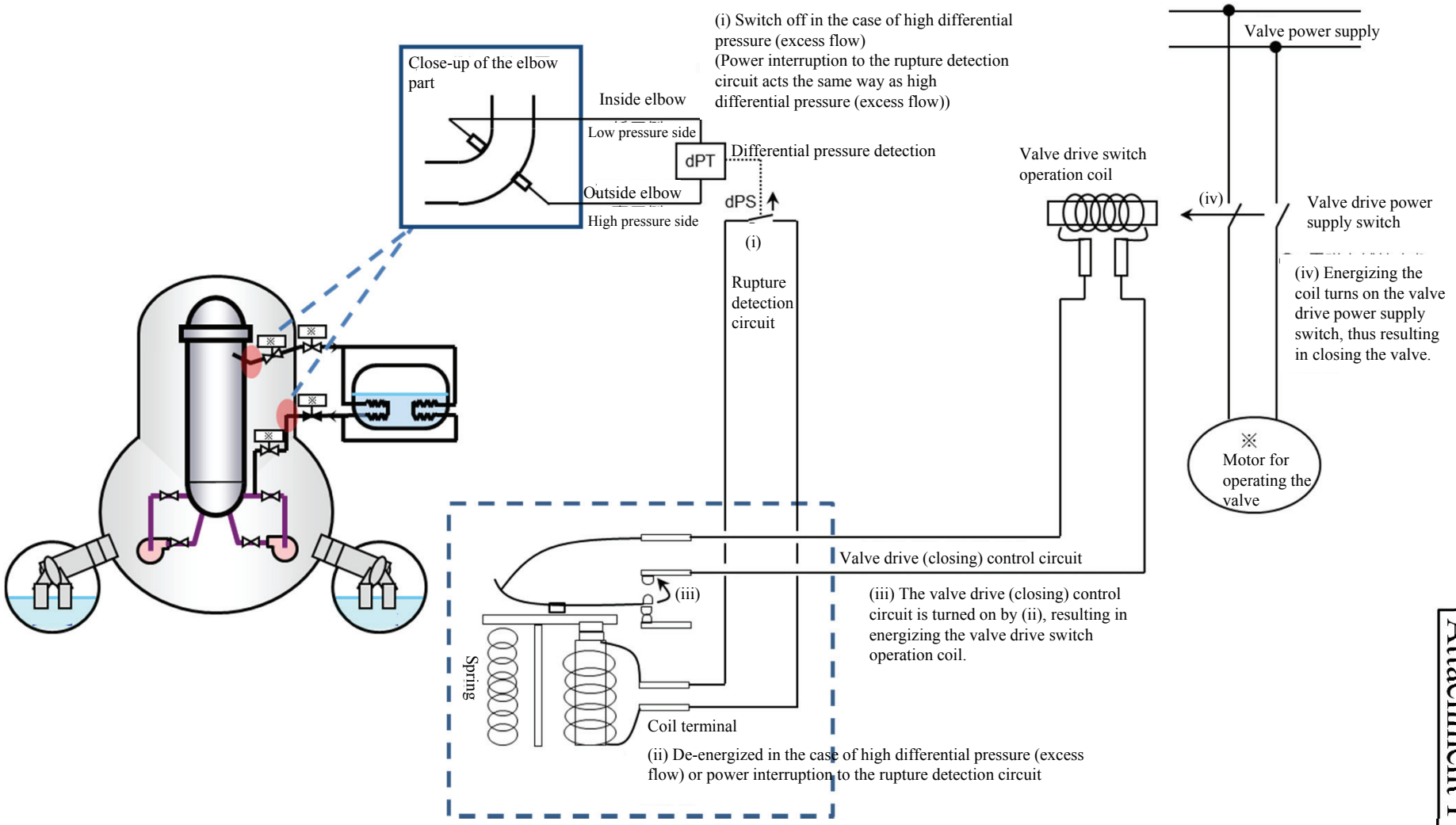
① Scram due to the earthquake at 14:46

② Decrease in power due to the scram, pressure decrease due to the operation of the isolation condenser and decrease in temperature due to the injection of low-temperature

③ Shutdown of the isolation condenser that automatically started

Extracted from "The Impact of the Tohoku District – off the Pacific Ocean Earthquake on Nuclear Reactor Facilities at the Fukushima Dai-ichi Nuclear Power Station" (September, 2011) by TEPCO

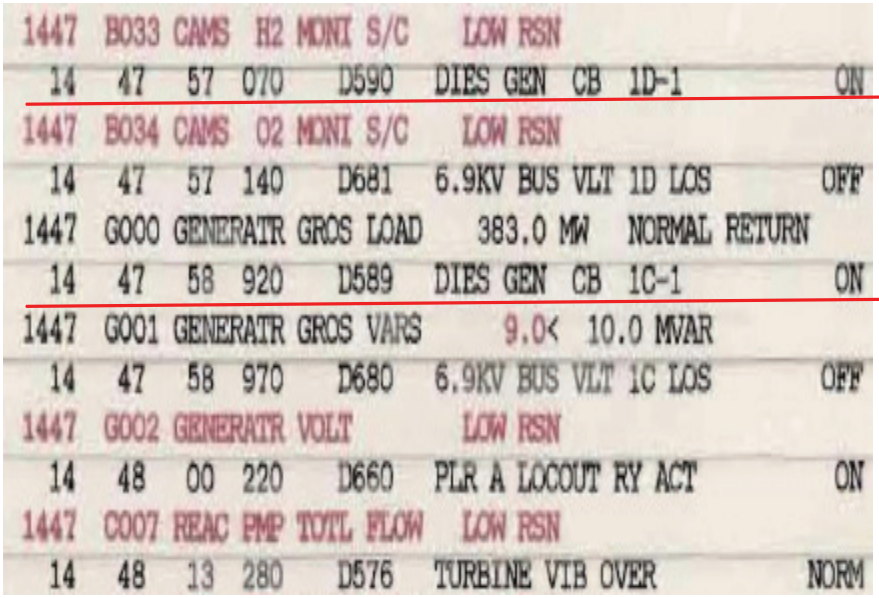
Illustrated overview of reactor core isolation by the IC system (closing of the isolation valve)



Created by TEPCO

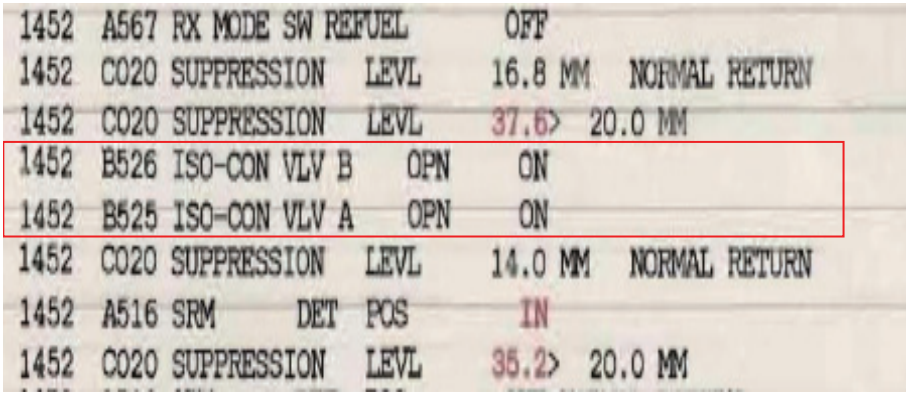
Attachment IV-10

The DG Breaker ON/OFF status and IC operation status
as recorded on the Unit 1 alarm typewriter



D/G 1B breaker on

D/G 1A breaker on

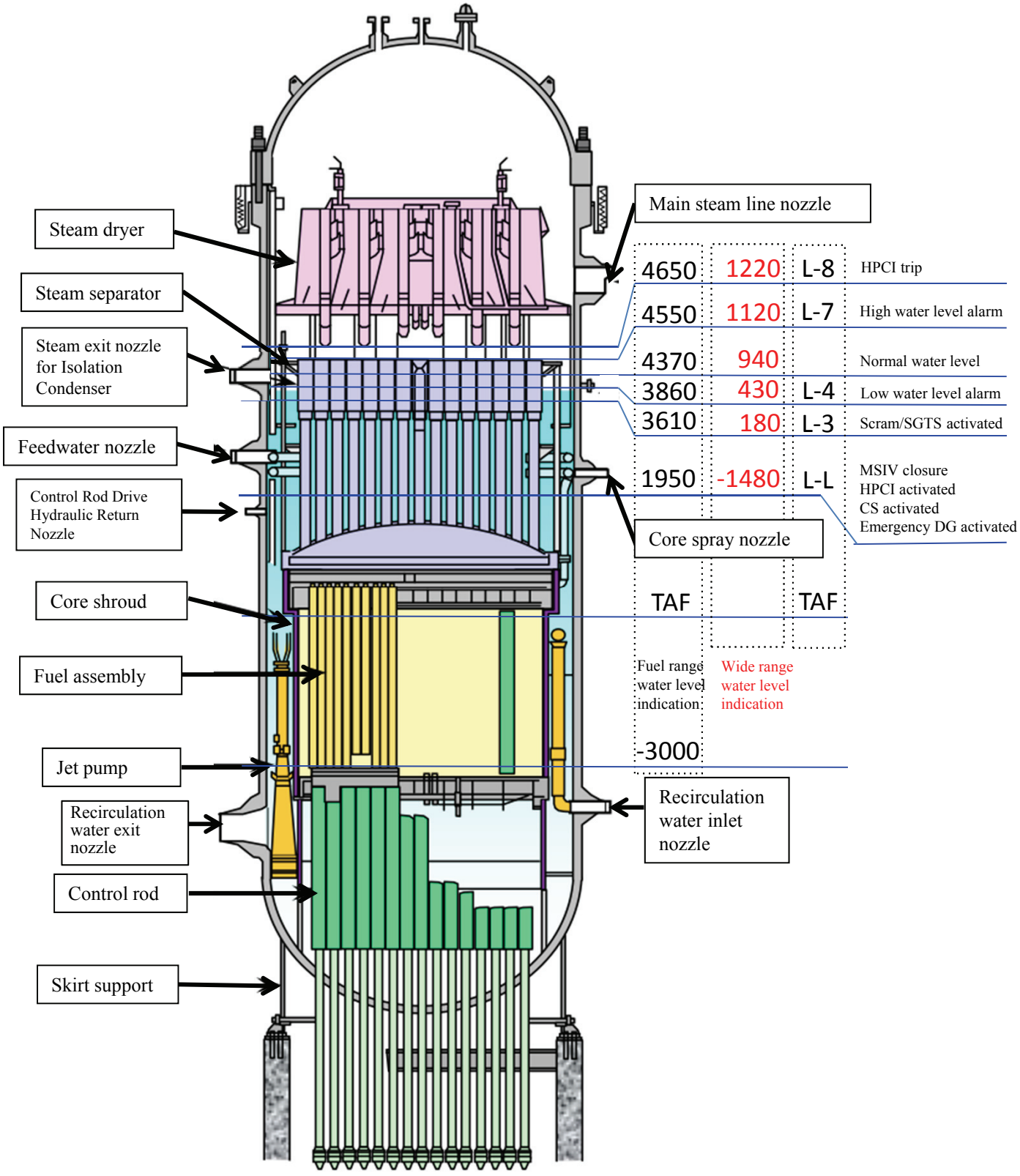


IC operation

Adopted from “The Impact of the Tohoku District – of the Pacific Ocean Earthquake on Nuclear Reactor Facilities at the Fukushima Dai-ichi Nuclear Power Station" (September, 2011) by TEPCO.

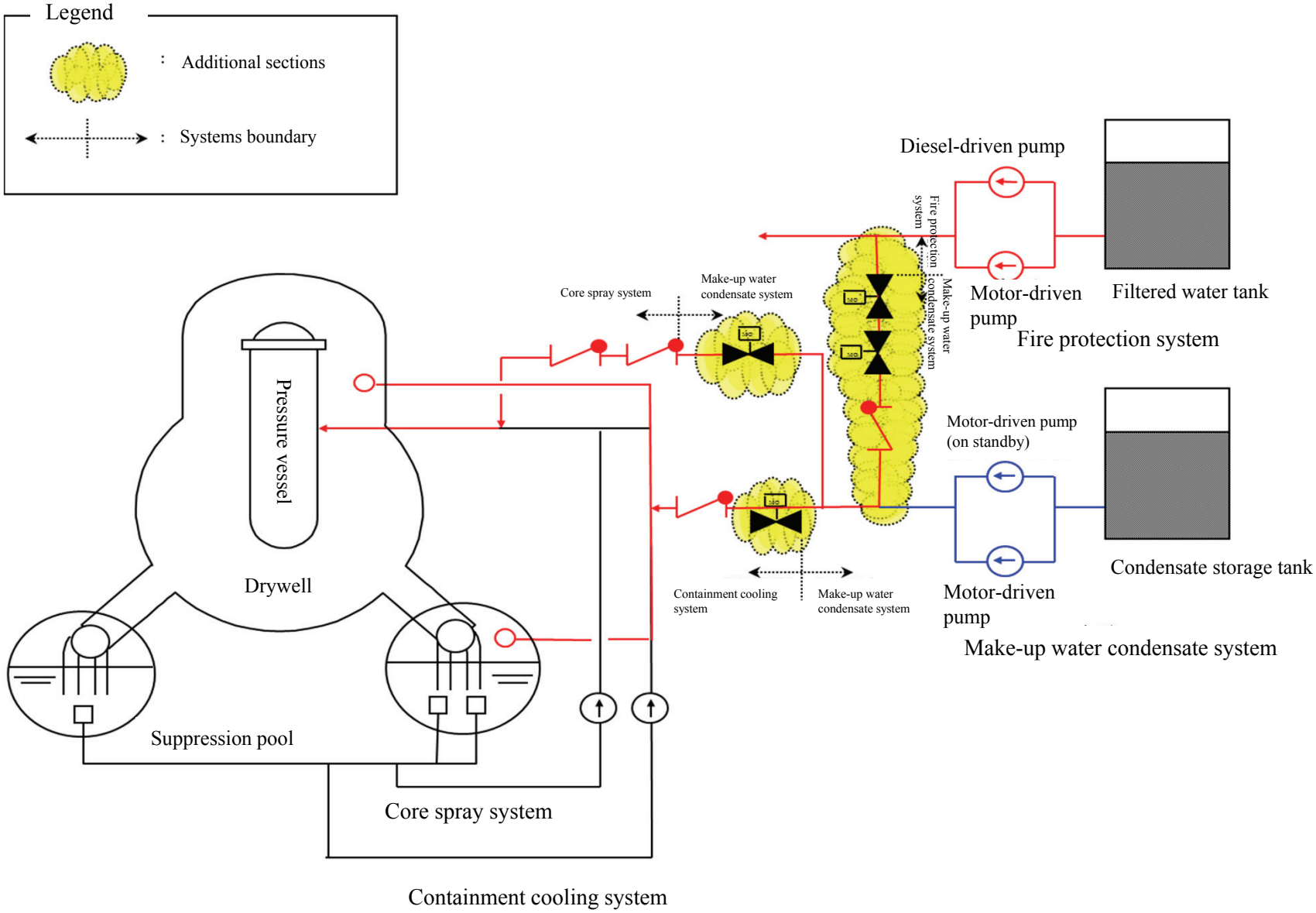
Attachment IV-12

Illustrated overview of reactor water levels



Created by TEPCO

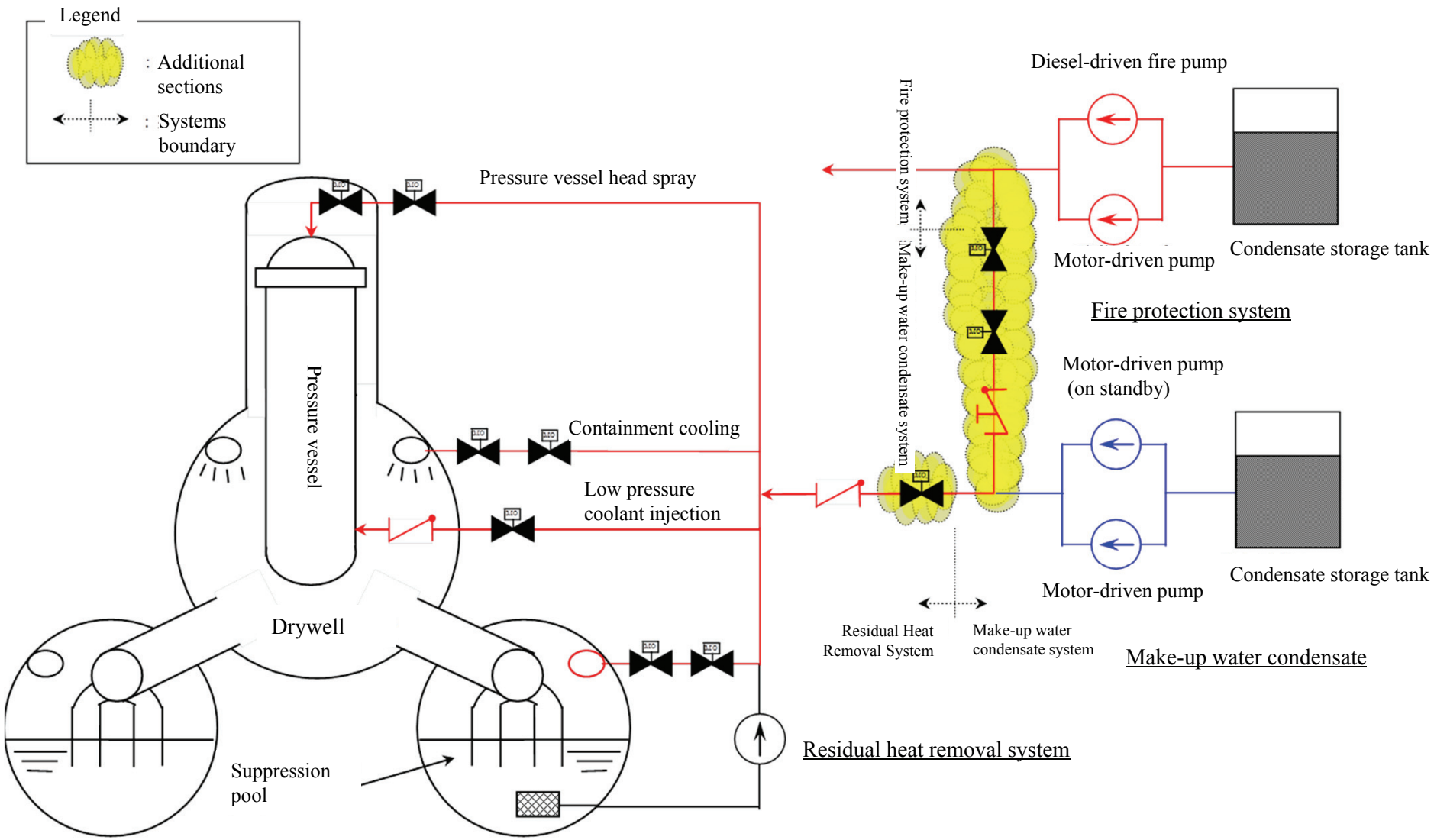
Conceptual diagram of alternative water injection facilities (Unit 1)



Compiled from the "Report on Preparation for Accident Management" (May, 2002) by TEPCO

