

Current Status of Fukushima Dai-ichi NPS - Appendix

September 17, 2012
Tokyo Electric Power Company

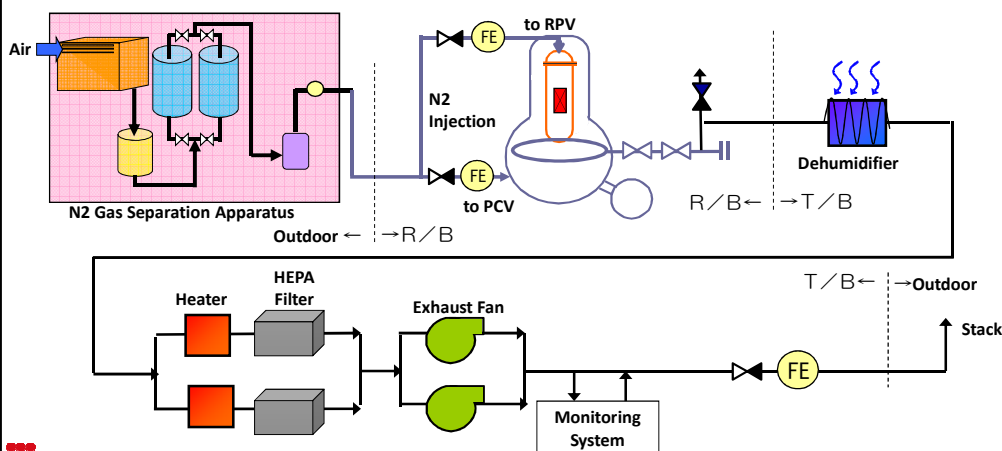
Side Event by Government of Japan
at 56th IAEA General Conference, Sep 17, 2012



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[2] Containment Gas Management

- Hydrogen Control : N₂ Injection
- RI Release Control : PCV Leakage Control with Slightly Positive Pressure
Radioactive Dust Filtering & Monitoring (Cs)
- Monitoring : H₂, O₂ Monitoring
Rare Gas Monitoring ; Recriticality Check by Xe (Short Half Life)

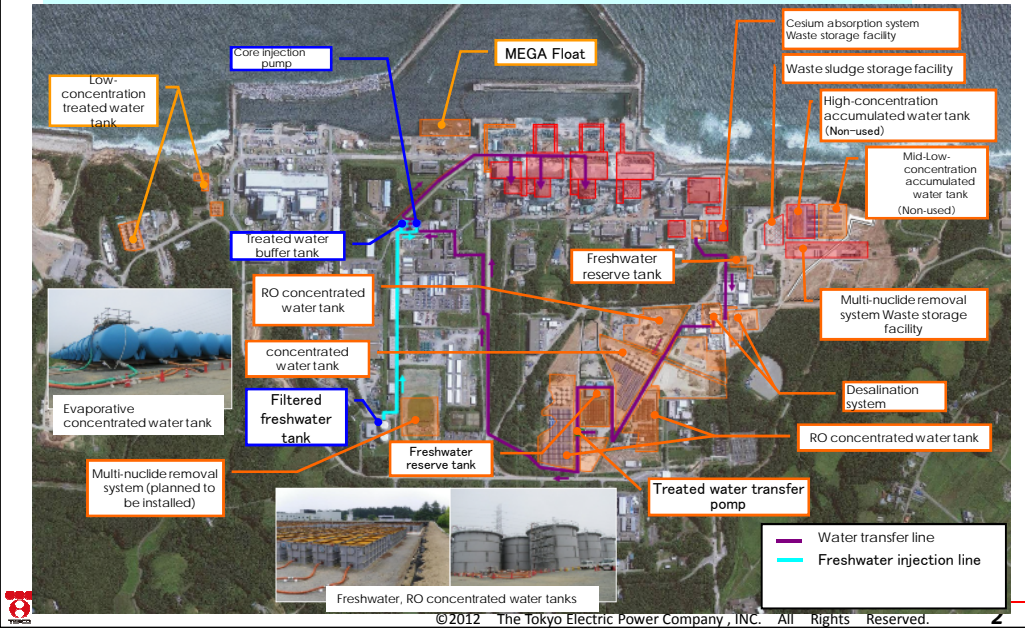


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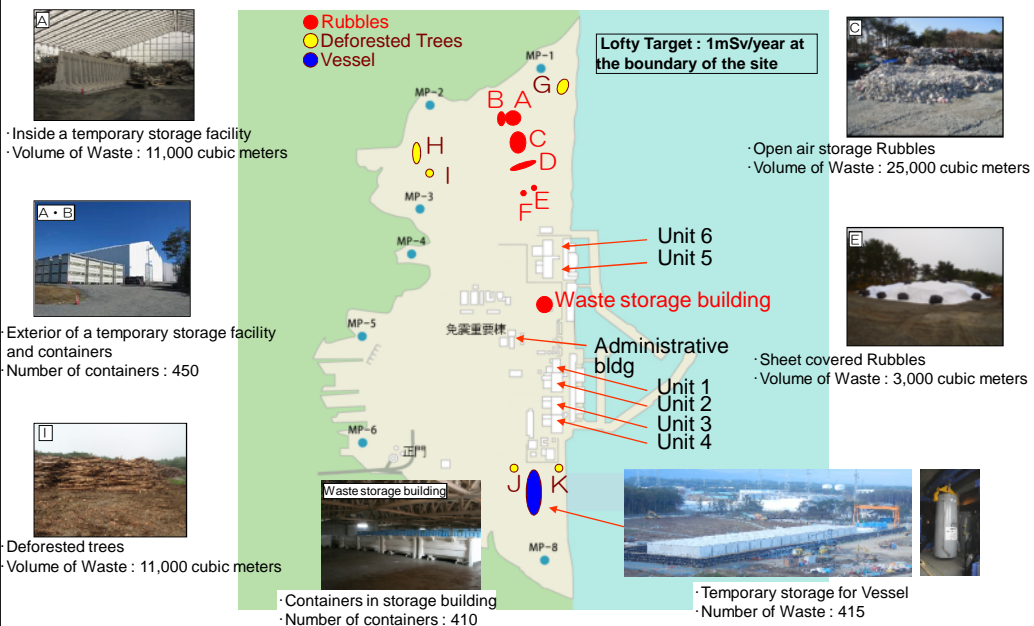
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[3] Accumulated water processing

