Current status of Fukushima Daiichi NPS

- Efforts for Decommissioning and Contaminated Water Control -

Agency for Natural Resources and Energy, METI

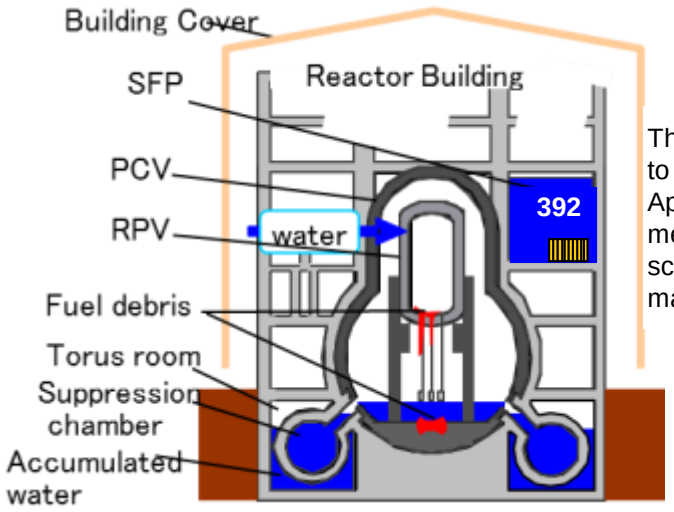
March 4, 2015

METI
Ministry of Economy, Trade and Industry

Current Status of Each Unit at Fukushima Daiichi NPP

Unit 1

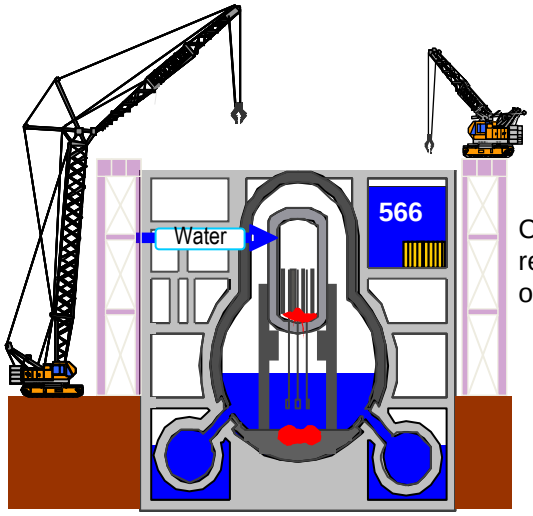
Hydrogen explosion
Core melt



The building cover is planed to be dismantled around April 2015, with sufficient measures to prevent the scattering of radioactive materials.

Unit 3

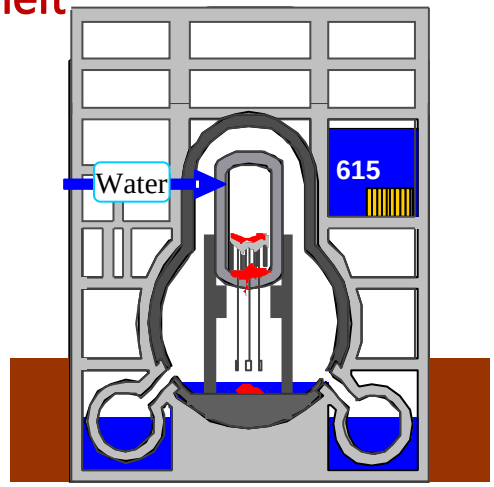
Hydrogen explosion
Core melt



Currently, toward the fuel removal from SPF, removal of rubbles is underway.