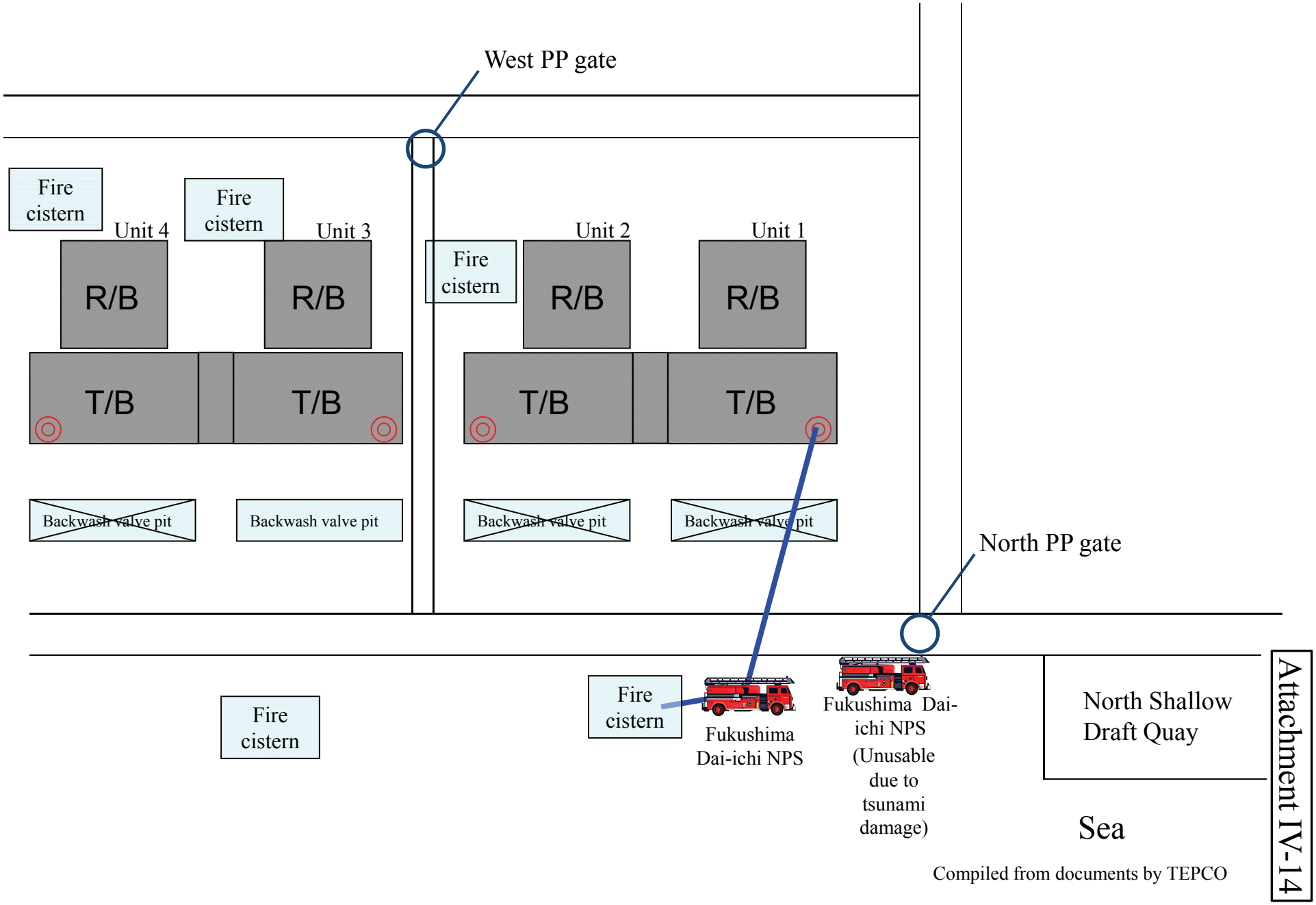
Attachment IV-13

Conceptual diagram of alternative water injection facilities (Units 2 to 5)



Compiled from the "Report on Preparation for Accident Management" (May, 2002) by TEPCO

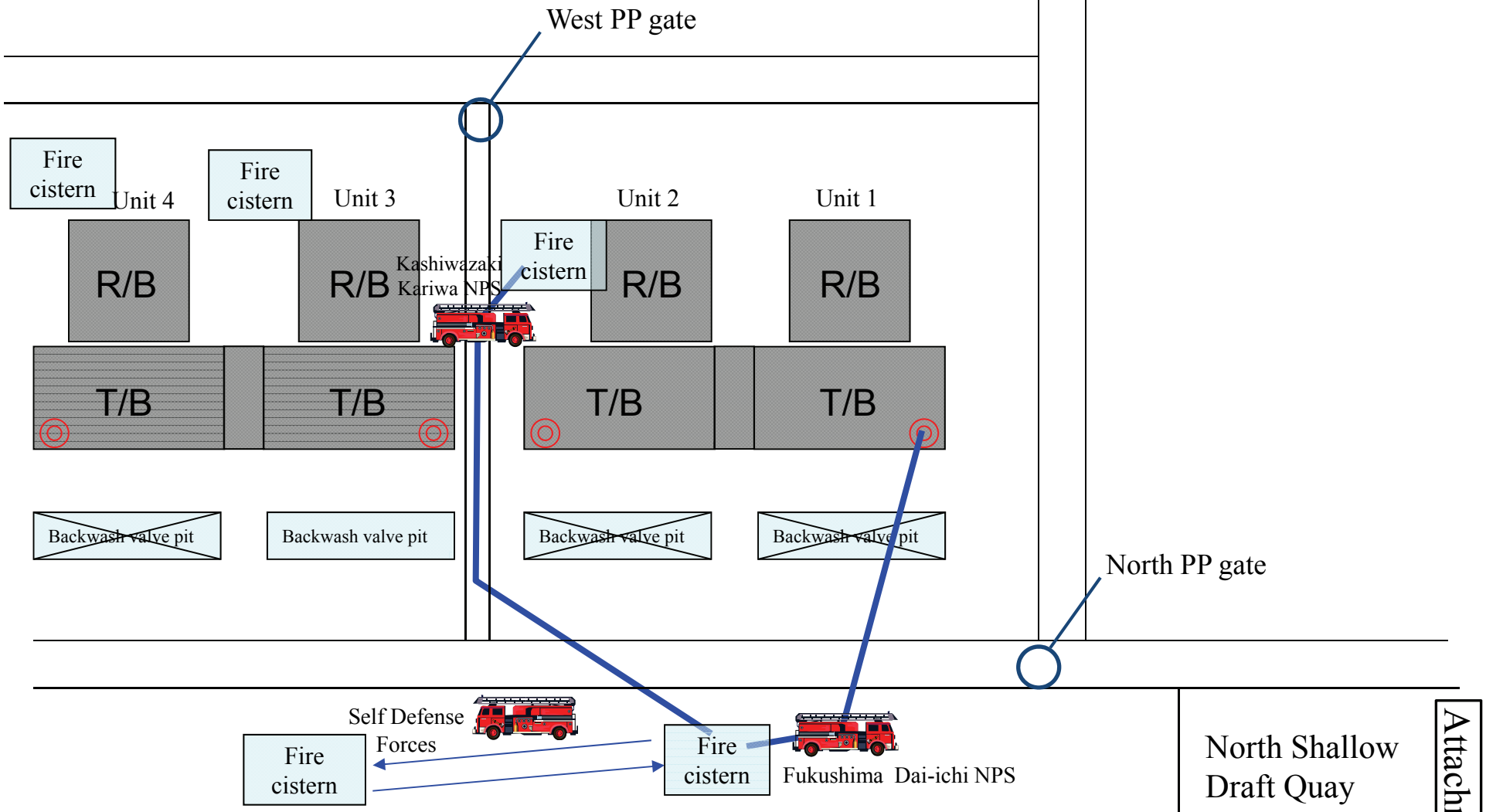
Overview of water injection by fire engines (at around 05:46 on March 12)



Compiled from documents by TEPCO

Attachment IV-14

Overview of water injection by fire engines (after around 10:52 on March 12)



Compiled from documents by TEPCO

Attachment IV-15

Attachment IV-16

Examples of protective outfits and gears used

General work uniform
Level B gloves,
Level B shoes,
Level B helmet

Level B clothing
Level B gloves,
Level B shoes,
Level B helmet

Level B clothing
Level B gloves,
thin latex gloves,
Level B2 shoes,
Level B helmet

Level C clothing
thin latex gloves,
Level C headwear,
Level C socks

Level C clothing
thin latex gloves,
Level C headwear,
Level C socks,
Level C shoes,
Level C helmet
(Level C gloves, if necessary)

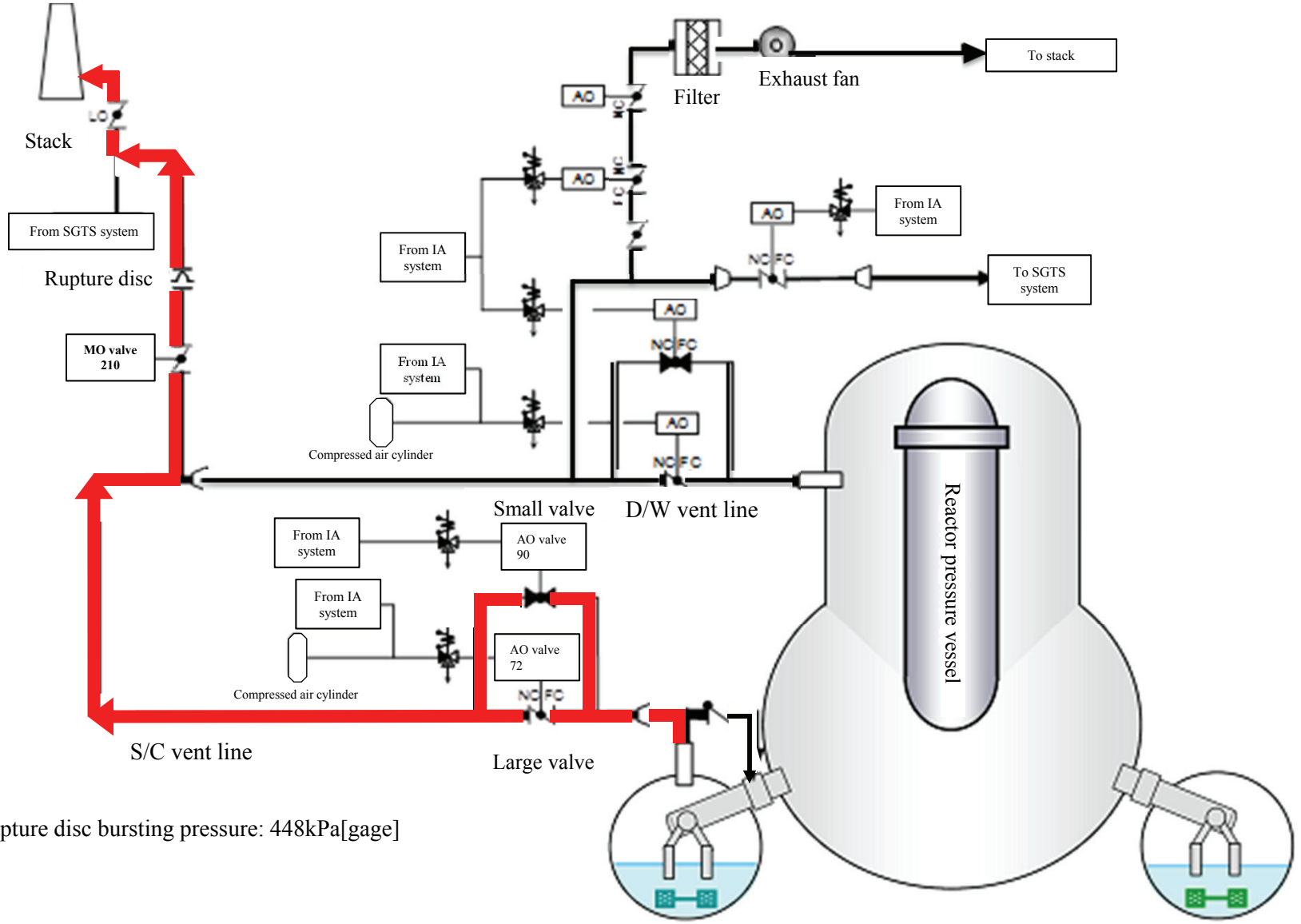
Two-piece anorak

Full face mask

Hood mask

Adopted from “The Impact of the Tohoku District – off the Pacific Ocean Earthquake on Nuclear Reactor Facilities at the Fukushima Dai-ichi Nuclear Power Station" (September, 2011) by TEPCO.

Unit 1 vent line



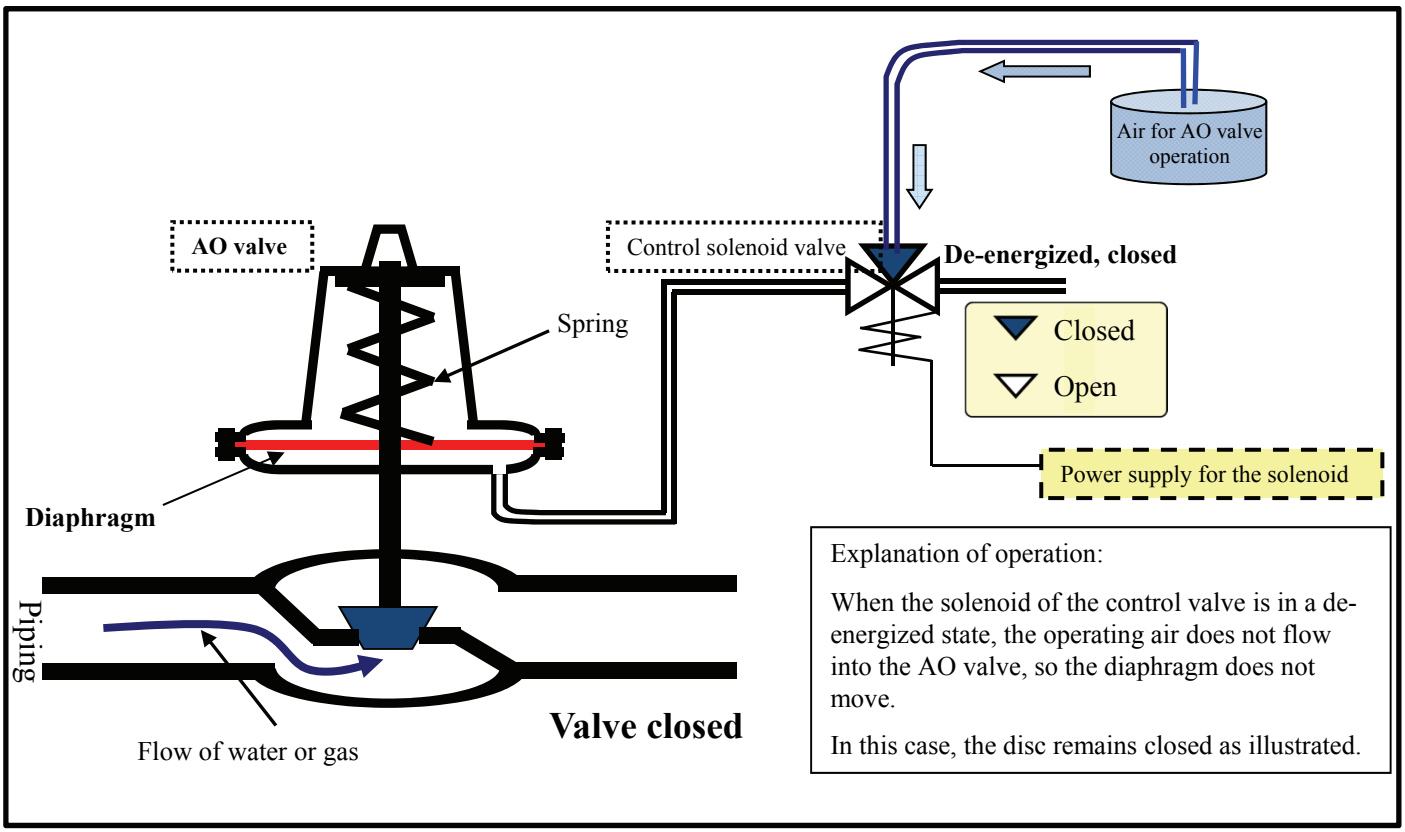
Rupture disc bursting pressure: 448kPa[gage]

Attachment IV-17

Compiled from "The Impact of the Tohoku District – off the Pacific Ocean Earthquake on Nuclear Reactor Facilities at the Fukushima Dai-ichi Nuclear Power Station" (September, 2011) by TEPCO

Attachment IV-18

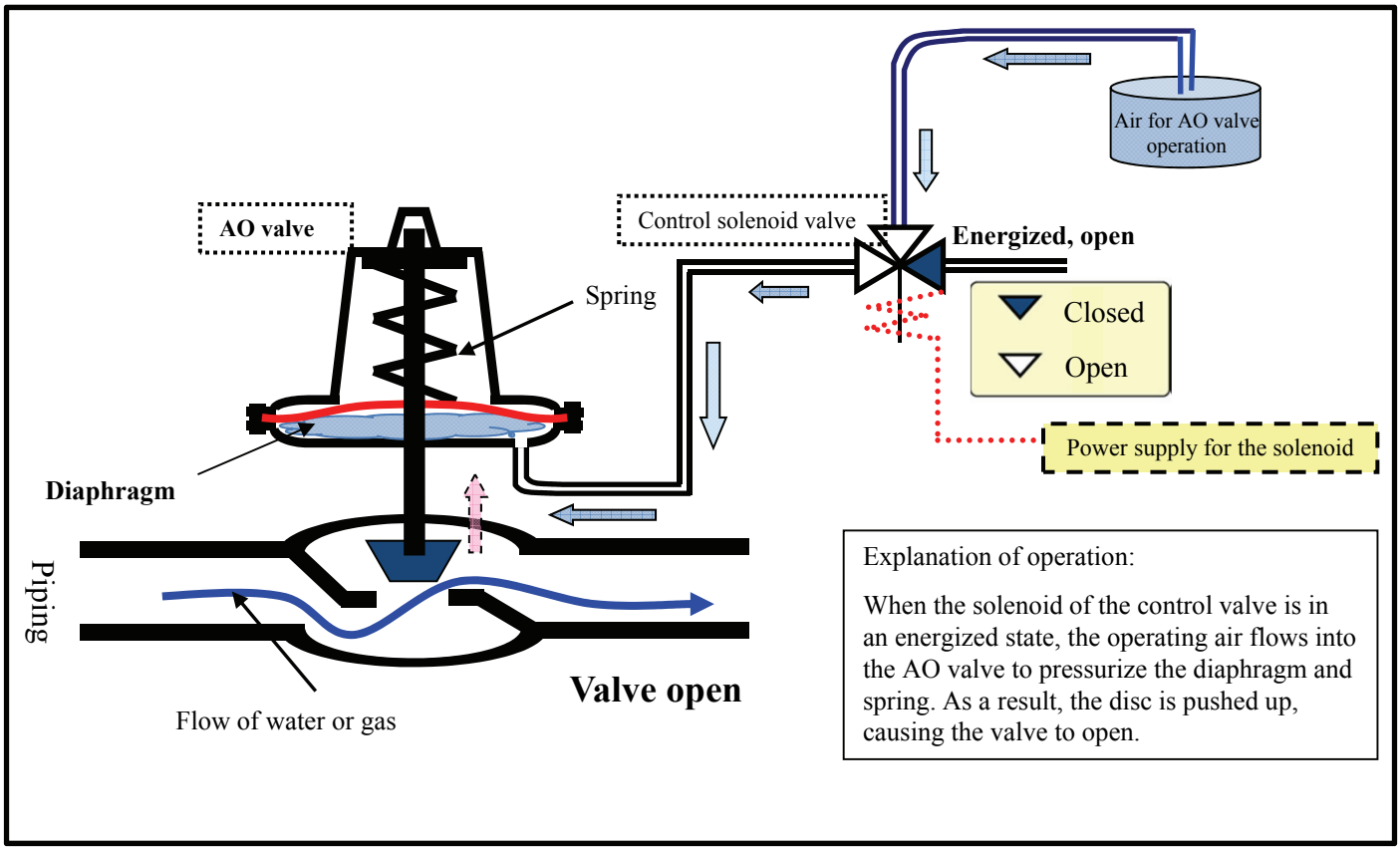
Illustrated overview of the operating principle of air-operated (AO) valves



Explanation of operation:

When the solenoid of the control valve is in a de-energized state, the operating air does not flow into the AO valve, so the diaphragm does not move.