Layout of Circulating Line & Water Storage Tanks



[5] Layout of Temporary Waste Storage Facilities



【6】Fuel Removal from Spent Fuel Pools(Water Quality Improvement)

SFP water quality sampling results (July 2012)

	Sampling Date	pH	conductivity	Cl	Cs137	Cs134	notes
		—	mS/m	ppm	Bq/cc	Bq/cc	
Unit 1	2012/7/11	7.6	15.8	6	1.8E+04	1.1E+04	* Cl, Cs137,134: sampled on 2012.4.11
Unit 2	2012/7/1	9.1	9	11	2.2E+01	1.4E+01	
Unit 3	2012/7/9	9.1	50	66	2.0E+03	1.3E+03	desalination is ongoing (RO/ED → Ion)
Unit 4	2012/7/17	9.6	43	100	3.3E+00	1.6E+00	desalination is ongoing (Mobile RO)

■ For Unit 2,3,4 hydrazine is injected into SFP intermittently. Hydrazine concentration is less than approx.200ppm.

■ I-131 is not detectable for every Unit.

■ For Unit 3 and 4 desalination is ongoing.

【6】Fuel Removal from Spent Fuel Pools

Amount of Fuels in SFP

	Amount of Spent Fuels	Amount of New Fuels
Unit1	292	100
Unit2	587	28
Unit3	514	52
Unit4	1331	204

【8】The integrity of the Spent Fuel Pool in Unit 4

【8】Unit 4 Spent Fuel Storage Conditions

- Despite the Reactor Building explosion of Units 1, 2, and 4, the spent fuel pools were filled with water and cooled using the concrete pump car and Fuel Pool Cooling system
- Currently, the water level and water temperature of the various pools are stable at around 30-50 degrees
- The explosion at Unit 4 happened when all fuel was being stored in the spent fuel pool, but based on helicopter verification (March 16, 2011), nuclide analysis of pool water, and the fact that pool water filling and cooling had been accomplished, there is thought to be no damage to the pool itself



Unit 4 Spent fuel pool conditions

Detected nuclide	Half-life	Concentration (Bq/cm ³)					
		Unit 4 pool water					(Reference) Accumulated water in the Unit 4 T/B basement (March 24)
		Apr 12	Apr 28	May 7	Aug 20	(Reference) March 4	
Cs-134	Approx. 2 years	88	49	56	44	ND	31
Cs-137	Approx. 30 years	93	55	67	61	0.13	32
I-131	Approx. 8 days	220	27	16	ND	ND	360

[8] The situation of the Reactor Building at unit 4

- The top of the Unit 4 R/B was damaged by the hydrogen explosion
BUT we confirmed that
 - the building has not tilted
 - the building, including the Spent Fuel Pool, will not collapse even if an earthquake equivalent (JMA Seismic Intensity Scale 6+) to the Tohoku-Pacific Ocean Earthquake occurs in the area.

【The fuel situation at unit 4】

- No fuel in the Reactor Pressure Vessel
 - *Planned outage at the Tohoku-Pacific Ocean Earthquake
- 1535 fuels in the Spent Fuel Pool
 - *include 204 fresh-fuels

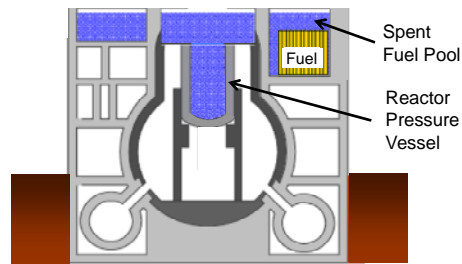
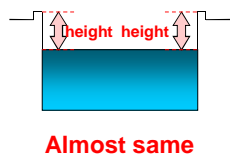


Image of the Unit 4 R/B

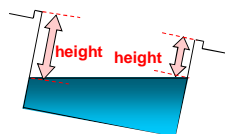
[8] Confirmed that the building has not tilted①

- We measured the distance between the water surface of the Spent Fuel Pool and the floor surface of the Reactor Building, and confirmed that the building has not tilted

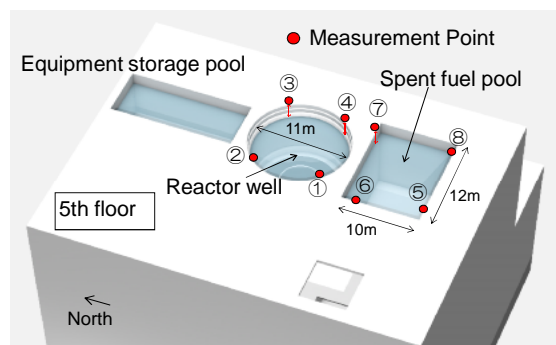
1) not tilted



2) tilted



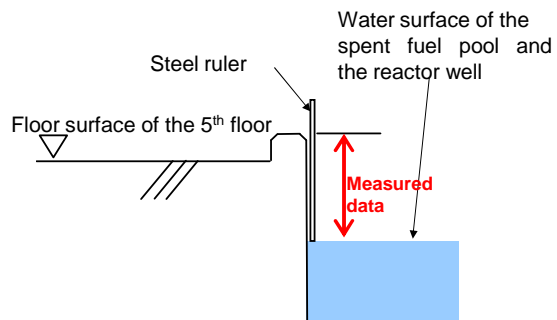
Not same



Measurement Point (on the 5th floor)

[8] Confirmed that the building has not tilted②

- We conducted the measurements four times on Feb.7, Apr.12, May 18 and Aug.21, 2012 and the measured data at the 4 corners were almost the same.
- Thus, we confirmed that the floor surface of the 5th floor and water surfaces of the spent fuel pool and the reactor well were leveled.