In this case, the disc remains closed as illustrated.

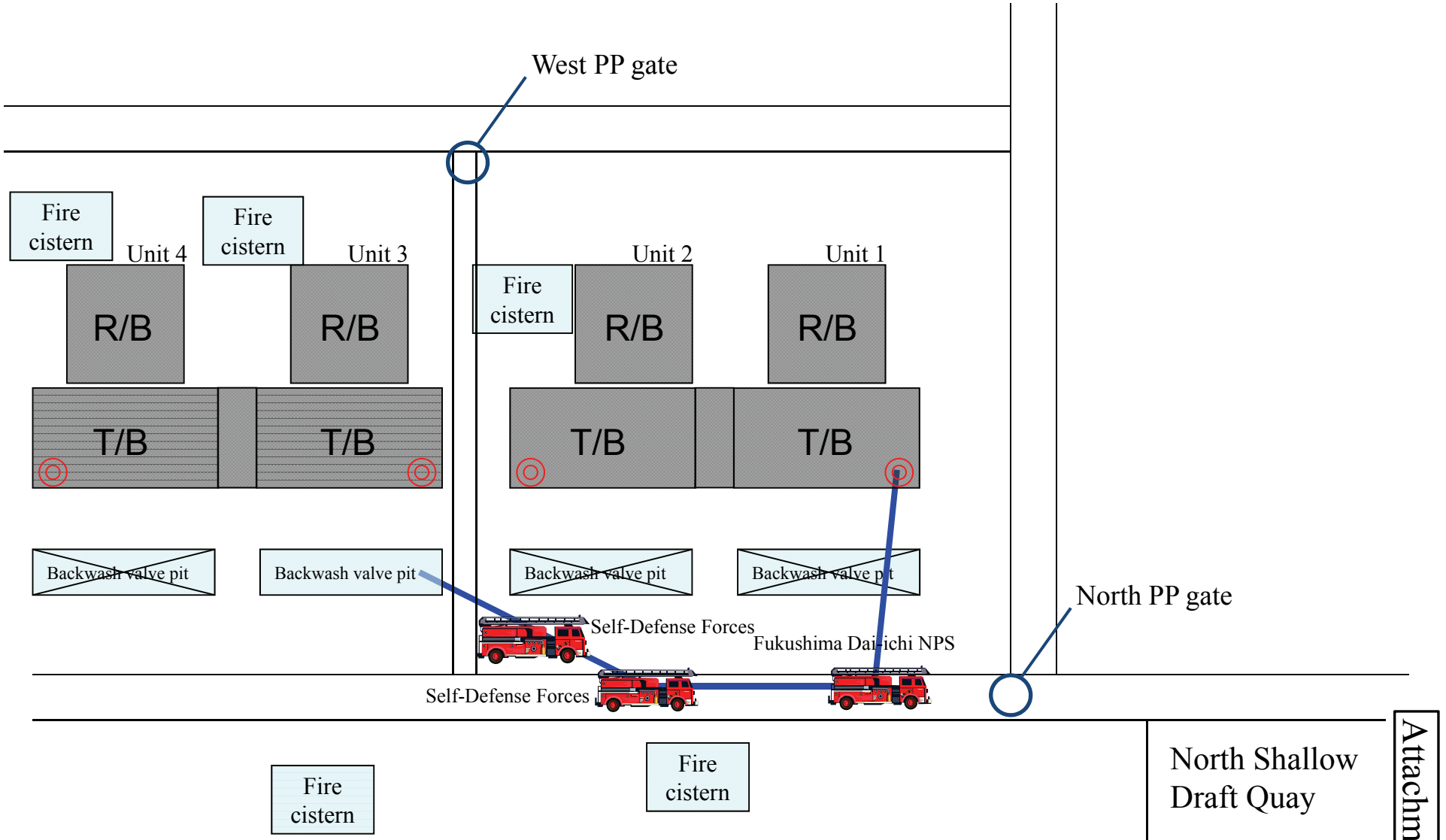


Explanation of operation:

When the solenoid of the control valve is in an energized state, the operating air flows into the AO valve to pressurize the diaphragm and spring. As a result, the disc is pushed up, causing the valve to open.

Compiled from documents by TEPCO

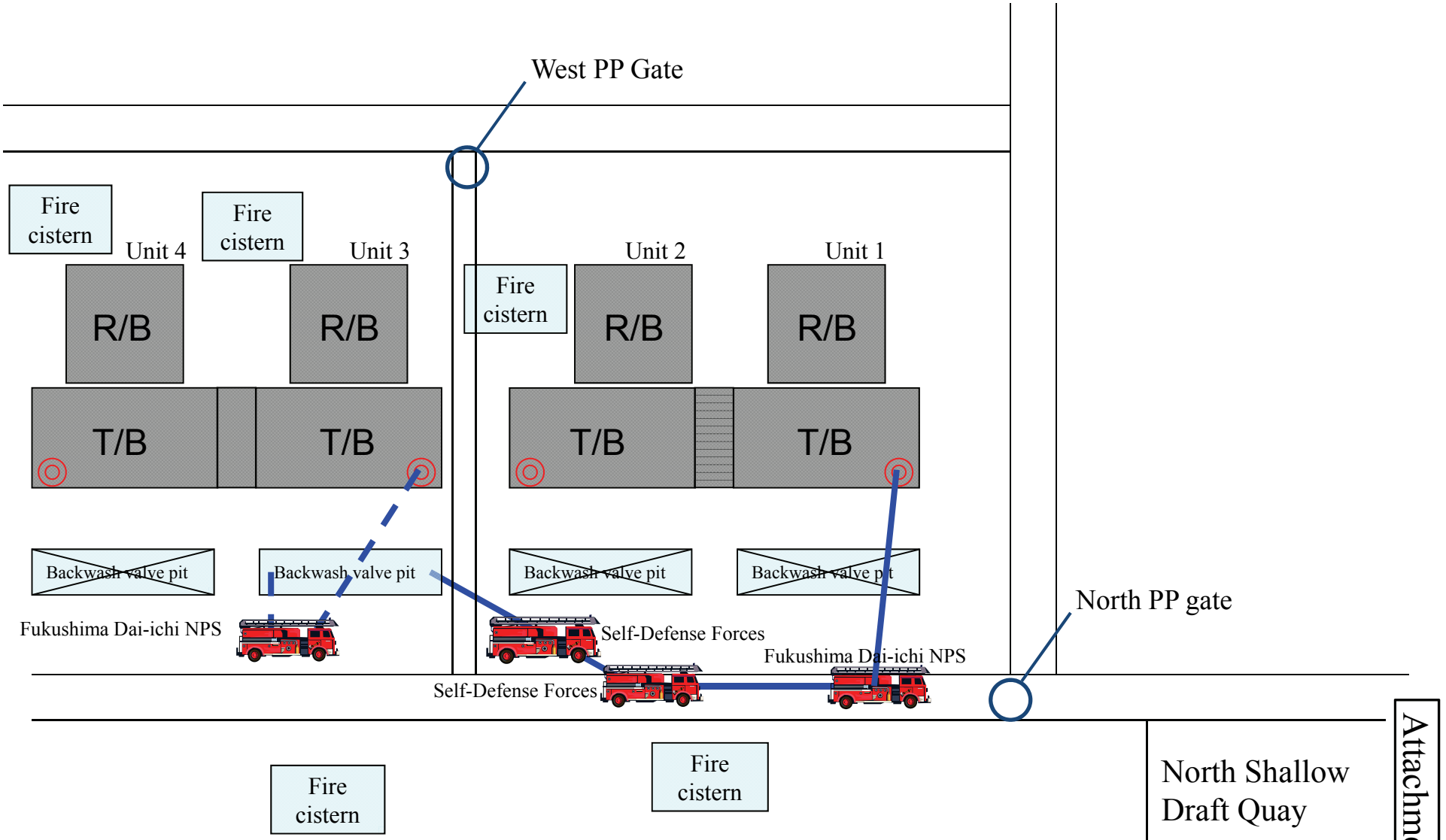
Overview of water injection by fire engines (at around 19:04 on March 12)



Compiled from documents by TEPCO

Attachment IV-19

Overview of water injection by fire engines (at around 07:00 on March 13)

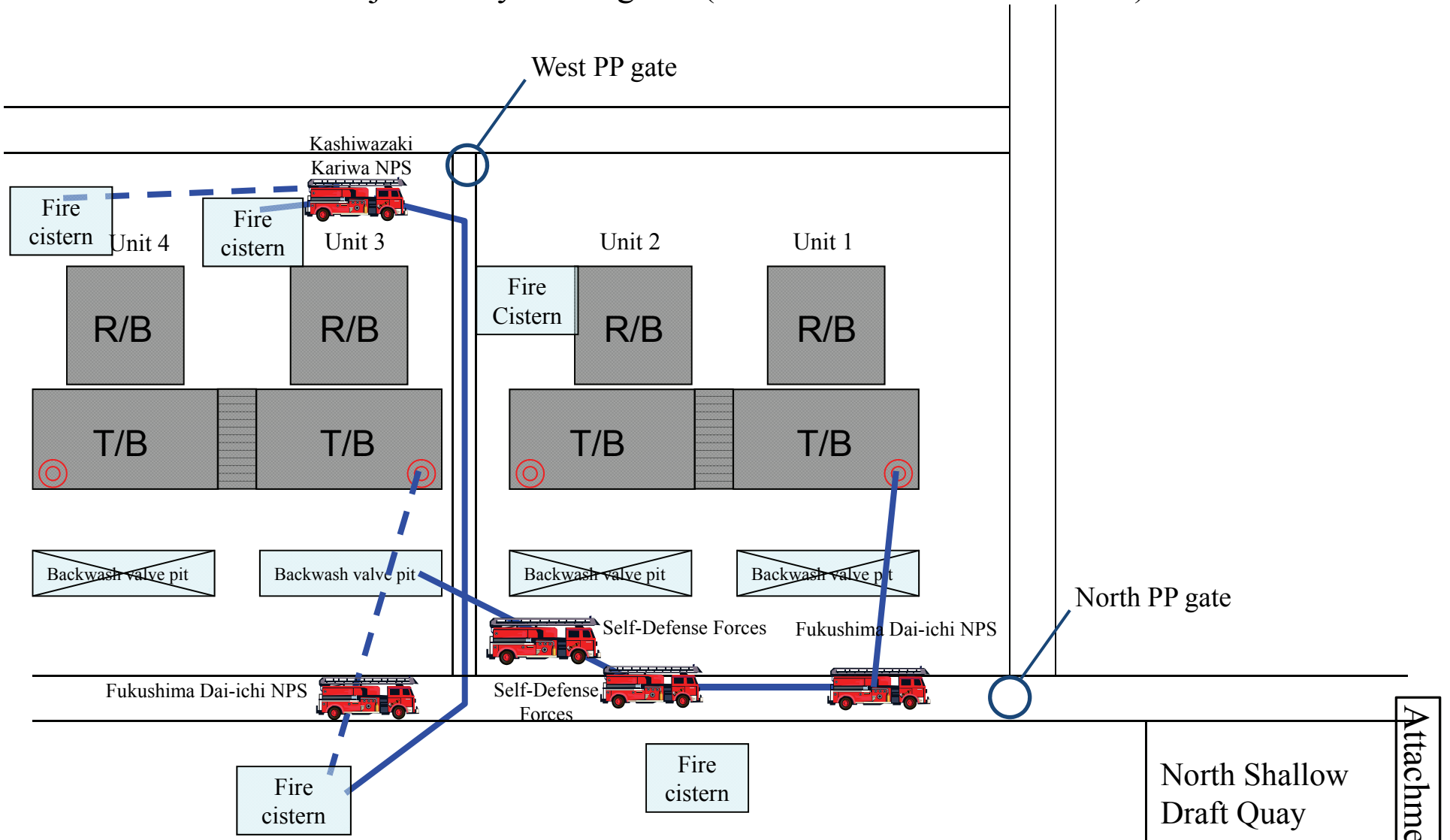


*The blue dotted lines show that water injection had not started by around 07:00 on March 13.

Compiled from documents by TEPCO

Attachment IV-20

Overview of water injection by fire engines (at around 09:00 on March 13)

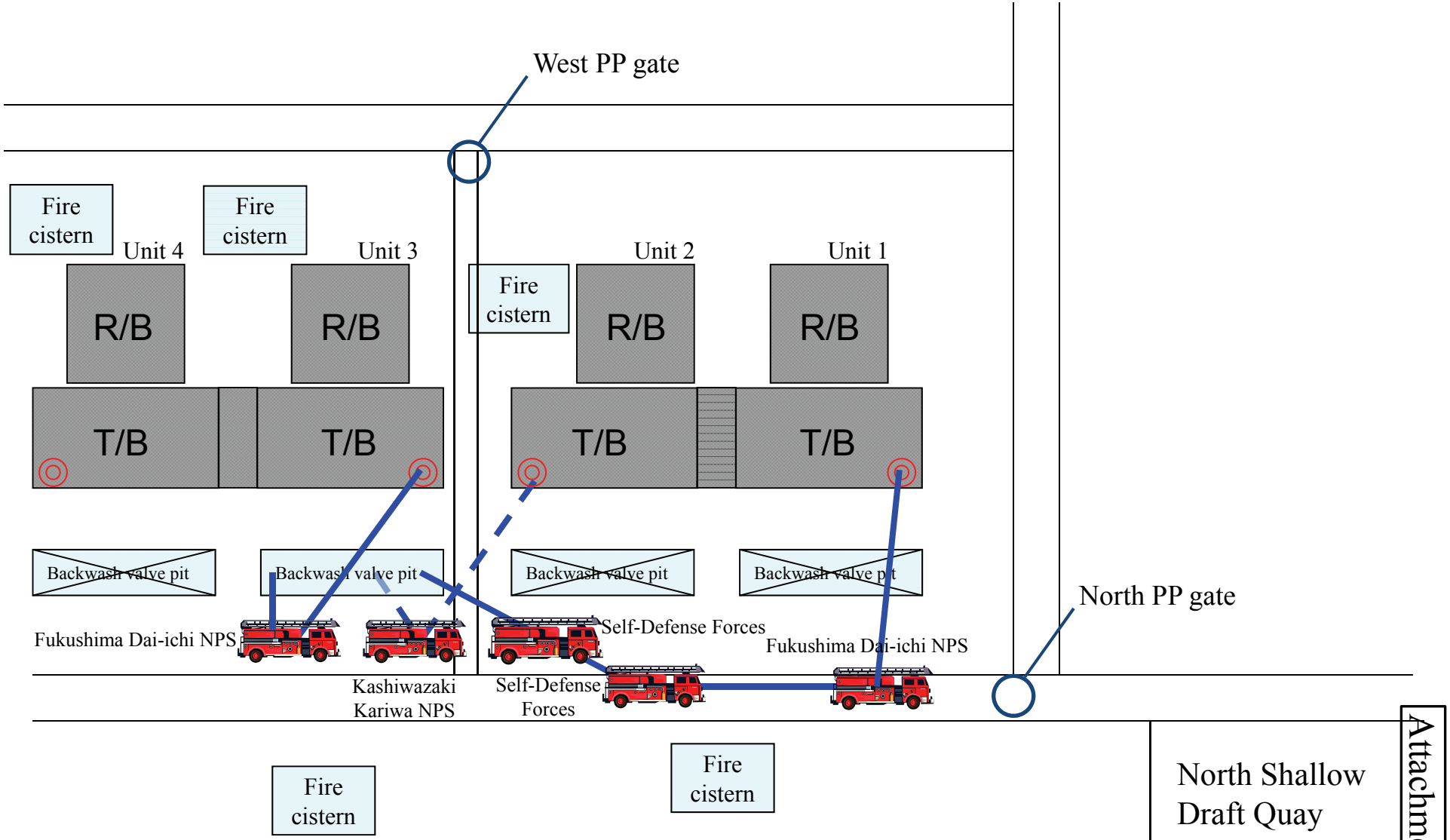


*The blue dotted lines show that water injection had not started by around 09:00 on March 13.

Compiled from documents by TEPCO

Attachment IV-21

Overview of water injection by fire engines (the early evening of March 13)

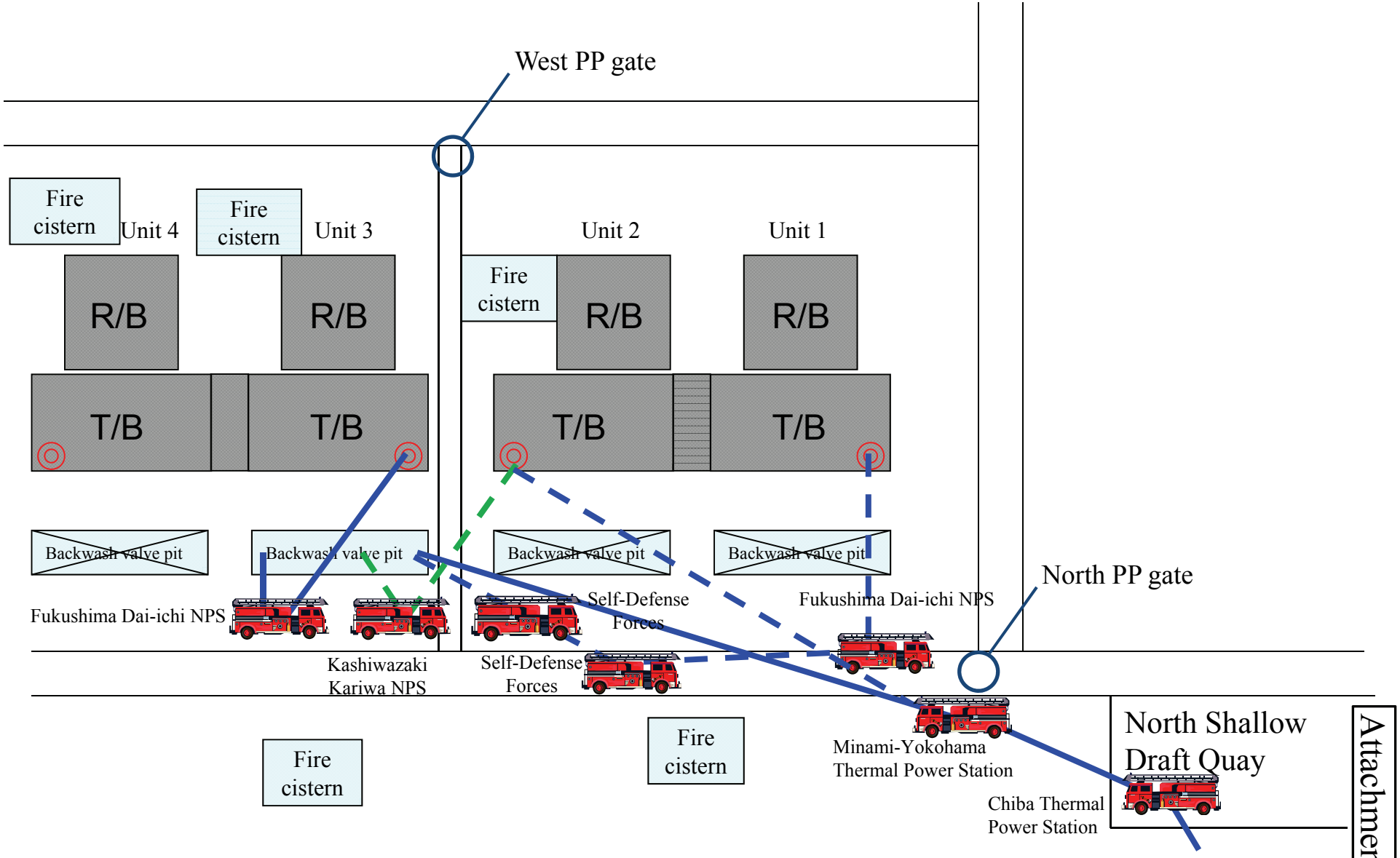


*The blue dotted lines show that water injection had not started by the early evening of March 13.

Compiled from documents by TEPCO

Attachment IV-22

Overview of water injection by fire engines (until around 11:01 on March 14)

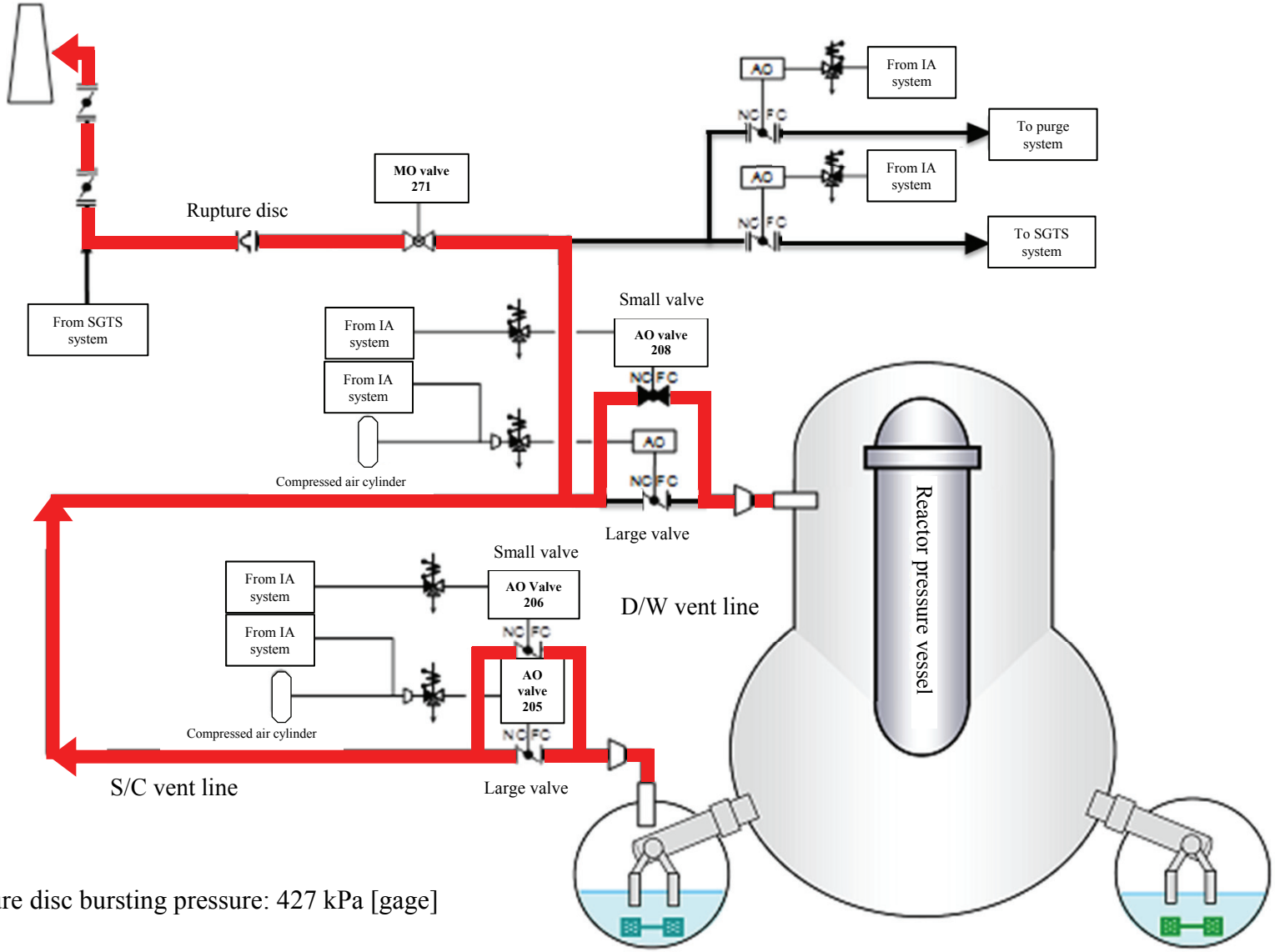


*The water injection lines to Unit 2 were changed from blue dotted lines to green before the explosion at Unit 3, but water injection had not started yet.

Compiled from documents by TEPCO

Attachment IV-23

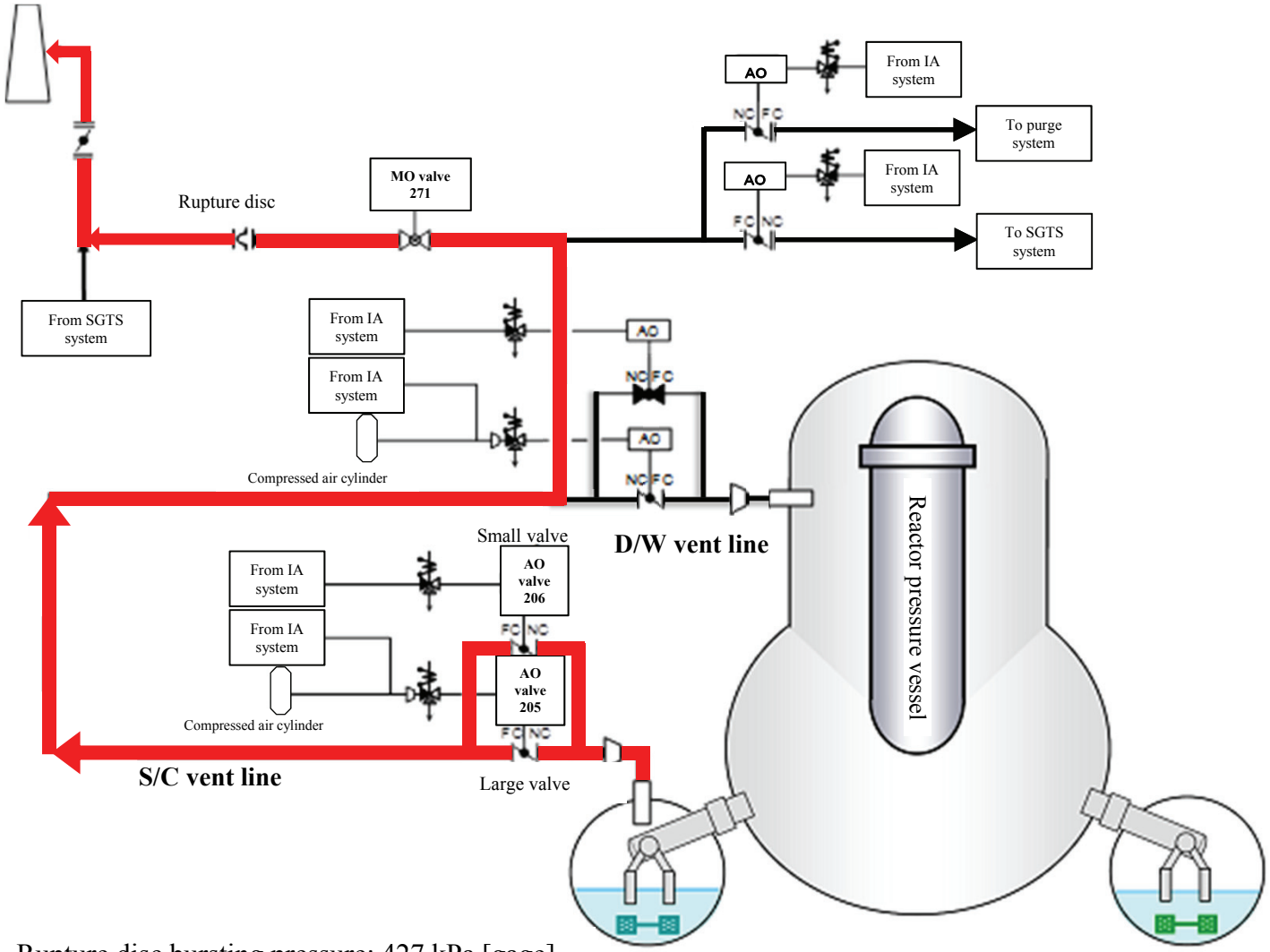
Unit 2 vent line



Rupture disc bursting pressure: 427 kPa [gage]

Attachment IV-24

Unit 3 vent line

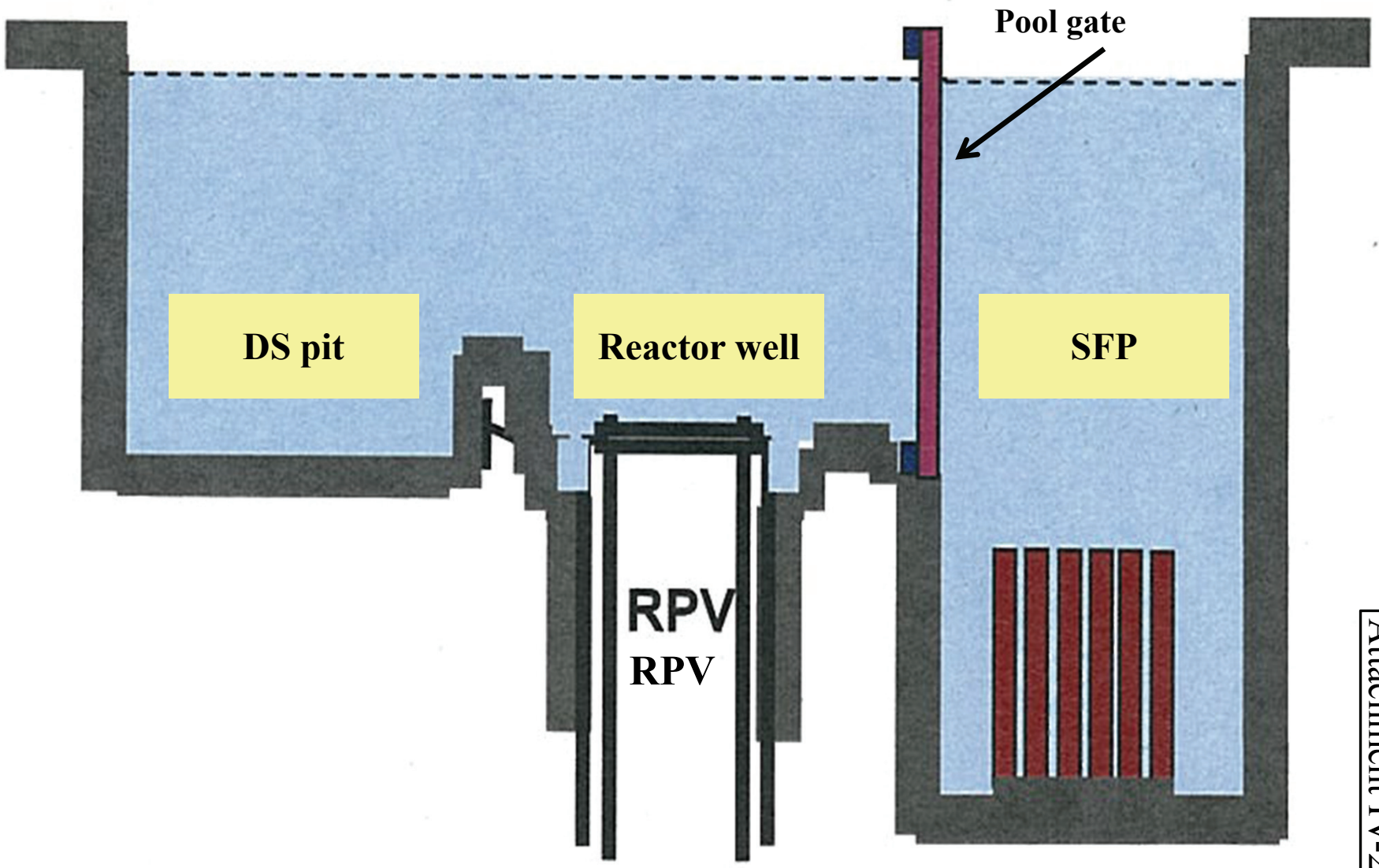


Rupture disc bursting pressure: 427 kPa [gage]

Attachment IV-25

Compiled from "The Impact of the Tohoku District – off the Pacific Ocean Earthquake on Nuclear Reactor Facilities at the Fukushima Dai-ichi Nuclear Power Station" (September, 2011) by TEPCO

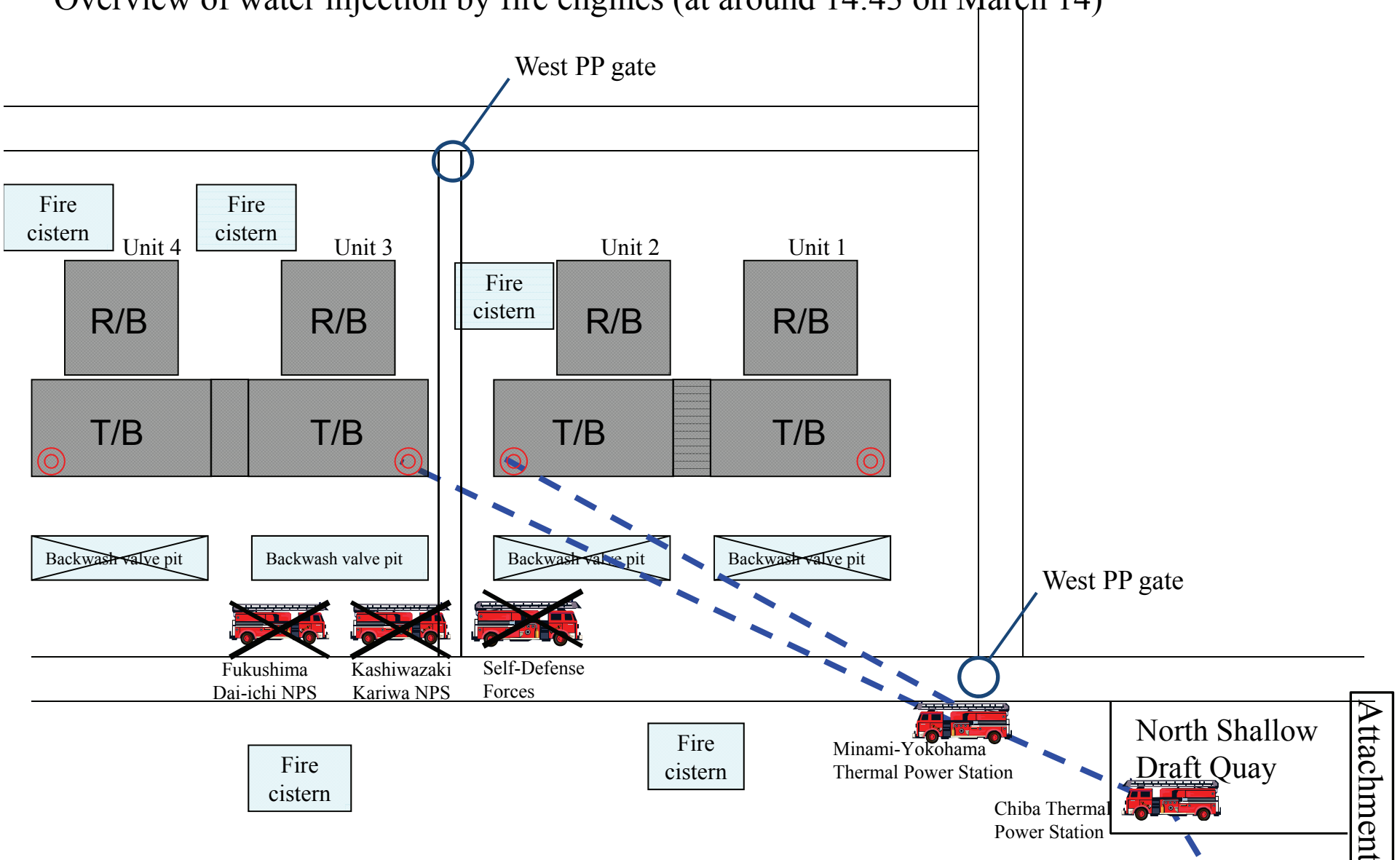
Sectional view of the Unit 4 spent fuel pool and nearby facilities



Attachment IV-26

Compiled from "The Impact of the Tohoku District – off the Pacific Ocean Earthquake on Nuclear Reactor Facilities at the Fukushima Dai-ichi Nuclear Power Station" (September, 2011) by TEPCO.

Overview of water injection by fire engines (at around 14:43 on March 14)

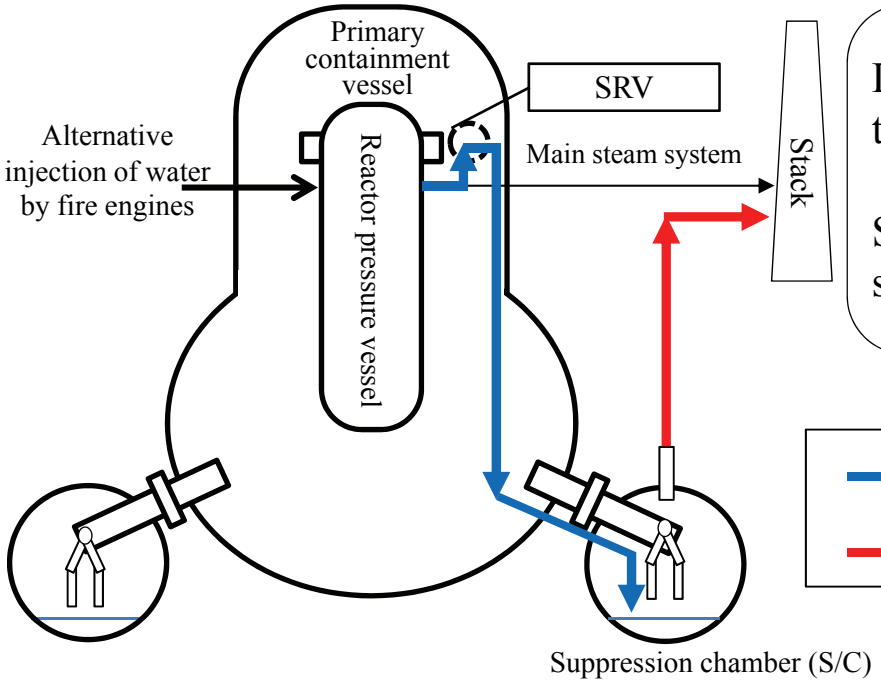


*The blue dotted lines show that water injection had not started by around 14:43 on March 13.

Compiled from documents by TEPCO

Attachment IV-27

Comparative review of the chosen methods for depressurization and alternative water injection of Unit 2



Depressurization of the reactor pressure vessel (RPV) through the safety relief valve (SRV) (original function)

Steam released from the RPV is cooled by water in the suppression chamber (S/C)

Flow of steam through the SRV

S/C vent line

Opinion of Site Superintendent, Mr. Yoshida

Concern:
Because of high pool temperature and pressure in the Unit 2 S/C uncondensed, steam through the SRV might lead to not only insufficient depressurization of the reactor but also damage of the S/C.
Proposal:
Water should be injected, depressurizing the RPV, after configuring an S/C vent line to secure an escape route for S/C pressure.