Measurement Method

※The measured data includes measurement errors

Measurement results Unit[mm]

Reactor well	Measurement Date			
	Feb 7 2012	Apr 12 2012	May 18 2012	Aug 21 2012
①	462	476	492	462
②	463	475	492	462
③	462	475	492	461
④	464	475	492	461

Spent fuel pool	Measurement Date			
	Feb 7 2012	Apr 12 2012	May 18 2012	Aug 21 2012
⑤	—	468	461	453
⑥		468	461	453
⑦		468	461	452
⑧		468	461	452

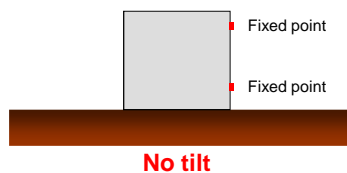
※Only reactor well was measured on Feb. 7

※Water level changes depending on the operation of cooling system

[8] Confirmed that the building has not tilted③

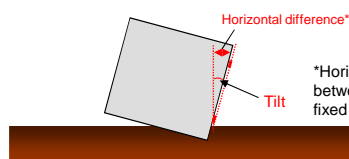
Perpendicularity of the exterior wall was measured by using an optical equipment.

1) Building not tilted



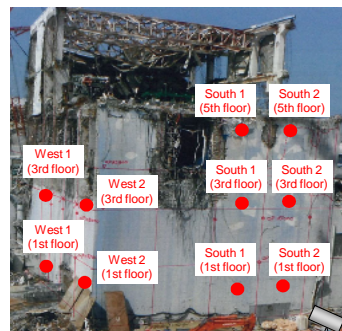
No tilt

2) Building tilted



Tilted

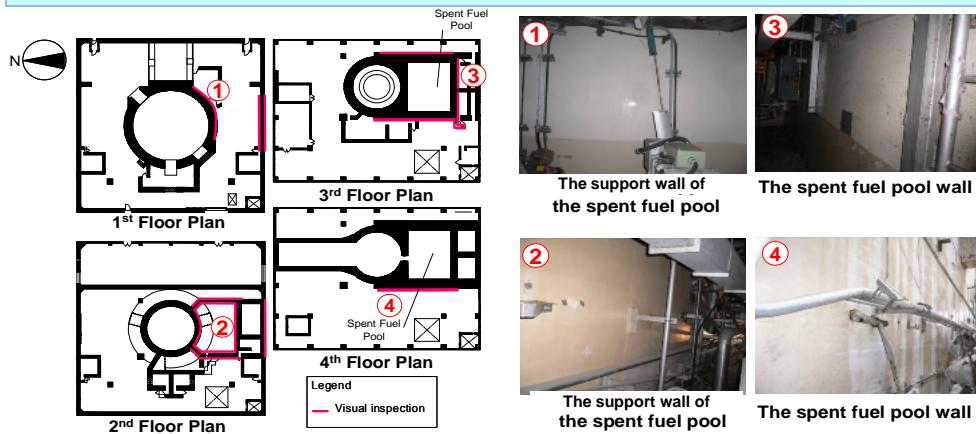
*Horizontal difference: The horizontal difference between the fixed point on the first floor and the fixed point on the upper floor



Optical equipment

[8] Visual Inspection

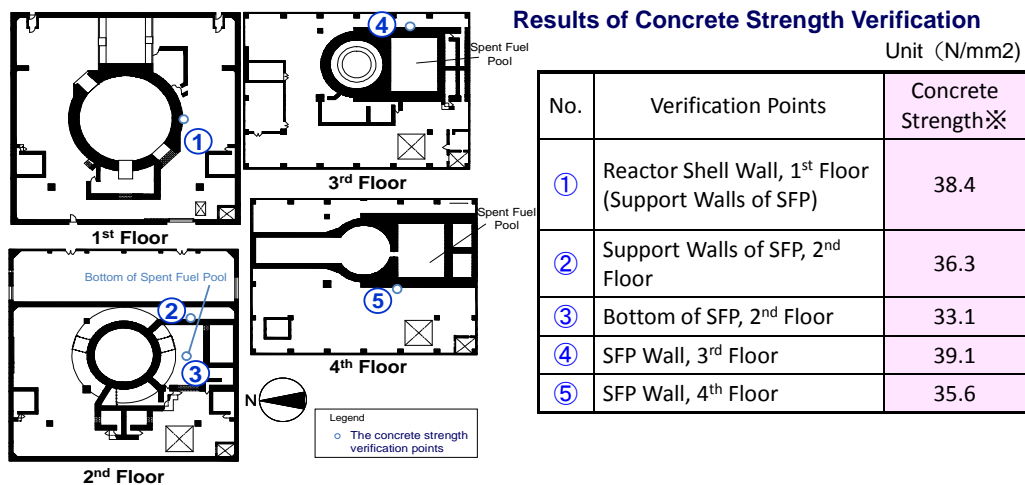
We inspected the defects such as cracks on the concrete floor and walls of the spent fuel pool (building frame) .



As a result of visual inspection, cracks of which the width exceed 1mm or which have the possibility of rebar corrosion were not confirmed.

[8] Concrete Strength Verification

The concrete strength of the spent fuel pool was measured by non-destructive inspection techniques (Schmidt Hammer*) to confirm that the strength fulfills the design standard (22.1N/mm²).



【8】 Preliminary analysis on SFP accident in Unit 4

- However fuel in SFP was stably cooled in nowadays. we conducted preliminary accident analysis on unit 4 SFP with assumption that water was lost due to some reason.
- Decay heat around late July with considering fuel loading history was employed.
- As a LOCA scenario, accident analysis was conducted by employing initial condition with zero SFP water level. We also conducted accident analysis in case of gradual water level decrease due to evaporation.
- ❑ LOCA : PCT rising was saturated **around 850 degree-C** by air natural convection cooling.
- ❑ Non-LOCA : It took **about 50 days until fuel uncover**. After the fuel uncover, PCT was suddenly increased and resulting in fuel melt due to water blockage of air natural convection cooling.