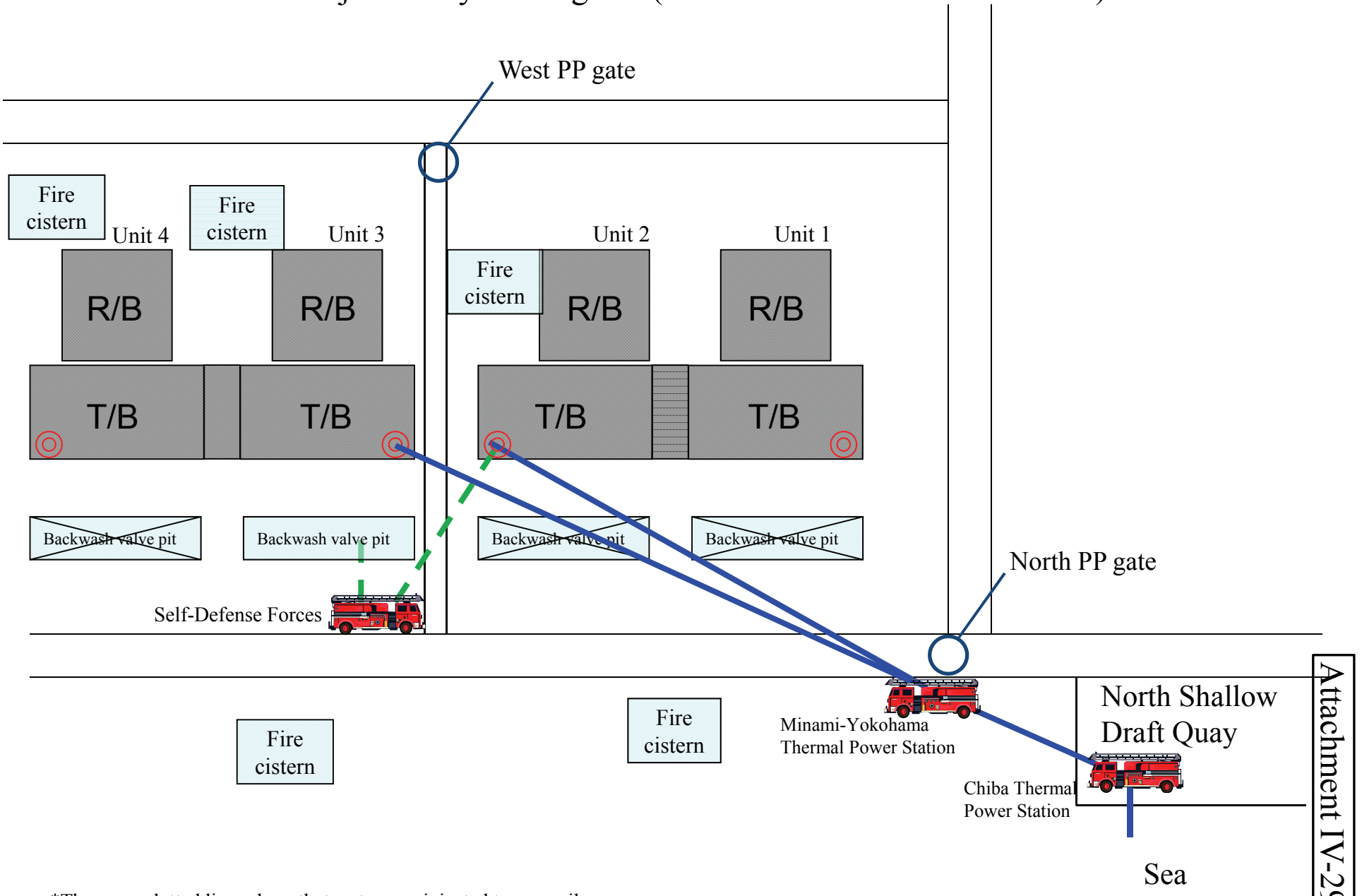
Opinion of Chairman, Madarame

Concern:
Because of no water injection into Unit 2 for a long time, there is a possibility that the RPV would be damaged due to possible fuel damage.

Proposal:
Water injection should come first, depressurizing the RPV without waiting for the completion of an S/C vent line.

Attachment IV-28

Overview of water injection by fire engines (after around 19:57 on March 14)

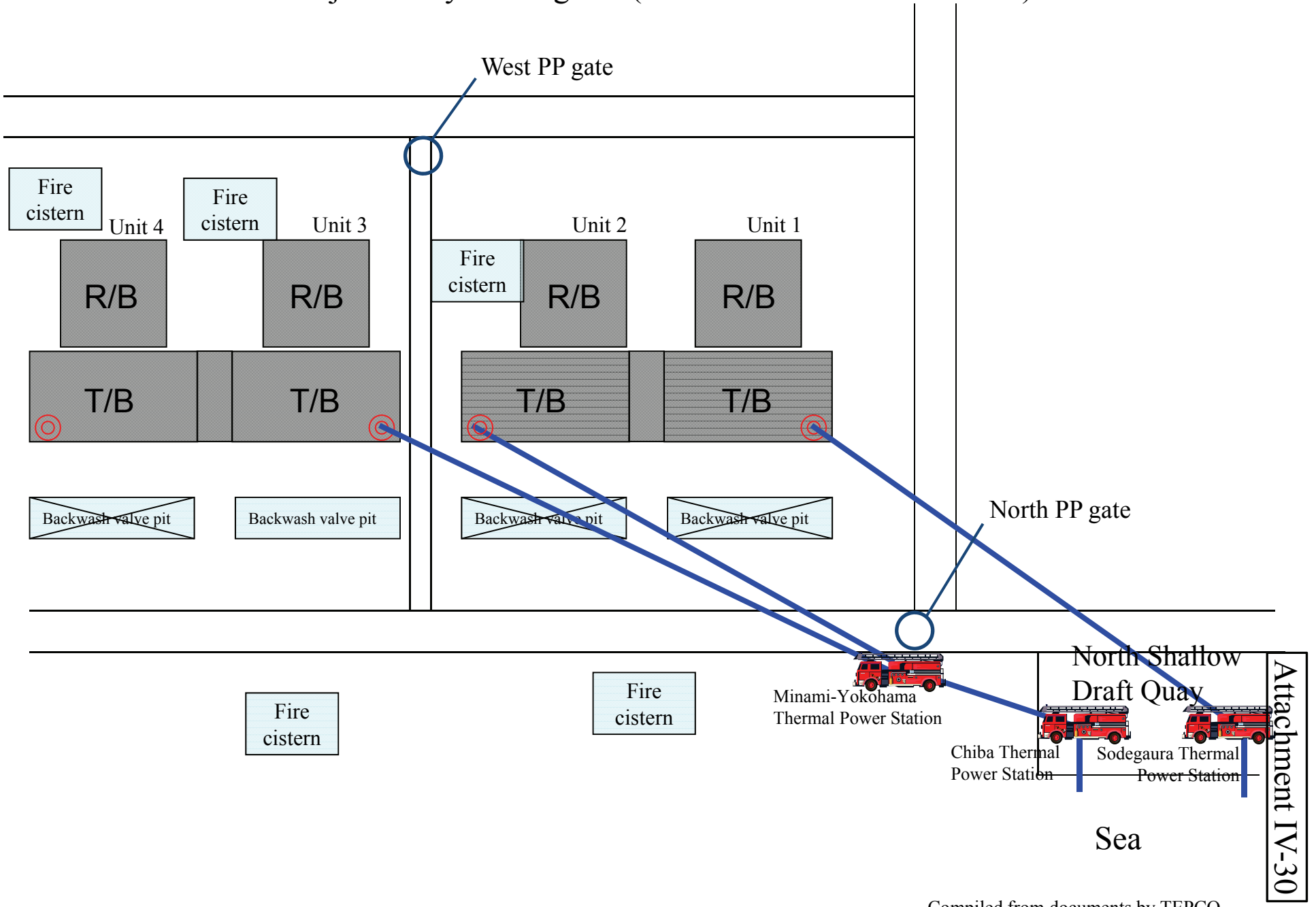


*The green dotted lines show that water was injected temporarily.

Compiled from documents by TEPCO

Attachment IV-29

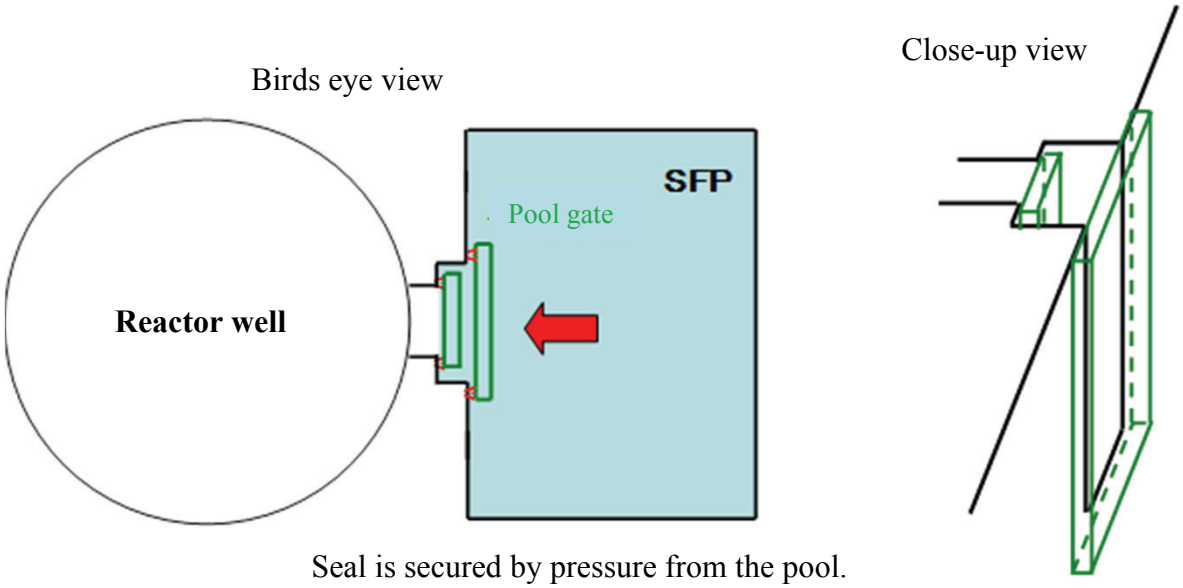
Overview of water injection by fire engines (at around 20:30 on March 14)



Compiled from documents by TEPCO

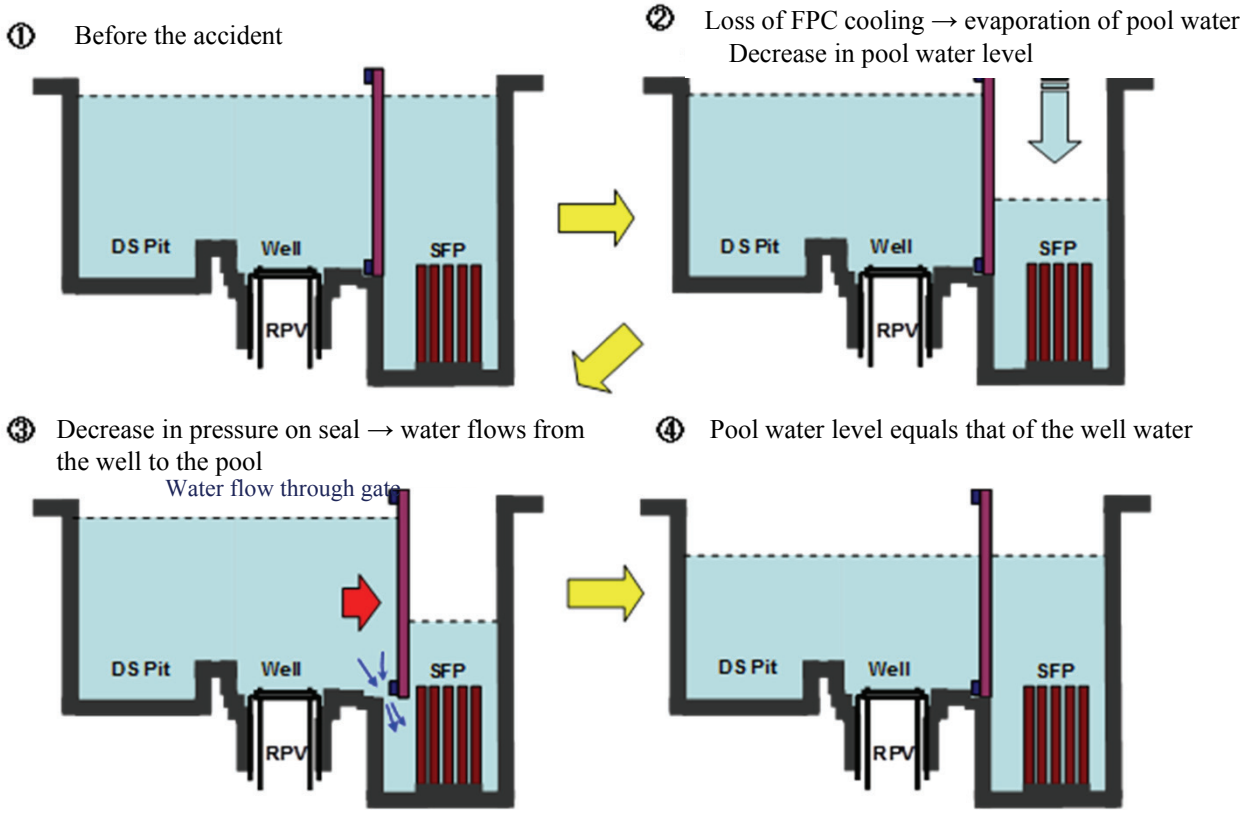
Attachment IV-31

Pool gate configuration



Seal is secured by pressure from the pool.

Water level changes of the spent fuel pool after the accident (before water injection started)



Compiled from "The Impact of the Tohoku District – off the Pacific Ocean Earthquake on Nuclear Reactor Facilities at the Fukushima Dai-ichi Nuclear Power Station" (September, 2011) by TEPCO.

Attachment IV-32

Progress in the cooling of spent fuel pools

Blue: Water spray by helicopters, water cannon trucks, fire engines and concrete pumping trucks
Green: Water injection from the fuel pool cooling & clean-up system (FPC)
Purple: Water injection by temporary water injection systems
Red: Cooling by alternative cooling systems

Date	Unit 1 Pool	Unit 2 Pool	Unit 3 Pool	Unit 4 Pool	Unit 5 Pool	Unit 6 Pool
Mar/17			9:48 - 10:01 Water sprinkle by the Self-Defense Force (Helicopters) [Approximately 30t / Seawater] 19:05 - 19:13 Water spray by the Tokyo Police Department (Water cannon trucks) [Approximately 44t / Seawater] 19:35 - 20:09 Water spray by the Self-Defense Forces (Fire Engines) [Approximately 30t / Fresh Water]			
Mar/18			14:00 - 14:38 Water spray by the Self-Defense Force (Fire Engines) [Approximately 40t / Fresh Water] 14:42 - 14:45 Water spray by TEPCO (High Pressure Water cannon truck of US forces) [approximately 2t / Fresh Water]			
Mar/19			0:30 - 1:10 Water spray by the Tokyo Fire Department (Fire Engines) [Approximately 60t / Seawater] 14:10 - 3/20 3:40 Water spray by the Tokyo fire Department ((Fire Engines) [Approximately 2430t / Seawater]		1:55 Startup of Temporary Residual Heat Removal Service Water System (RHRS) 5:00 Start of Cooling in the Fuel Pool Cooling mode of the Residual Heat Removal System (RHR)	21:16 Startup of Temporary Residual Heat Removal Service Water System (RHRS) 22:14 Start of Cooling in the Fuel Pool Cooling mode of the Residual Heat Removal System (RHR)
Mar/20		15:05 - 19:45 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 40t / Seawater]	21:36 - 3/21 3:58 Water spray by the Tokyo Fire Department (Fire Engines) [Approximately 1137t / Seawater]	8:21 - 9:40 Water spray by the Self-Defense Force (Fire Engines) [Approximately 80t / Fresh Water] 18:30 - 19:46 Water spray by the Self-Defense Force (Fire Engines) [Approximately 80t / Fresh Water]	Cooling by Temporar	Cooling by Temporary

Date	Unit 1 Pool	Unit 2 Pool	Unit 3 Pool	Unit 4 Pool	Unit 5 Pool	Unit 6 Pool
Mar/21				6:37 - 8:41 Water spray by the Self-Defense Force (Fire Engines, High Pressure Water cannon truck of US forces) [Approximately 92t / Fresh Water]	Cooling by Residual Heat Removal System (RHR)	Cooling by Residual Heat Removal System (RHR)
Mar/22		16:07 - 17:01 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 18 t / Seawater]	15:10 - 15:59 Water spray by Tokyo Fire Department and Osaka-City Fire Department (Fire Engines) [Approximately 150t / Seawater]	17:17 - 20:32 Water spray by concrete pumping trucks [Approximately 150t / Seawater]		
Mar/23			11:03 - 13:20 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 35 t / Seawater]	10:00 - 13:02 Water spray by concrete pumping trucks [Approximately 125t / Seawater]		
Mar/24			5:35 - 16:05 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 120 t / Seawater]	14:36 - 17:30 Water spray by concrete pumping trucks [Approximately 150t / Seawater]		
Mar/25		10:30 - 12:19 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 30 t / Seawater]	13:28 - 16:00 Water spray by Kawasaki City Fire Department (Fire Engines) [Approximately 450 t / Seawater]	6:05 - 10:20 Water spray from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 21t / Seawater] 19:05 - 22:07 Water spray by concrete pumping trucks [Approximately 150t / Seawater]		
Mar/26						
Mar/27			12:34 - 14:36 Water spray by concrete pumping trucks [Approximately 100t / Seawater]	16:55 - 19:25 Water spray by concrete pumping trucks [Approximately 125t / Seawater]		
Mar/28						
Mar/29		16:30 - 18:25 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 15 - 30 t / Fresh Water]	14:17 - 18:18 Water spray by concrete pumping trucks [Approximately 100t / Fresh Water]			
Mar/30		19:05 - 23:50 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Less than 20 t / Fresh Water]		14:04 - 18:33 Water spray by concrete pumping trucks [Approximately 140t / Fresh Water]		
Mar/31	13:03 - 16:04 Water spray by concrete pumping trucks [Approximately 90 t / Fresh Water]		16:30 - 19:33 Water spray by concrete pumping trucks [Approximately 105t / Fresh Water]			
Apr/1		14:56 - 17:05 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 70 t / Fresh Water]		8:28 - 14:14 Water spray by concrete pumping trucks [Approximately 180t / Fresh Water]		
Apr/2			9:52 - 12:54 Water spray by concrete pumping trucks [Approximately 75 t / Fresh Water]			
Apr/3				17:14 - 22:16 Water spray by concrete pumping trucks [Approximately 180 t / Fresh Water]		

Date	Unit 1 Pool	Unit 2 Pool	Unit 3 Pool	Unit 4 Pool	Unit 5 Pool	Unit 6 Pool
Apr/4		11:05 - 13:37 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 70 t / Fresh Water]	17:03 - 19:19 Water spray by concrete pumping trucks [Approximately 70 t / Fresh Water]		Cooling by Temporary Residual Heat Removal System (RHR)	Cooling by Temporary Residual Heat Removal System (RHR)
Apr/5				17:35 - 18:22 Water spray by concrete pumping trucks [Approximately 20 t / Fresh Water]		
Apr/6						
Apr/7		13:29 - 14:34 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 36 t / Fresh Water]	6:53 - 8:53 Water spray by concrete pumping trucks [Approximately 70 t / Fresh Water]	18:23 - 19:40 Water spray by concrete pumping trucks [Approximately 38 t / Fresh Water]		
Apr/8			17:06 - 20:00 Water spray by concrete pumping trucks [Approximately 75 t / Fresh Water]			
Apr/9				17:07 - 19:24 Water spray by concrete pumping trucks [Approximately 90 t / Fresh Water]		
Apr/10		10:37 - 12:38 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 60 t / Fresh Water]	17:15 - 19:15 Water spray by concrete pumping trucks [Approximately 80 t / Fresh Water]			
Apr/11						
Apr/12			16:26 - 17:16 Water spray by concrete pumping trucks [Approximately 35 t / Fresh Water]			
Apr/13		13:15 - 14:55 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 60 t / Fresh Water]		0:30 - 6:57 Water spray by concrete pumping trucks [Approximately 195 t / Fresh Water]		
Apr/14			15:56 - 16:32 Water spray by concrete pumping trucks [Approximately 25 t / Fresh Water]			
Apr/15				14:30 - 18:29 Water spray by concrete pumping trucks [Approximately 140 t / Fresh Water]		
Apr/16		10:13 - 11:54 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 45 t / Fresh Water]				
Apr/17				17:39 - 21:22 Water spray by concrete pumping trucks [Approximately 140 t / Fresh Water]		
Apr/18			14:17 - 15:02 Water spray by concrete pumping trucks [Approximately 30 t / Fresh Water]			
Apr/19		16:08 - 17:28 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 47 t / Fresh Water]		10:17 - 11:35 Water spray by concrete pumping trucks [Approximately 40 t / Fresh Water]		