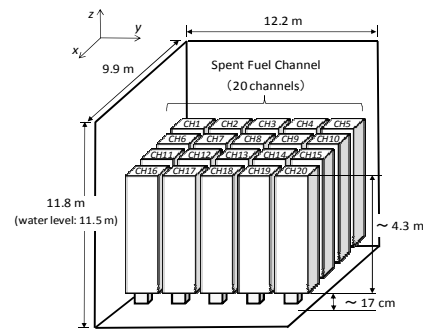


Fig.1 MAAP model

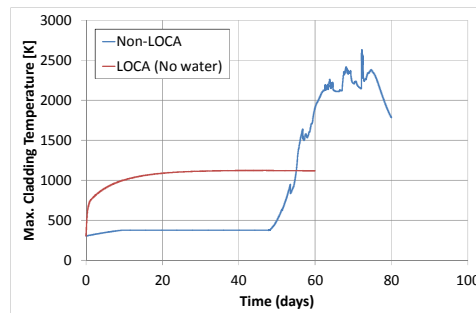


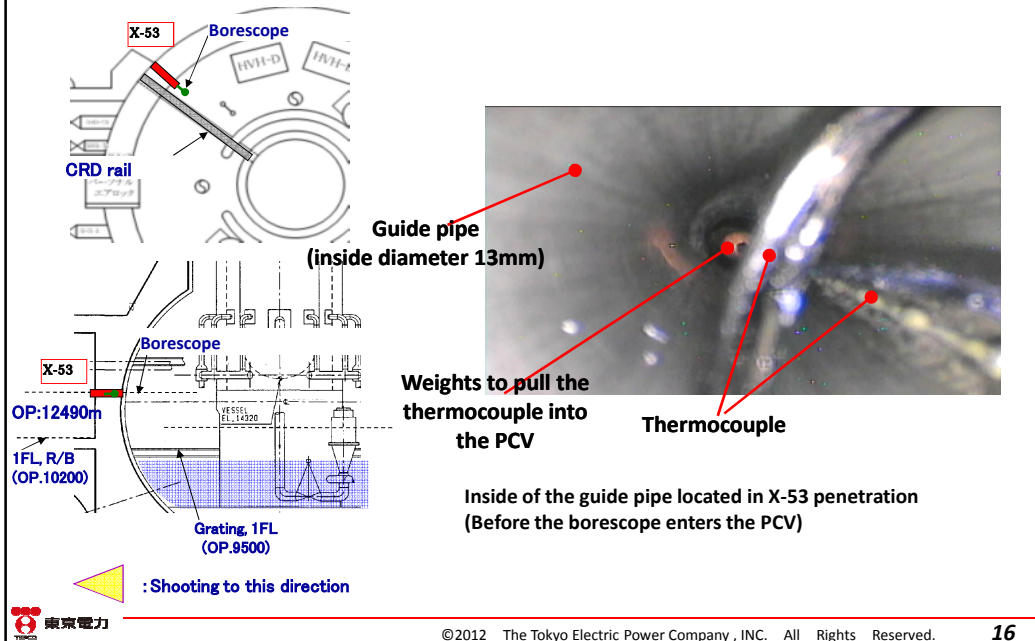
Fig.2 MAAP results

【9】 Approach for monitoring of the reactors and removal of fuel debris

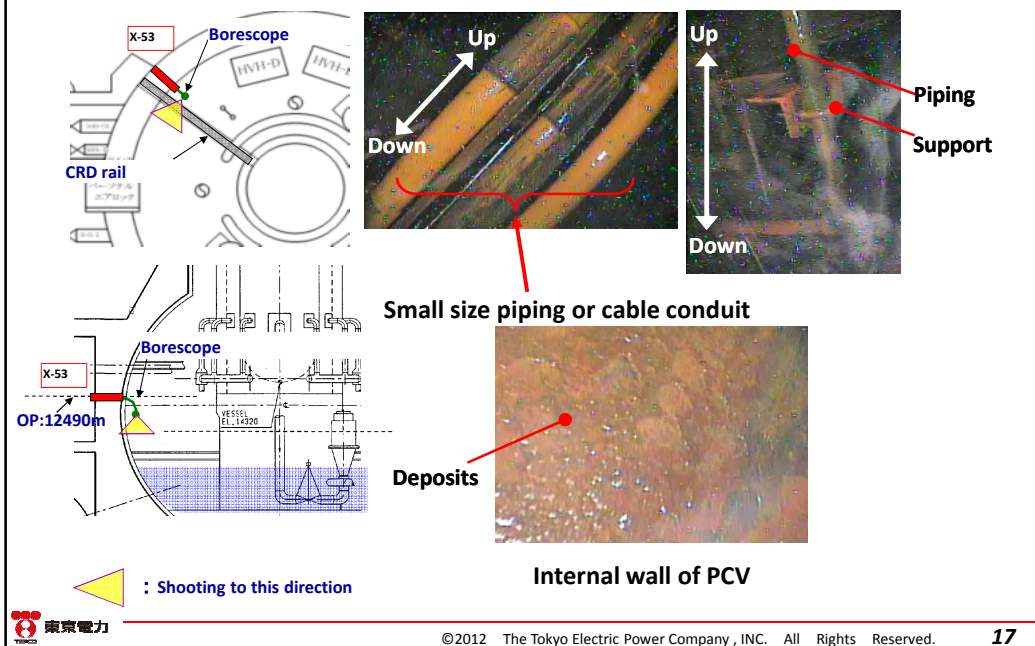
Unit 2 PCV Investigation

First Investigation on Jan. 19th
Second Investigation on Mar. 26th

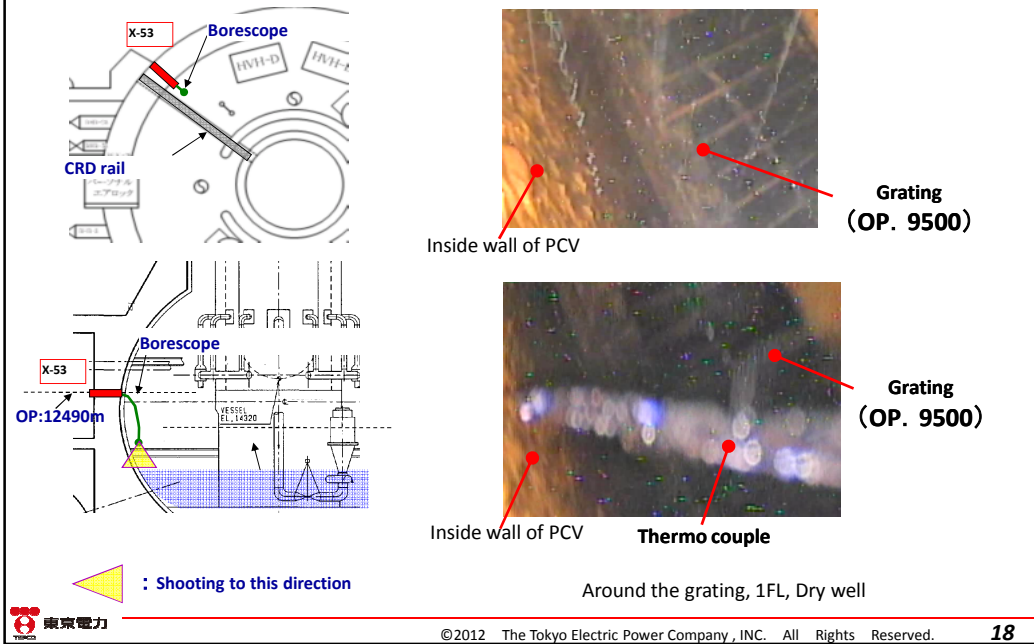
[9] Photos inside of PCV, Unit 2① on Jan.19th



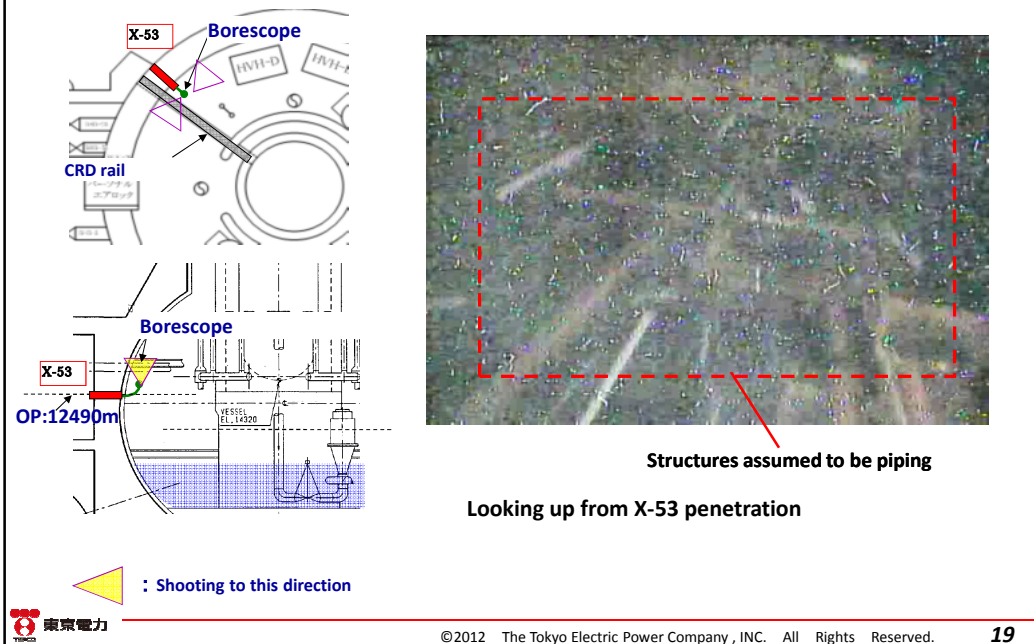
[9] Photos inside of PCV, Unit 2② on Jan.19th



【9】Photos inside of PCV, Unit 2③ on Jan.19th

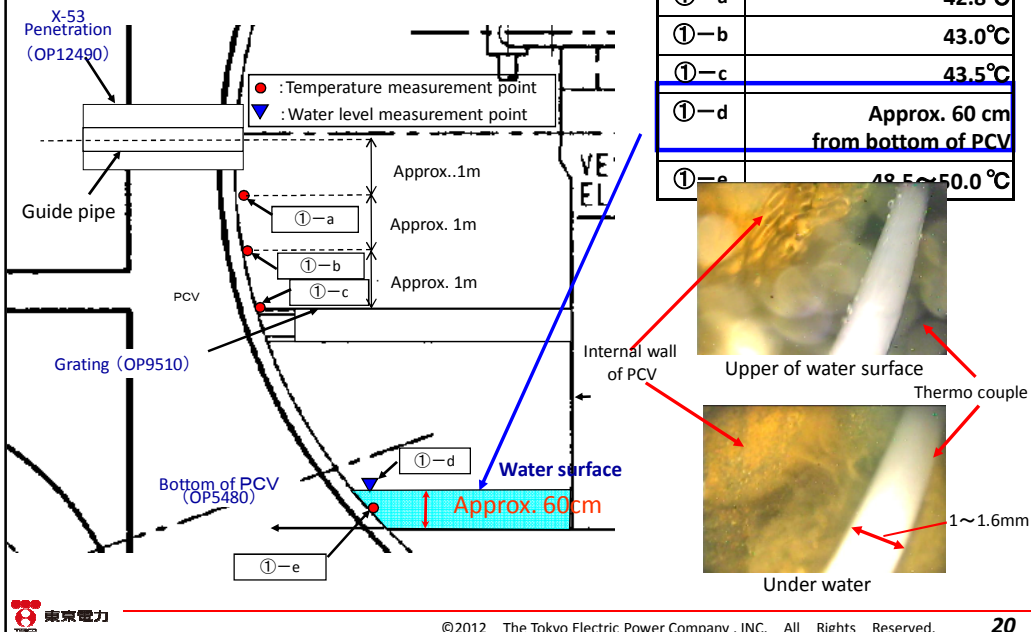


【9】Photos inside of PCV, Unit 2④ on Jan.19th



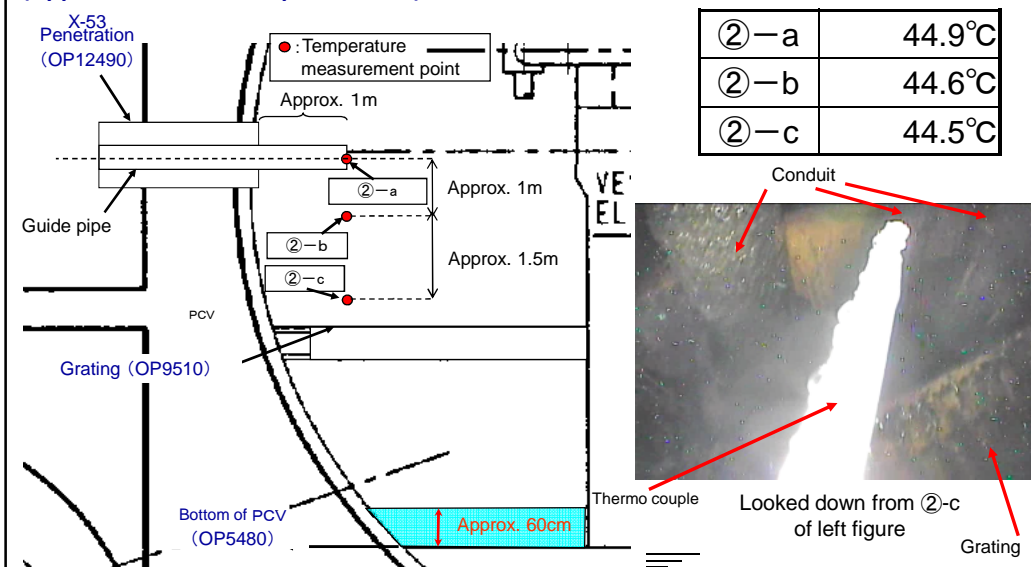
[9] Water level and Surrounding temperature in the PCV, Unit2