Date	Unit 1 Pool	Unit 2 Pool	Unit 3 Pool	Unit 4 Pool	Unit 5 Pool	Unit 6 Pool
Apr/20				17:08 - 20:31 Water spray by concrete pumping trucks [Approximately 100 t / Fresh Water]	Cooling by Temporary Residual Heat Removal System (RHR)	Cooling by Temporary Residual Heat Removal System (RHR)
Apr/21				17:14 - 21:20 Water spray by concrete pumping trucks [Approximately 140 t / Fresh Water]		
Apr/22		15:55 - 17:40 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 50 t / Fresh Water]	14:19 - 15:40 Water spray by concrete pumping trucks [Approximately 50 t / Fresh Water]	17:52 - 23:53 Water spray by concrete pumping trucks [Approximately 200 t / Fresh Water]		
Apr/23				12:30 - 16:44 Water spray by concrete pumping trucks [Approximately 140 t / Fresh Water]		
Apr/24				12:25 - 17:07 Water spray by concrete pumping trucks [Approximately 165 t / Fresh Water]		
Apr/25		10:12 - 11:18 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 38 t / Fresh Water]		18:15 - 4/26 0:26 Water spray by concrete pumping trucks [Approximately 210 t / Fresh Water]		
Apr/26			12:25 - 14:02 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 47.5 t / Fresh Water]	16:50 - 20:35 Water spray by concrete pumping trucks [Approximately 130 t / Fresh Water]		
Apr/27				12:18 - 15:15 Water spray by concrete pumping trucks [Approximately 85 t / Fresh Water]		
Apr/28		10:15 - 11:28 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 43 t / Fresh Water]				
Apr/29						
Apr/30						
May/1						
May/2		10:05 - 11:40 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 55 t / Fresh Water]				
May/3						
May/4						
May/5				12:19 - 20:46 Water spray by concrete pumping trucks [Approximately 270 t / Fresh Water]		
May/6		9:36 - 11:16 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 58 t / Fresh Water]		12:38 - 17:51 Water spray by concrete pumping trucks [Approximately 180 t / Fresh Water]		
May/7				14:05 - 17:30 Water spray by concrete pumping trucks [Approximately 120 t / Fresh Water]		

Date	Unit 1 Pool	Unit 2 Pool	Unit 3 Pool	Unit 4 Pool	Unit 5 Pool	Unit 6 Pool
May/8			12:10 - 14:10 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 60 t / Fresh Water]		Cooling by Temporary Residual Heat Removal System (I	Cooling by Temporary Residual Heat Removal System (I
May/9			12:14 - 15:00 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 80 t / Fresh Water]	16:05 - 19:05 Water spray by concrete pumping trucks [Approximately 100 t / Fresh Water]		
May/10		13:09 - 14:45 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 56 t / Fresh Water]				
May/11				16:07 - 19:38 Water spray by concrete pumping trucks [Approximately 120 t / Fresh Water]		
May/12						
May/13				16:04 - 19:04 Water spray by concrete pumping trucks [Approximately 100 t / Fresh Water]		
May/14		13:00 - 14:37 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 56 t / Fresh Water]				
May/15				16:25 - 20:25 Water spray by concrete pumping trucks [Approximately 140 t / Fresh Water]		
May/16			15:00 - 18:32 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 106 t / Fresh Water]			
May/17				16:14 - 20:06 Water spray by concrete pumping trucks [Approximately 120 t / Fresh Water]		
May/18		13:10 - 14:40 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 53 t / Fresh Water]				
May/19				16:30 - 19:30 Water spray by concrete pumping trucks [Approximately 100 t / Fresh Water]		
May/20	15:06 - 16:15 Water spray by concrete pumping trucks [Approximately 60 t / Fresh Water]					
May/21				16:00 - 19:56 Water spray by concrete pumping trucks [Approximately 130 t / Fresh Water]		
May/22	15:33 - 17:09 Water spray by concrete pumping trucks [Approximately 90 t / Fresh Water]	13:02 - 14:40 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 56 t / Fresh Water]				

Date	Unit 1 Pool	Unit 2 Pool	Unit 3 Pool	Unit 4 Pool	Unit 5 Pool	Unit 6 Pool
May/23				16:00 - 19:09 Water spray by concrete pumping trucks [Approximately 100 t / Fresh Water]		
May/24			10:15 - 13:35 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 100 t / Fresh Water]			
May/25				16:36 - 20:04 Water spray by concrete pumping trucks [Approximately 121 t / Fresh Water]		
May/26		10:06 - 11:36 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 53 t / Fresh Water]				
May/27				17:05 - 20:00 Water spray by concrete pumping trucks [Approximately 100 t / Fresh Water]		
May/28	16:47 - 17:00 Leak Test of the Fuel Pool Cooling & Clean-up System (FPC) Line [Approximately 5t / Fresh Water]		13:28 - 15:08 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 50 t / Fresh Water]	17:56 - 19:45 Water spray by concrete pumping trucks [Approximately 60 t / Fresh Water]	21:14 One of the pumps of the temporary Residual Heat Removal Service Water System (RHRS) stopped.	
May/29	11:10 - 15:35 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 168 t / Fresh Water]				12:31 The temporary Residual Heat Removal Service Water System (RHRS) Pump restored and Started up	
May/30		12:06 - 13:52 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 53 t / Fresh Water]				
May/31		17:21 - Start of Cooling by Alternative Cooling System				
Jun/1		5:06 - 7:06 Sirculation cooling system pump stopped 6:06 - 6:53 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 25t / Fresh Water] 7:06 - Resumed of Cooling by Alternative Cooling System	14:34 - 15:54 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 40t / Fresh Water]			
Jun/2						
Jun/3				14:35 - 21:15 Water spray by concrete pumping trucks [Approximately 210 t / Fresh Water]		
Jun/4				14:23 - 19:45 Water spray by concrete pumping trucks [Approximately 180 t / Fresh Water]		
Jun/5	10:16 - 10:48 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 15 t / Fresh Water]		13:08 - 15:14 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 60 t / Fresh Water]			

Date	Unit 1 Pool	Unit 2 Pool	Unit 3 Pool	Unit 4 Pool	Unit 5 Pool	Unit 6 Pool
Jun/6				15:56 - 18:35 Water spray by concrete pumping trucks [Approximately 90 t / Fresh Water]		
Jun/7						
Jun/8				16:12 - 19:41 Water spray by concrete pumping trucks [Approximately 120 t / Fresh Water]		
Jun/9			13:42 - 15:31 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 55 t / Fresh Water]			
Jun/10						
Jun/11						
Jun/12						
Jun/13			10:09 - 11:48 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 42 t / Fresh Water]	16:36 - 21:00 Water spray by concrete pumping trucks [Approximately 150 t / Fresh Water]		
Jun/14				16:10 - 20:52 Water spray by concrete pumping trucks [Approximately 150 t / Fresh Water]		
Jun/15						
Jun/16				13:14 - 15:44 Water injection by temporary water injection system [Approximately 75t / Fresh Water]		
Jun/17			10:19 - 11:57 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 49 t / Fresh Water]			
Jun/18				16:05 - 19:23 Water injection by temporary water injection system [Approximately 99t / Fresh Water]		
Jun/19						
Jun/20						
Jun/21						
Jun/22				14:31 - 16:38 Water injection by temporary water injection system [Approximately 56t / Fresh Water]		
Jun/23						
Jun/24						
Jun/25						
Jun/26			9:56 - 11:23 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 45 t / Fresh Water]			
Jun/27			15:00 - 17:18 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 60 t / Fresh Water]			
Jun/28						

Cooling by Alternative Cooling System

Cooling by Temporary Residual Heat Removal System (RHR)

Cooling by Temporary Residual Heat Removal System (RHR)

Date	Unit 1 Pool	Unit 2 Pool	Unit 3 Pool	Unit 4 Pool	Unit 5 Pool	Unit 6 Pool
Jun/29			14:45 - 15:53 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 30 t / Fresh Water]	11:47 - 12:01 Water injection by temporary water injection system [Approximately 7t / Fresh Water]		
Jun/30			19:47 Start of Cooling by Alternative Cooling system	11:30 - 11:55 Water injection by temporary water injection system [Approximately 13t / Fresh Water]		
Jul/1						
Jul/2						
Jul/3						
Jul/4						
Jul/5	15:10 - 17:30 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 75 t / Fresh Water]					
Jul/6						
Jul/7						
Jul/8						
Jul/9						
Jul/10						
Jul/11						
Jul/12						
Jul/13						
Jul/14						
Jul/15						
Jul/16						
Jul/17						
Jul/18						
Jul/19						
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Jul/21						
Jul/22						
Jul/23						
Jul/24						
Jul/25						
Jul/26						
Jul/27						
Jul/28						
Jul/29						
Jul/30						
Jul/31				8:47 - 9:38 Water injection by temporary water injection system [Approximately 25t / Fresh Water] 12:44 Start of Cooling by Alternative Cooling System		
Aug/1						
Aug/2						
Aug/3						
Aug/4						

Cooling by Alternative Cooling System

Cooling by Alternative Cooling System

Cooling by Temporary Residual Heat Removal System (RHR)

Cooling by Temporary Residual Heat Removal System (RHR)

Date	Unit 1 Pool	Unit 2 Pool	Unit 3 Pool	Unit 4 Pool	Unit 5 Pool	Unit 6 Pool
Aug/5	15:20 - 17:51 Water injection from the Fuel Pool Cooling & Clean-up System (FPC) [Approximately 75 t / Fresh Water]					
Aug/6						
Aug/7						
Aug/8						
Aug/9						
Aug/10	11:22 Start of Cooling by Alternative Cooling System					
Aug/11						
Aug/12						
Aug/13						
Aug/14						
Aug/15						
Aug/16						
Aug/17						
Aug/18						
Aug/19						
Aug/20						
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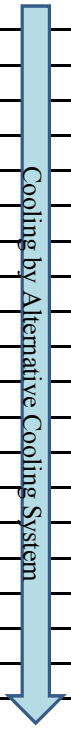
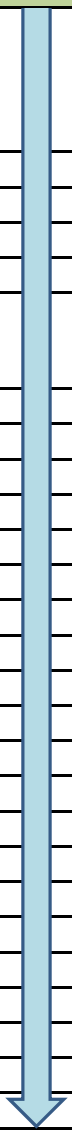
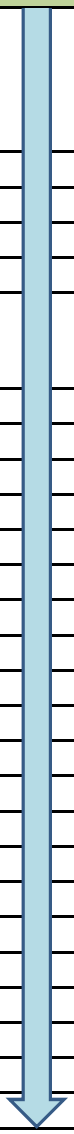
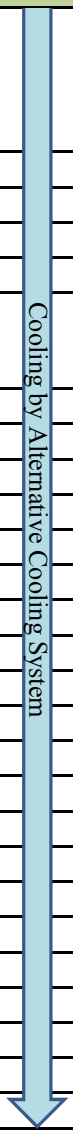
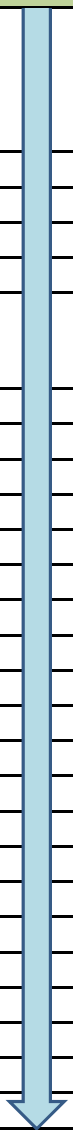
Aug/30						
Aug/31						

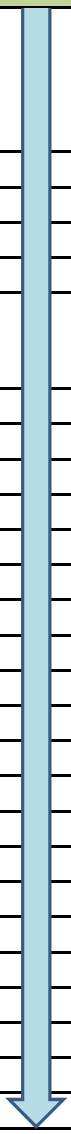




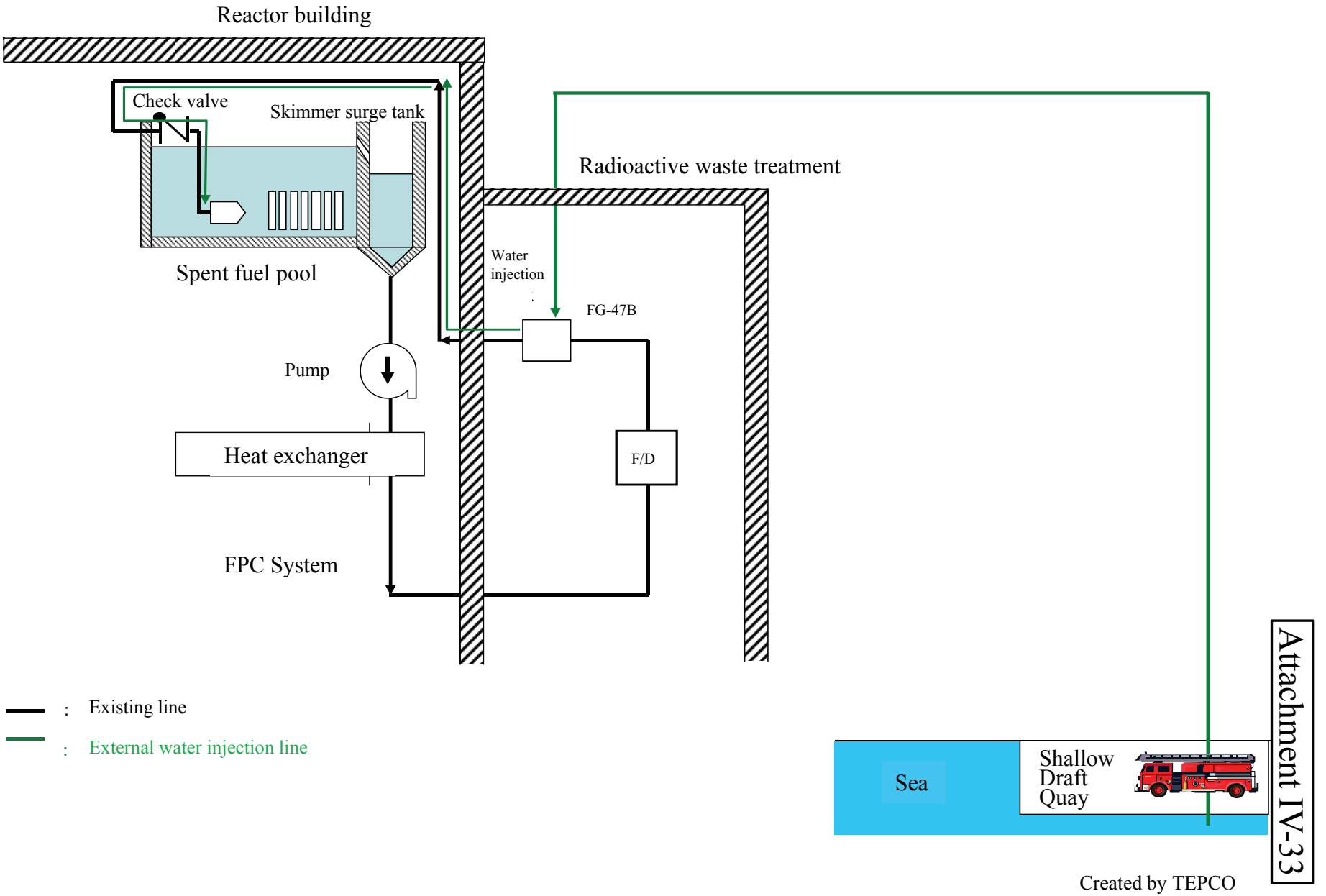








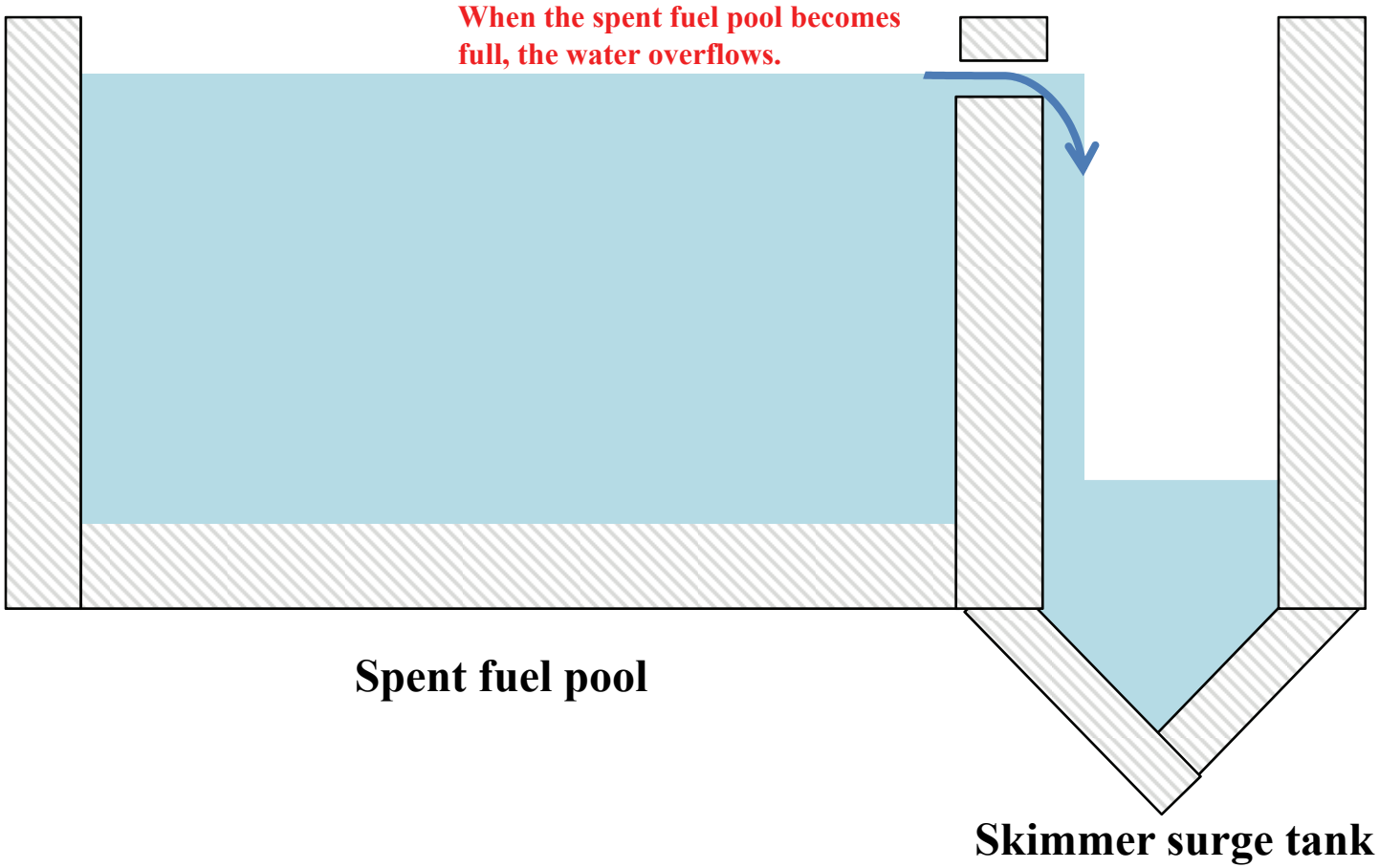
Water injection into the Unit 2 spent fuel pool using the FPC System