on March 26th

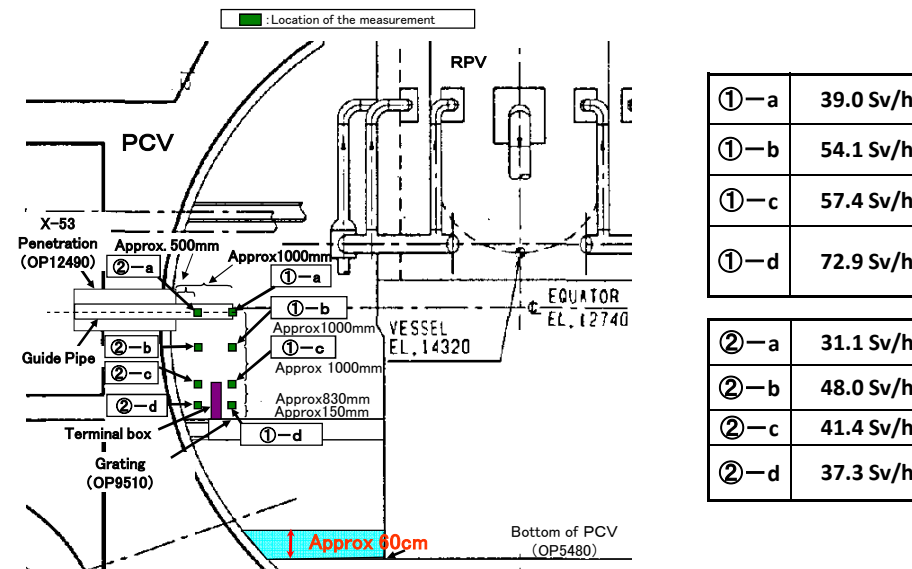


[9] PCV Atmosphere temperature, Unit 2

(Approx. 1m from X-53 penetration) on Mar. 26th



**[9] Radiation Level in the PCV, Unit 2 (approx. 1000mm inside of the internal wall)
on Mar. 26th**



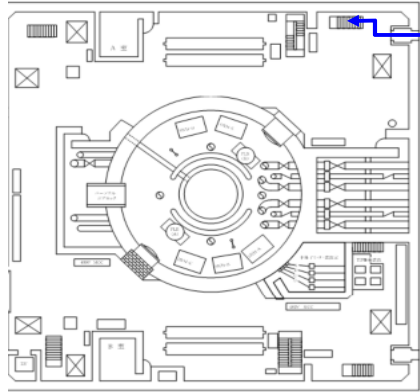
[9] Approach for monitoring of the reactors and removal of fuel debris

Unit 2 Torus Room Investigation

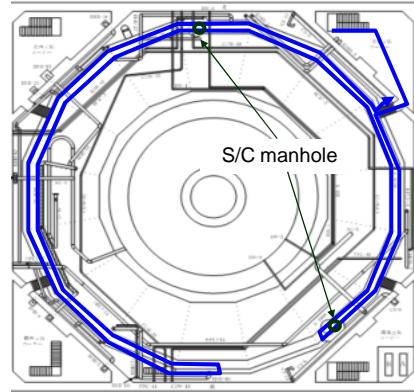
Robot survey : Apr. 28th, 2012

Water level measurement : June. 6th, 2012

【9】 Access route of the robot (Result) ,Apr 28th

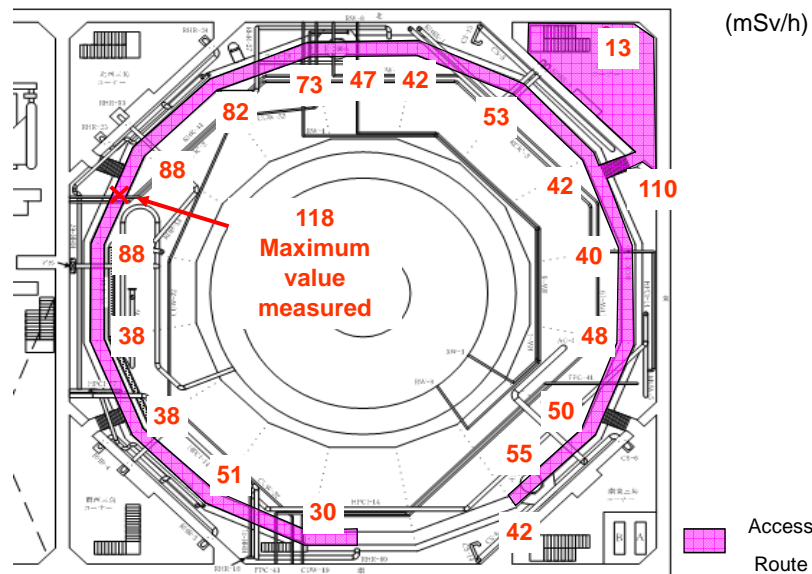


First Floor of the Reactor Building

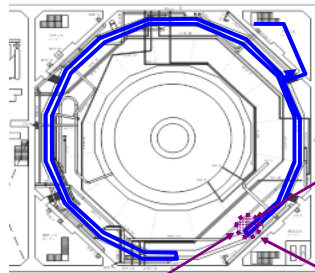


Basement Floor of the Reactor Building

【9】 Air dose rate in the Torus Room ,Apr 28th



【9】Photos 1/3 ,Apr 28th



Direction to PCV



Upper part of the southeast S/C manhole



Southeast S/C manhole



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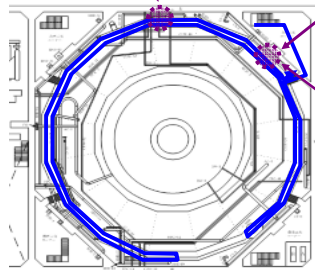
【9】Photos 2/3 ,Apr 28th