Attachment IV-33

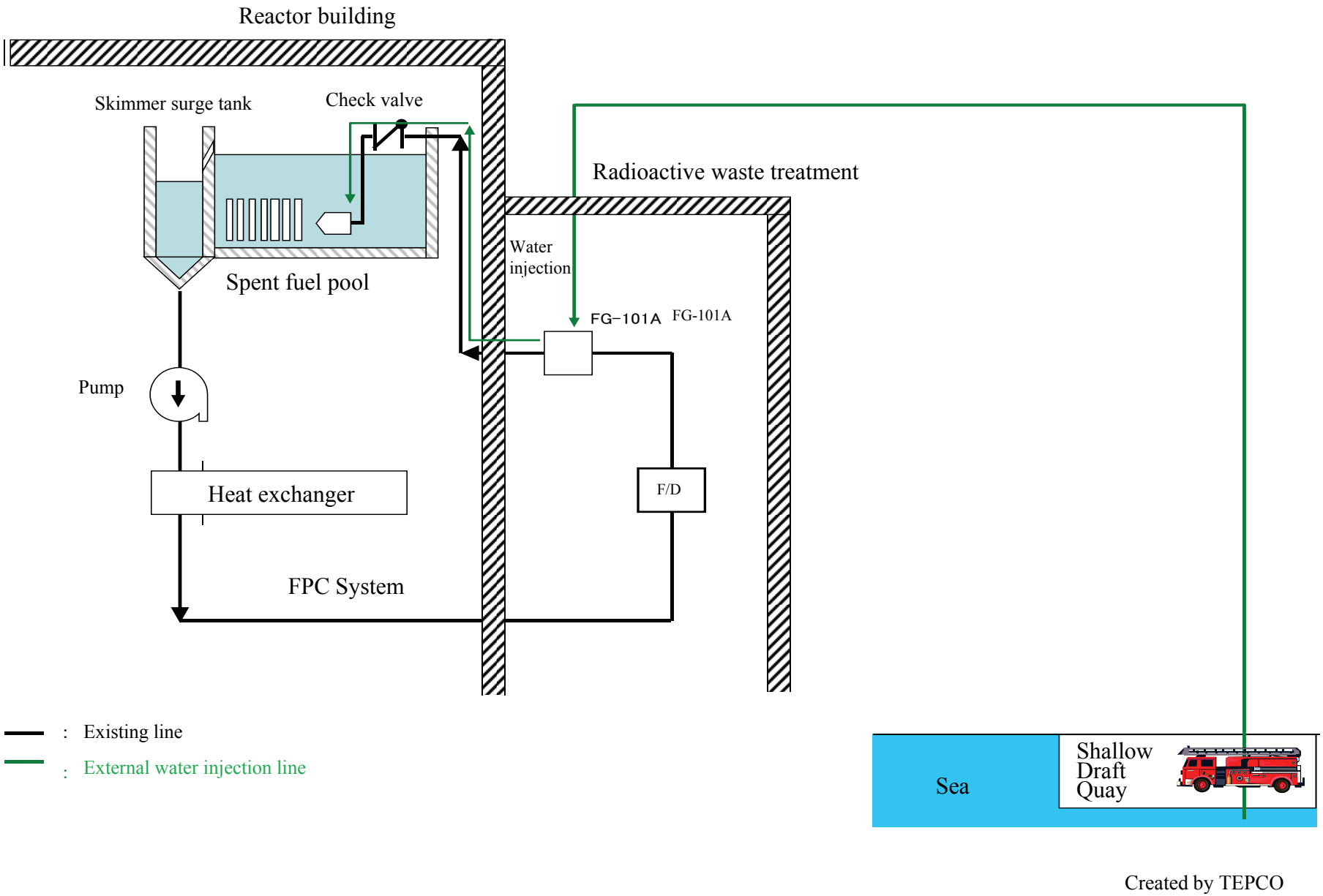
Created by TEPCO

Skimmer surge tank configuration



Attachment IV-34

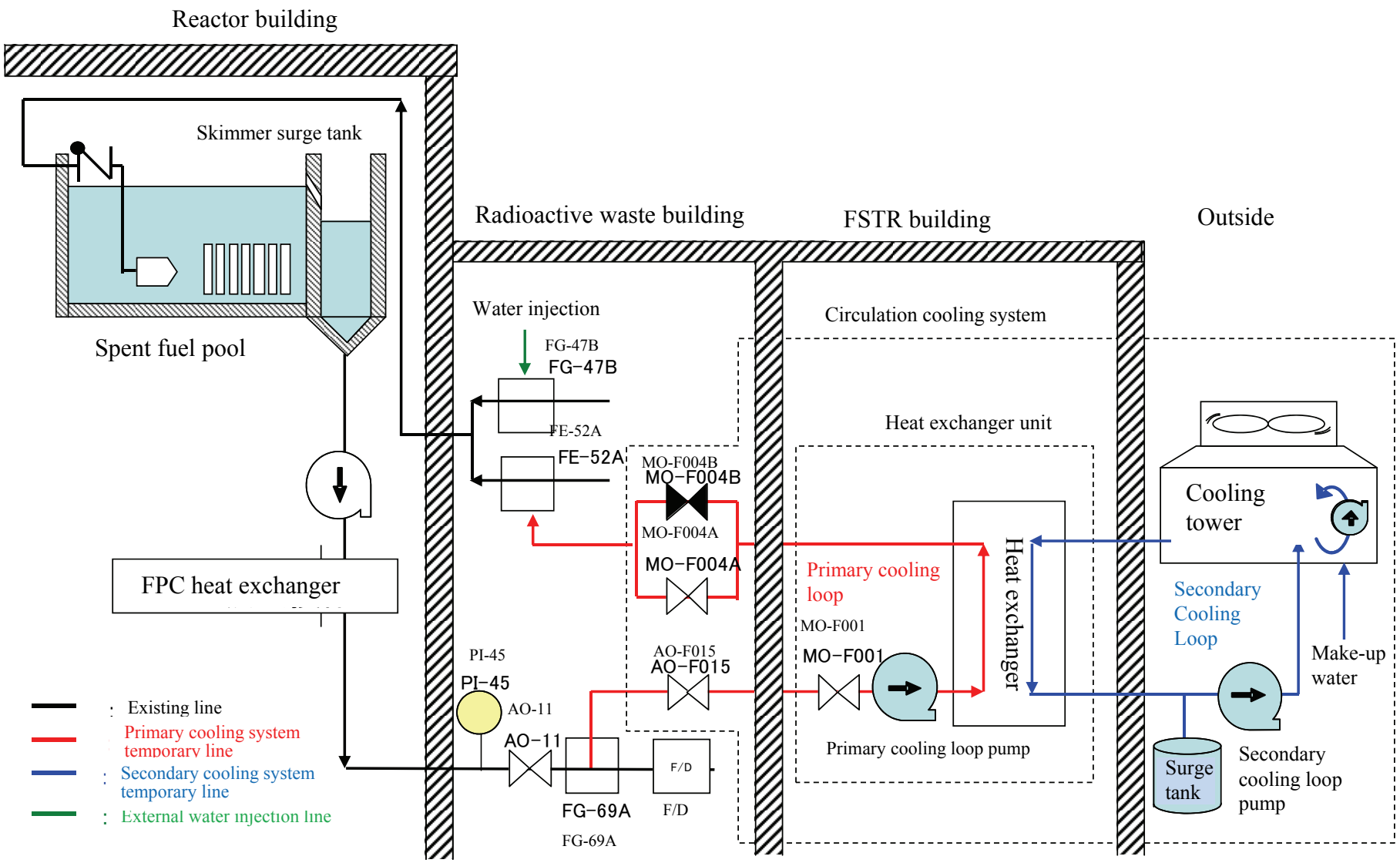
Water injection into the spent fuel pools of Units 3 and 4 using the FPC System



Attachment IV-35

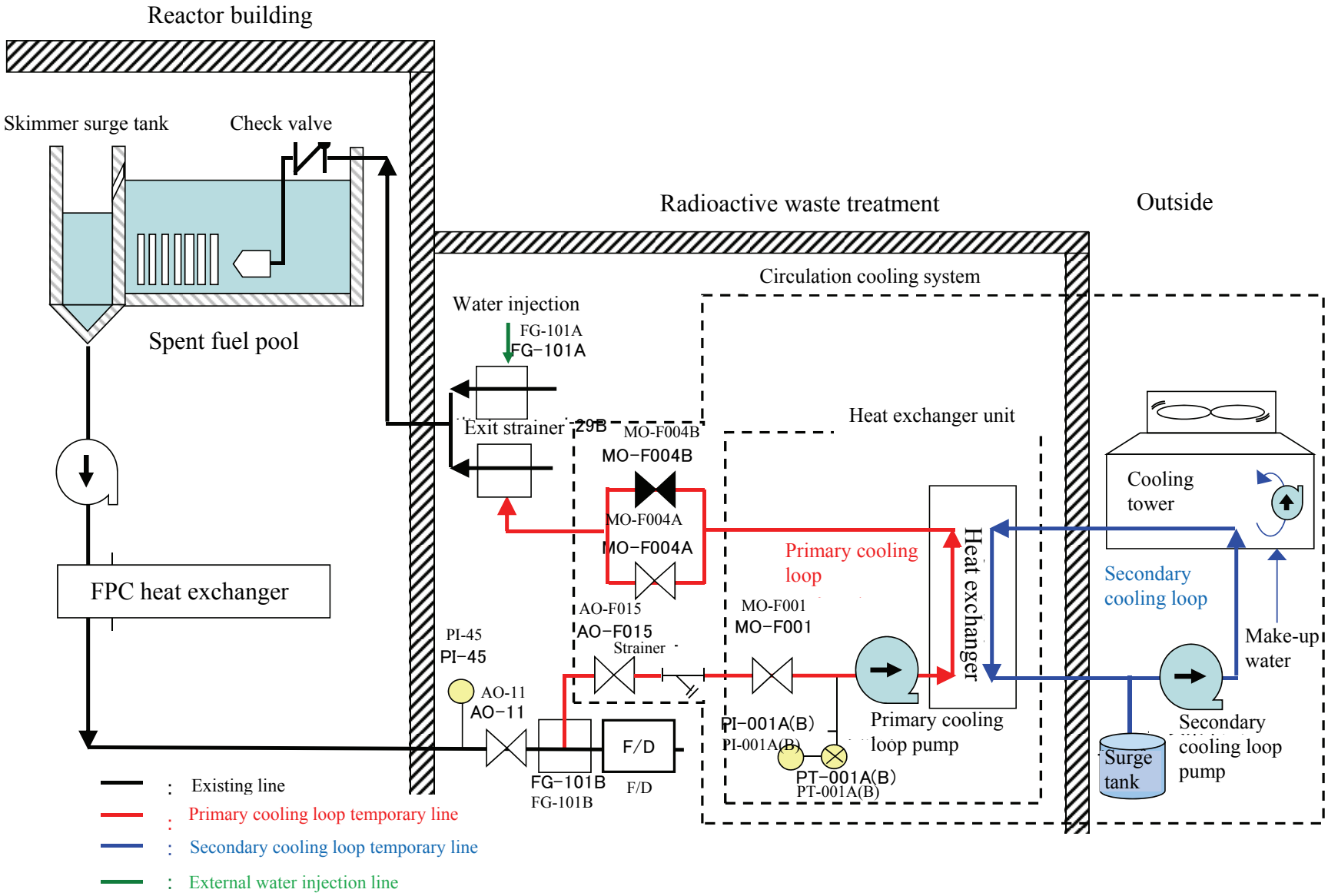
Created by TEPCO

Alternative cooling system for the Unit 2 spent fuel pool



Attachment IV-36

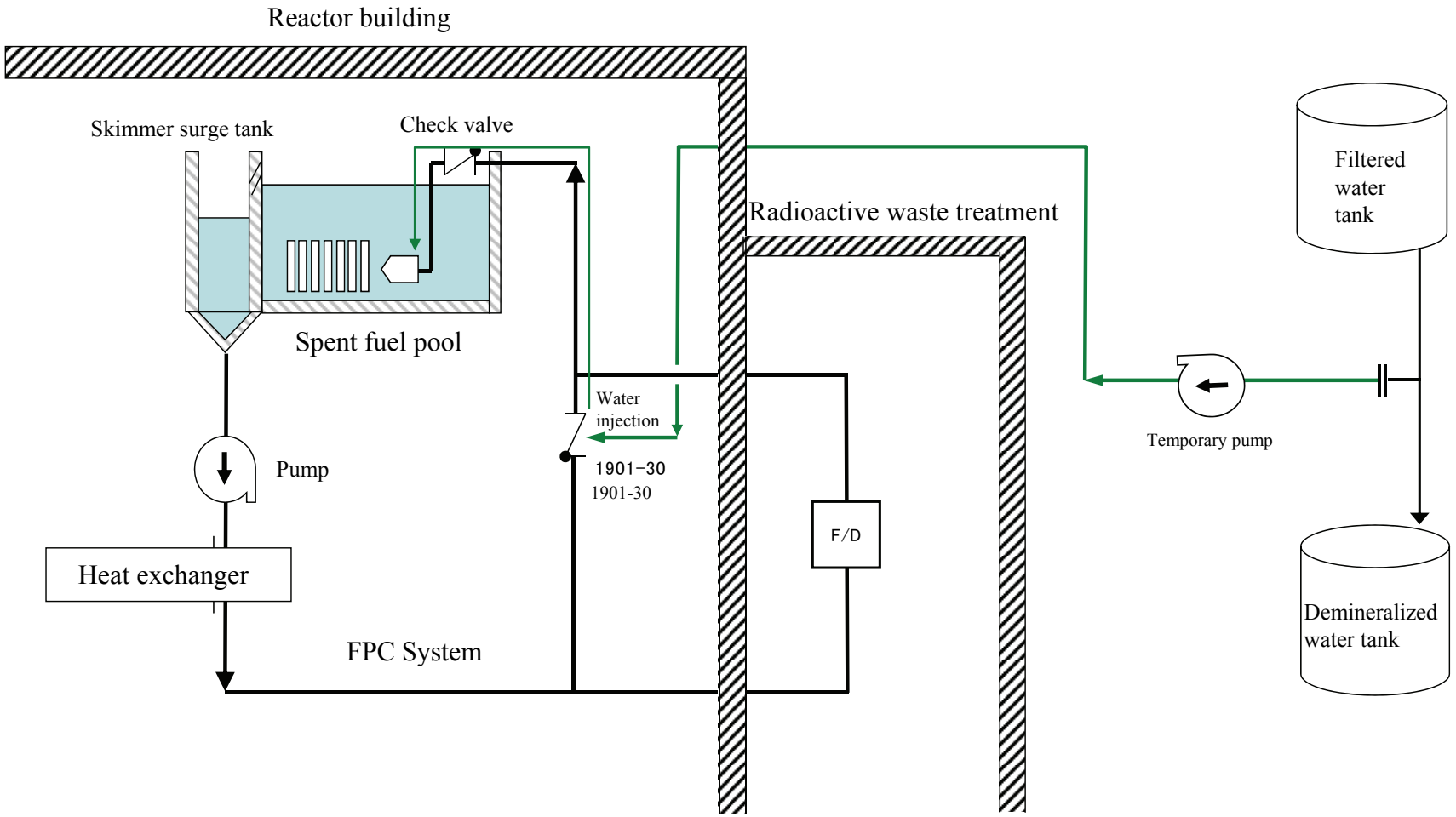
Alternative cooling system for the Unit 3 spent fuel pool



Created by TEPCO

Attachment IV-37

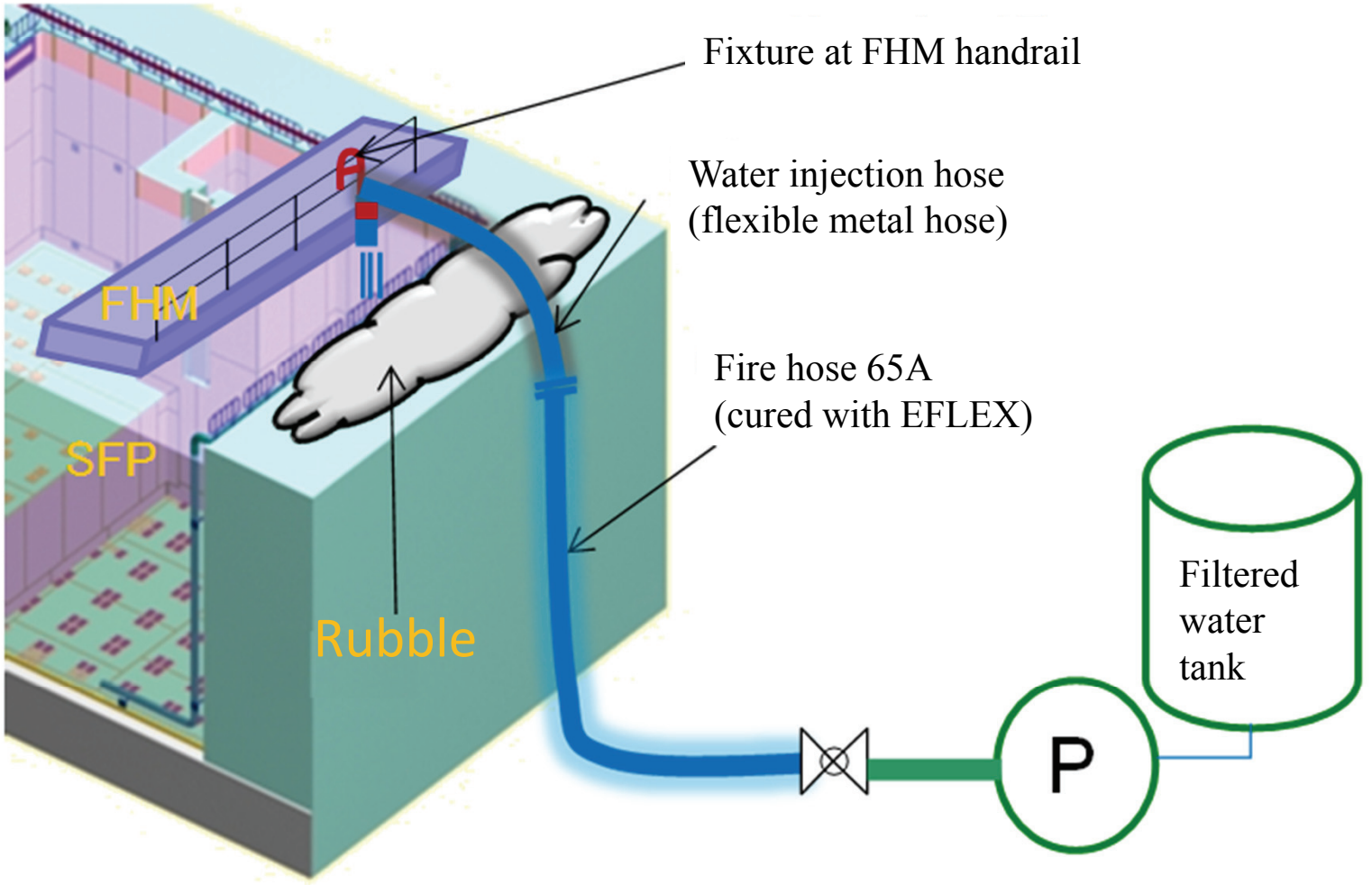
Water injection into the Unit 1 spent fuel pool using the FPC system



Created by TEPCO

Attachment IV-38

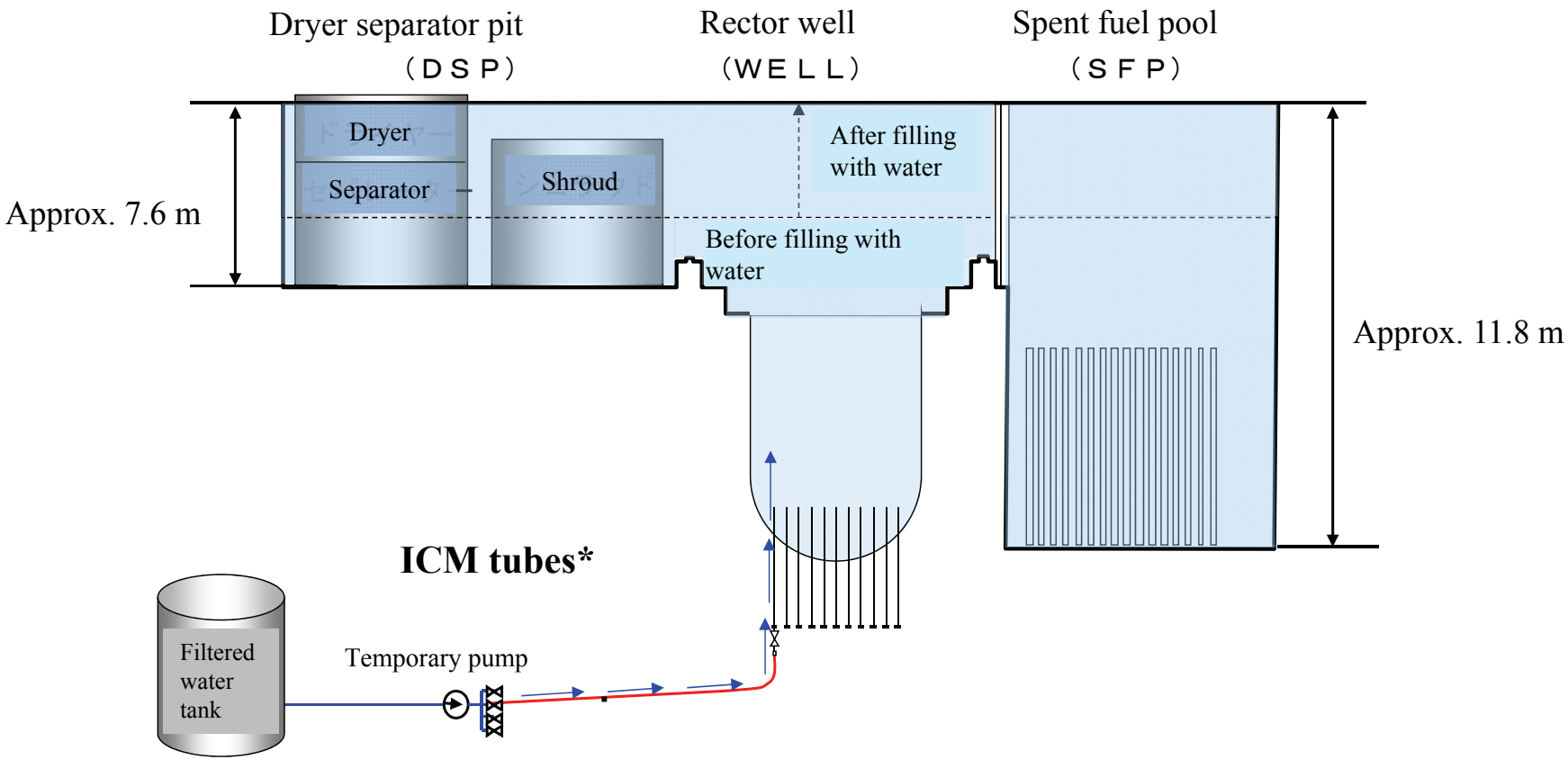
Temporary SFP water injection system ("Mizuha")



Adopted from "Progress Status of *Roadmap towards Restoration after the Accident at the Fukushima Daiichi Nuclear Power Station, TEPCO*" (September, 2009)

Attachment IV-39

Water injection into the Unit 4 spent fuel pool using the ICM tubes

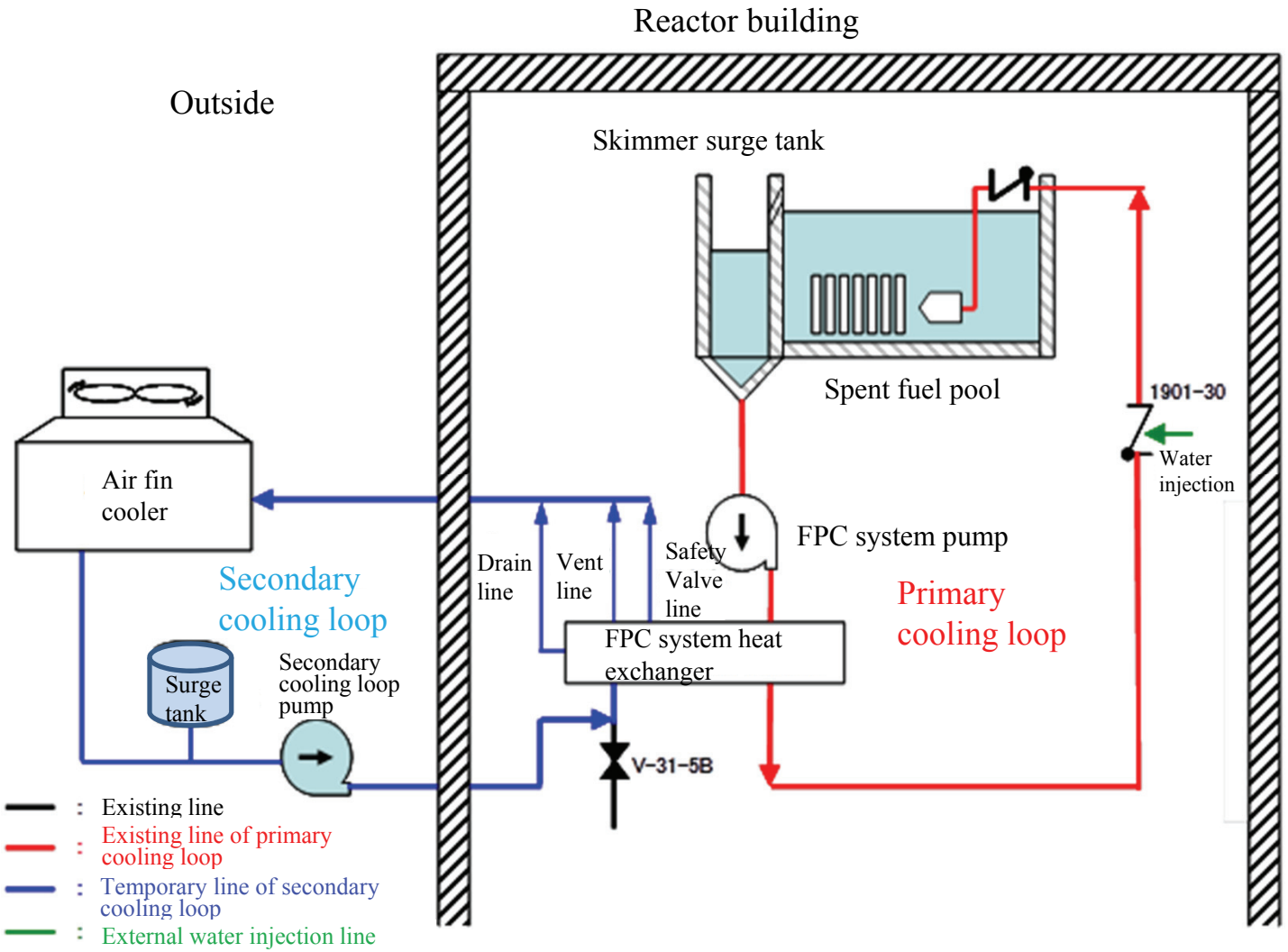


* The ICM tubes are stainless steel tubes housings installed within and welded to the reactor pressure vessel to protect the In-Core Monitors)ICMs) that measure neutron flux in the reactor.

Compiled from documents by TEPCO

Attachment IV-40

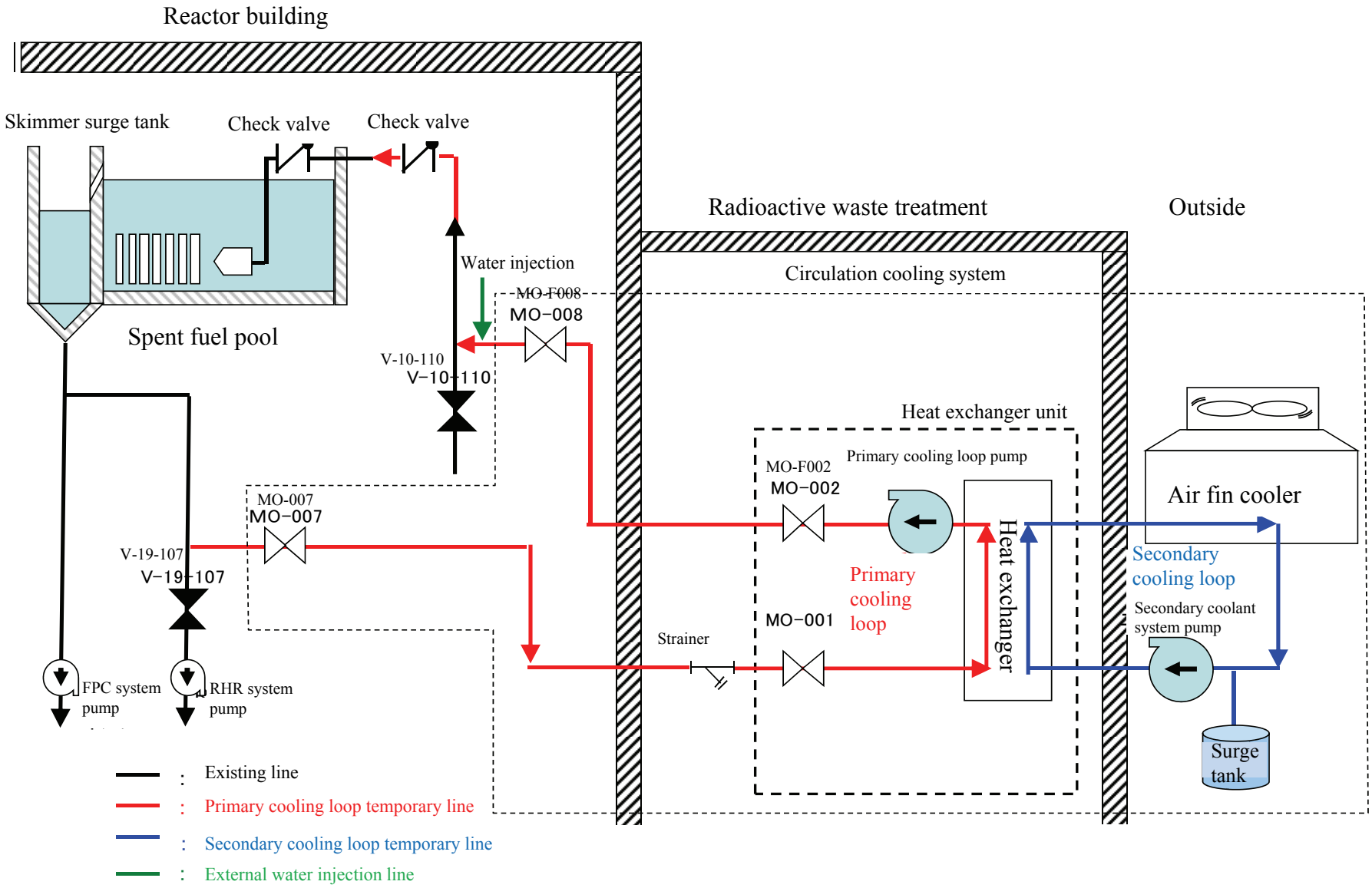
Alternative cooling system for the Unit 1 spent fuel pool



Adopted from "The Impact of the Tohoku District – off the Pacific Ocean Earthquake on Nuclear Reactor Facilities at the Fukushima Dai-ichi Nuclear Power Station" (September, 2011) by TEPCO

Attachment IV-41

Alternative cooling system for the Unit 4 spent fuel pool



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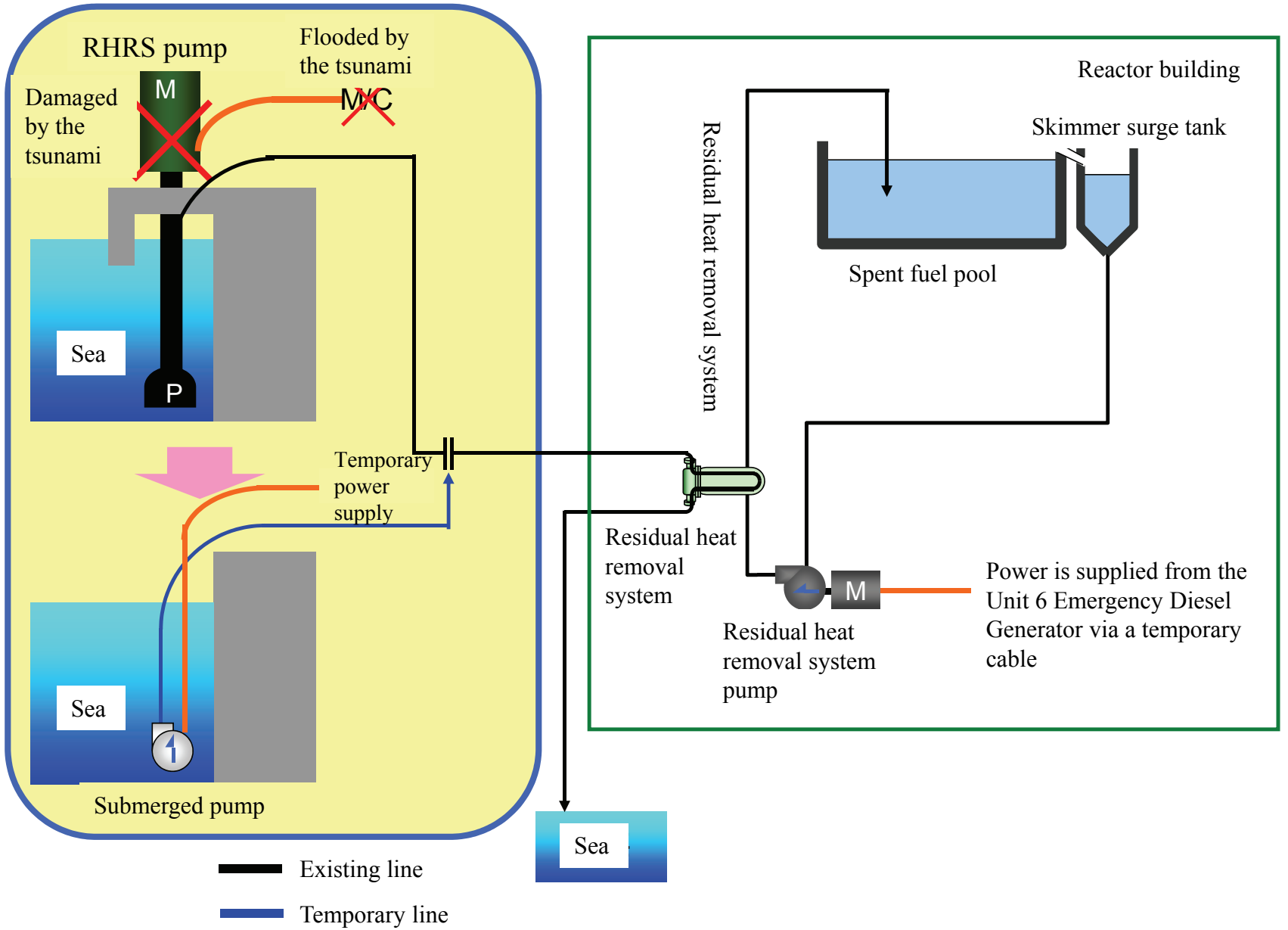
Attachment IV-42

Cooling system for the Unit 5 spent fuel pool



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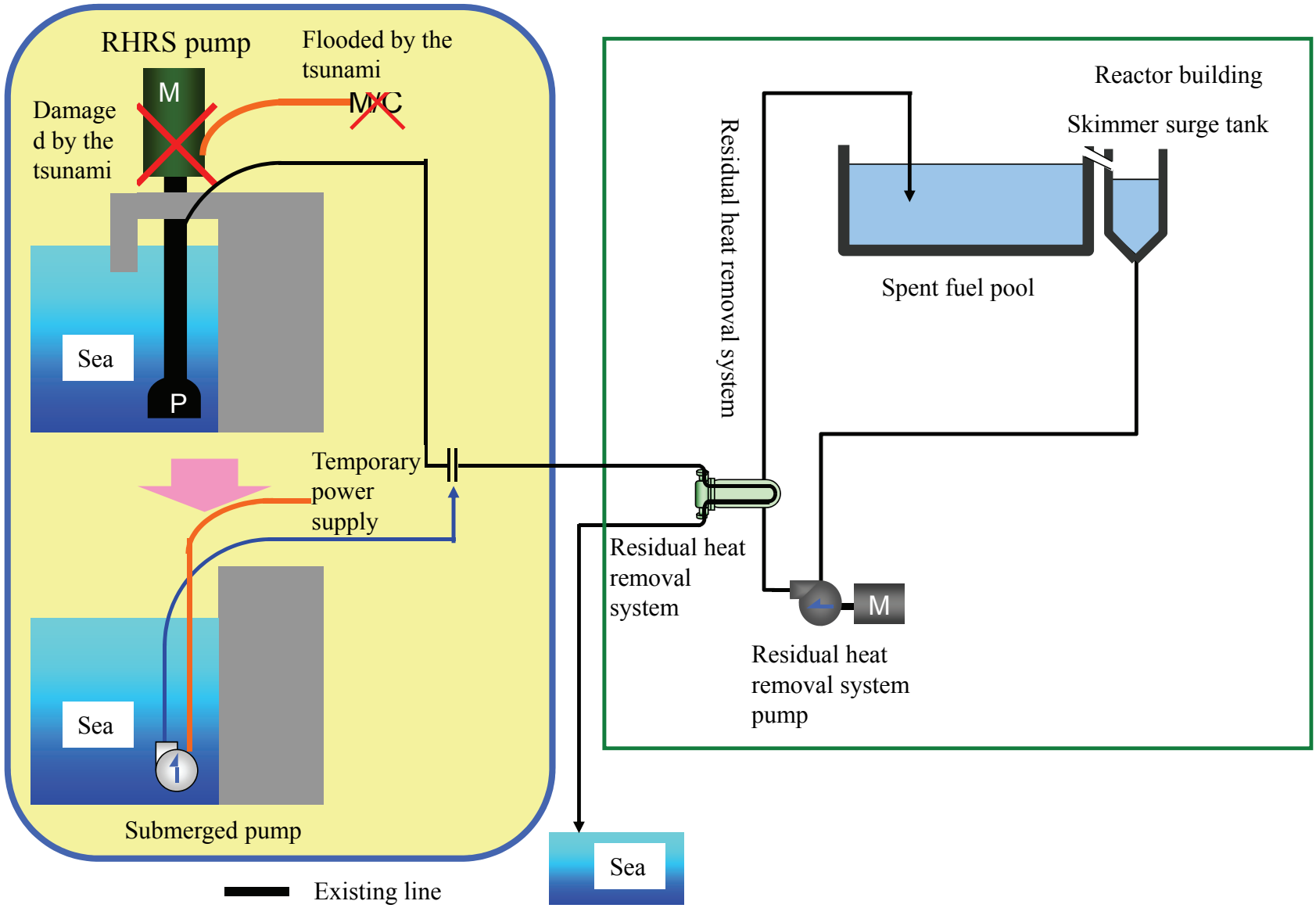
Attachment IV-43

Cooling system for the Unit 6 spent fuel pool



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Attachment IV-44

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