Manhole of North S/C



Route of northeast



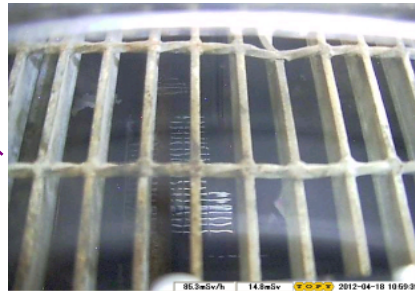
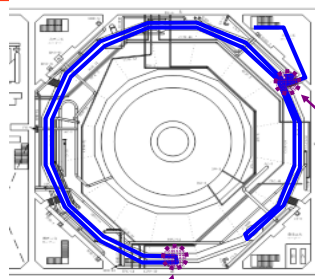
Upper part of the route of northeast



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【9】Photos 3/3 ,Apr 28th



Lower part of the Torus Room



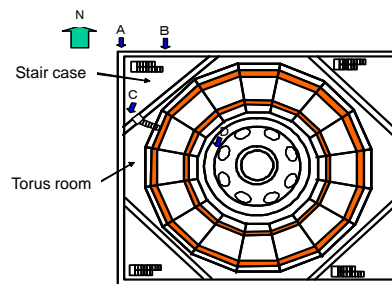
Upper part of the south route



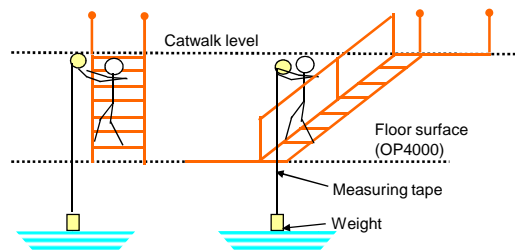
【9】Water Level Measurement at Unit 2-3 Torus Room, June 6th

Measurement Result on June 6th

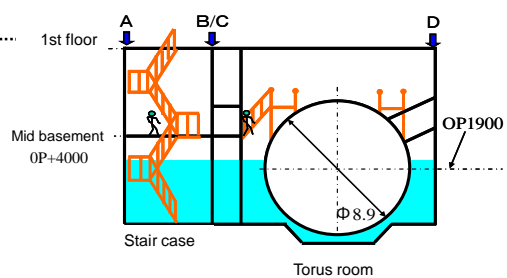
	Unit 2	Unit 3
Stair case water level	OP 3260	OP 3150
Torus room water level	OP 3270	OP 3370



Mid basement of the Reactor Building



Water level measurement



【9】Photos at Unit 2&3 Torus Room , June 6th



Unit 2 stair case (Northwest)



Unit 3 stair case (Northwest)

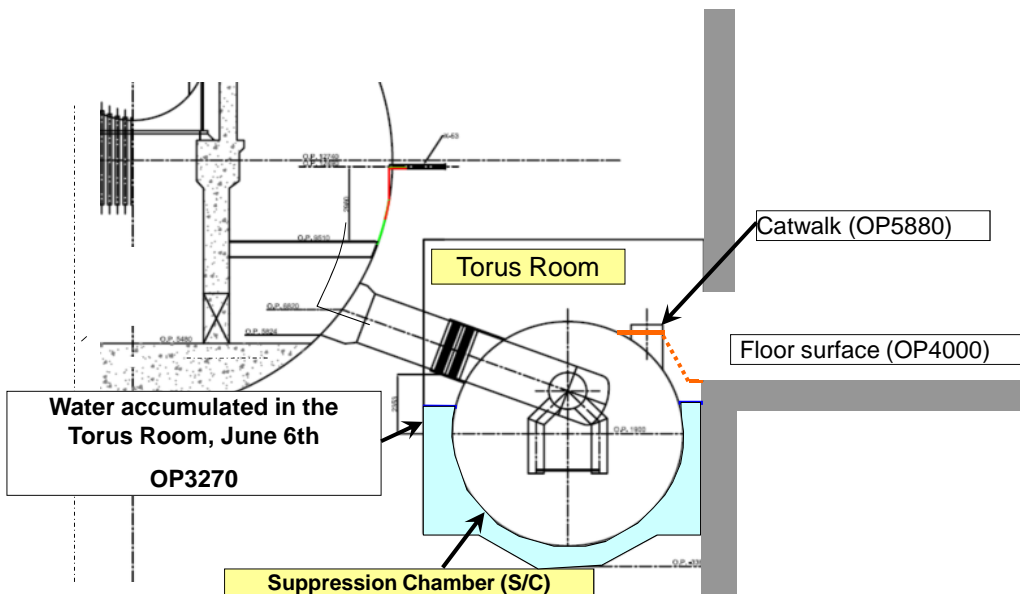


Unit 2 torus room (Northwest entrance)



Unit 3 torus room catwalk

【9】Water Level at the Bottom of Unit 2 PCV

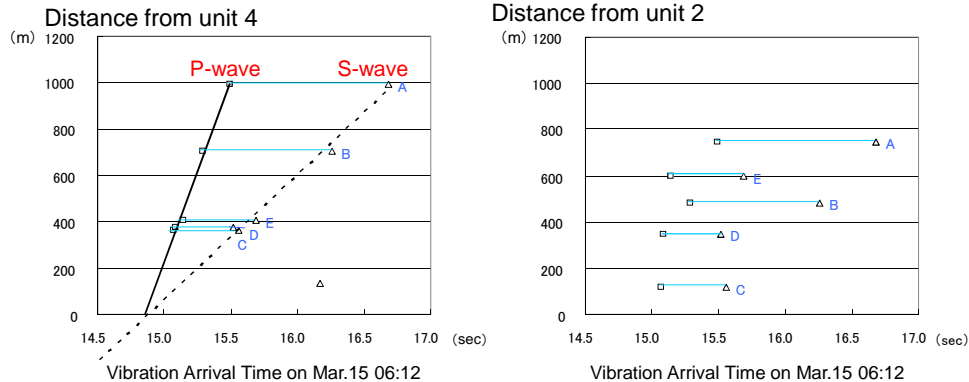


[9] Large Explosive Sound on Mar.15 , 2011

An explosion was believed to occur at unit 2, because large explosive sound seemed to accompany drop on S/C pressure at unit 2 on Mar.15, 2011



Explosive sound is confirmed to come from unit 4

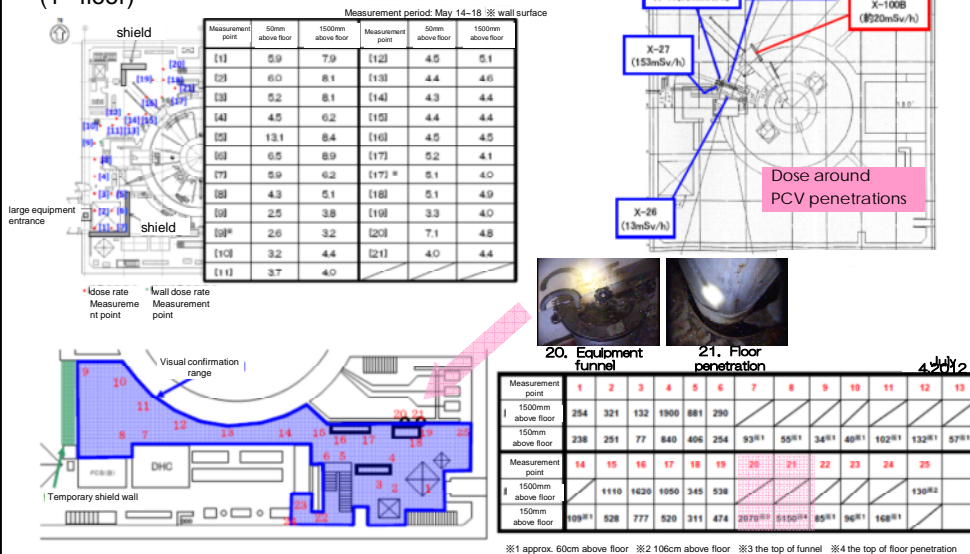


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[9] Approach for monitoring of the reactors and removal of fuel debris

Unit 1 Reactor Building Dose map (mSv/h)
(1st floor)



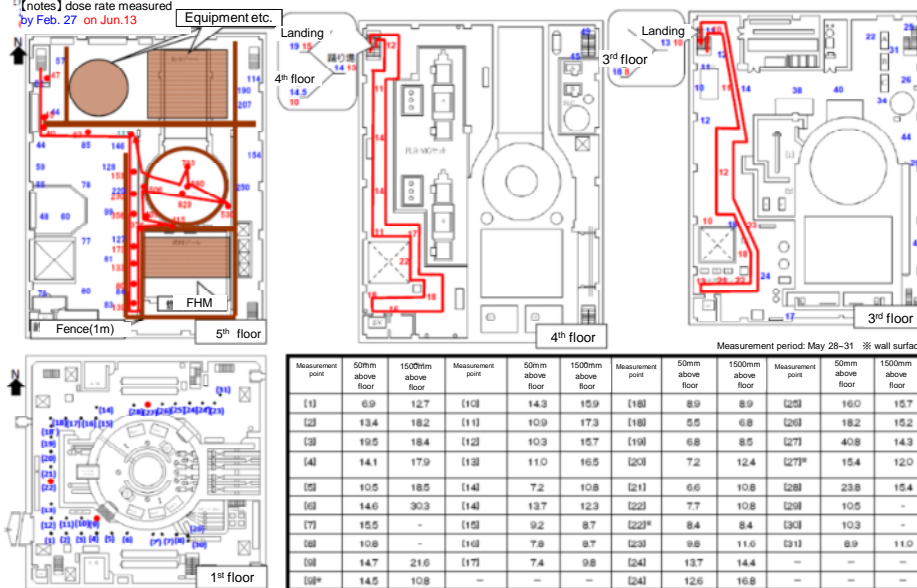
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[9] Approach for monitoring of the reactors and removal of fuel debris

Unit 2 Reactor Building Dose map (mSv/h) (1st,3rd~5th floor)

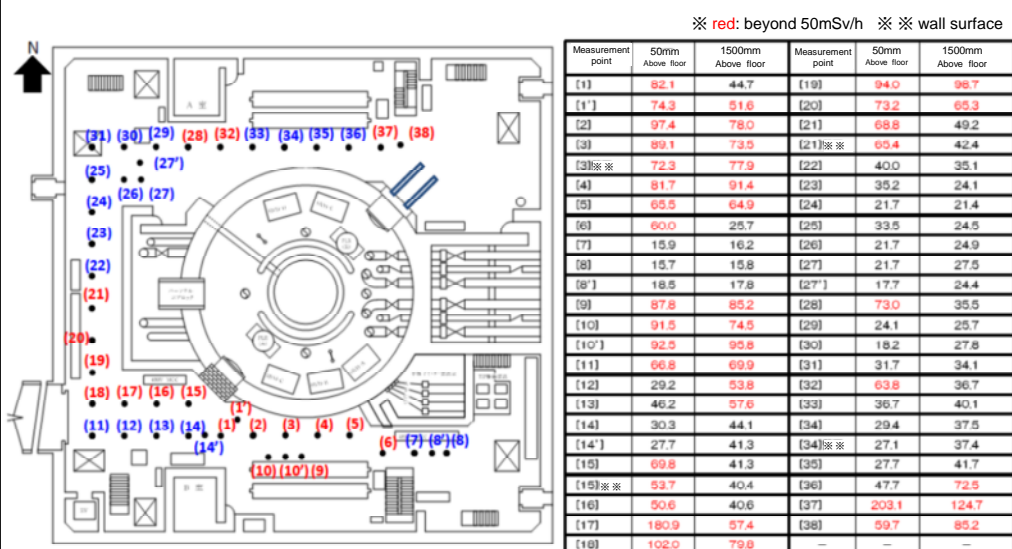
[Notes] dose rate measured
by Feb. 27 on Jun.13



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[9] Approach for monitoring of the reactors and removal of fuel debris

Unit 3 Reactor Building Dose map (mSv/h) (1st floor)



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