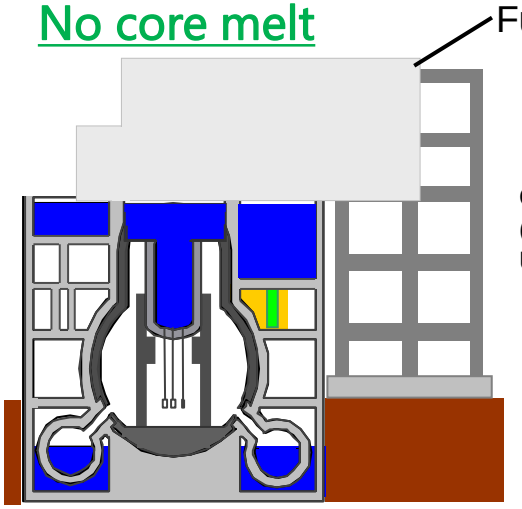
Unit 2

No hydrogen explosion
Core melt



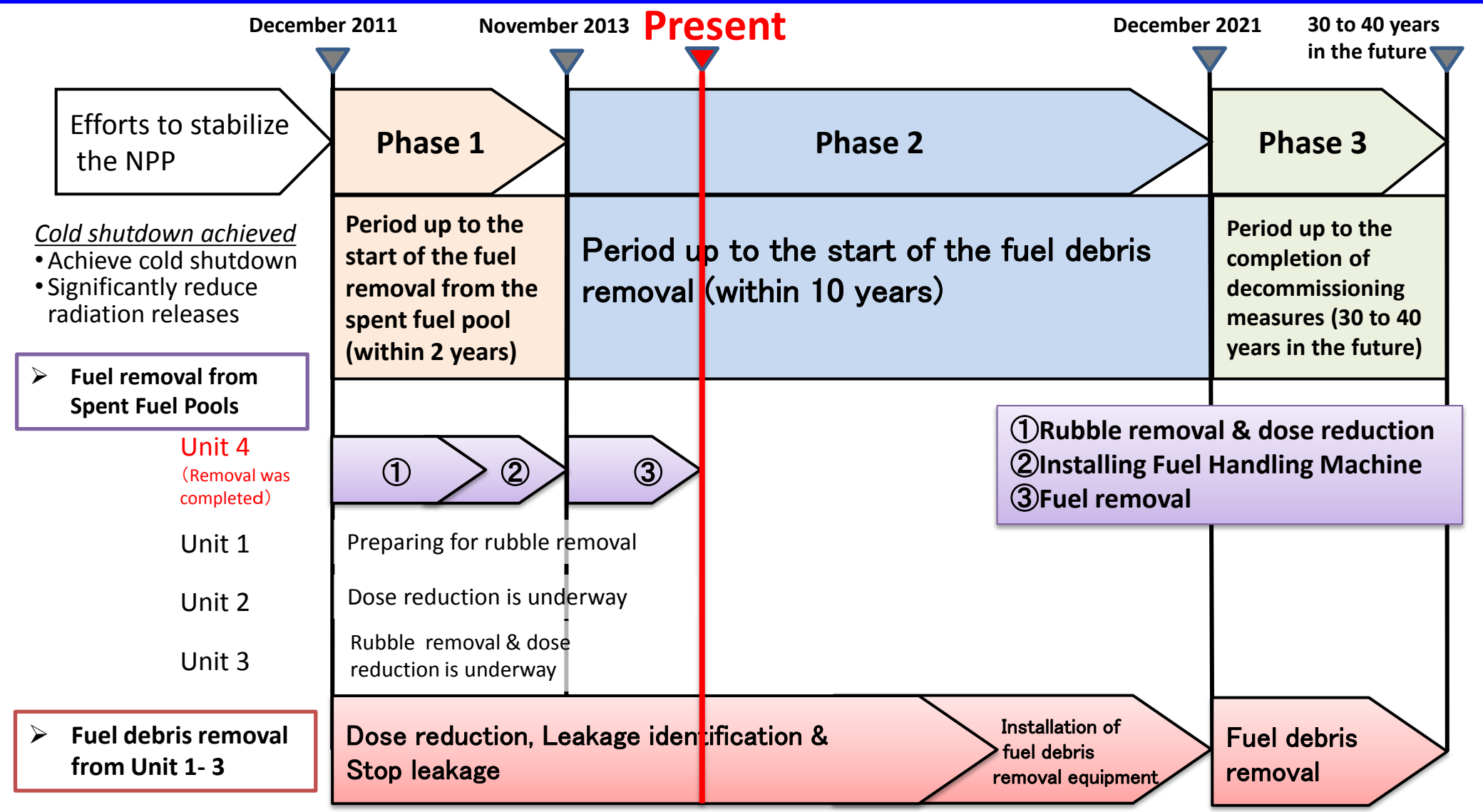
Unit 4

Hydrogen explosion
No core melt



On December 22, 2014, all (1533) fuel removal from Unit 4 SPF was completed.

Mid-and-Long Term Roadmap towards the Decommissioning



◇ Based on the site situation and the result of R&D, the roadmap will be revised continuously.

◇ The Government of Japan has commenced the discuss toward the revision, based on the "Strategic Plan" which NDF* is developing. *NDF: Nuclear Damage Liability and Decommissioning Facilitation Corporation, established on August 2014.

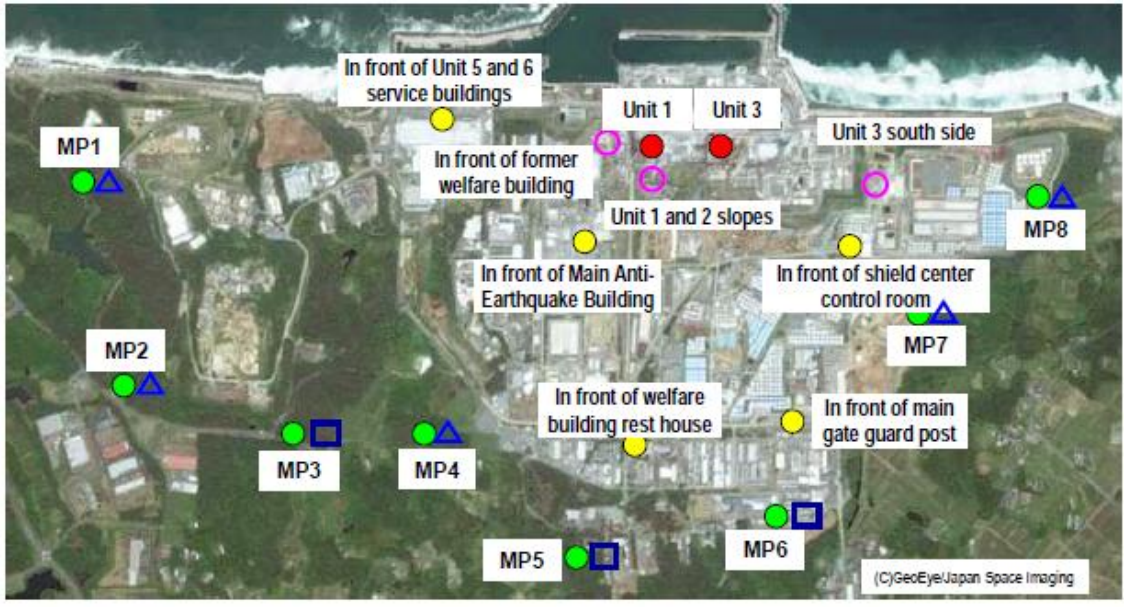
Removal of Unit 1 building temporary cover

◇On October 22, 2014, spraying of anti-scattering agents began from holes opened in the roof panels of the building cover. Two roof panels were removed (the 1st, on October 31 and the 2nd, on November 10). After the investigation, the removed roof panels temporarily returned to the roof on December 4.

◇The result of these investigations confirmed that no scattering of dust or conditions that would cause immediate damage to the fuel assemblies in the SFP were detected.

◇After removing the two roof panels, the trends of the dust conditions were monitored with regard to the density of radioactive materials in the air, and the results confirmed that due to the effects of the wind, there were no elevations in the concentration of dust.

◇It is scheduled for the roof panels to be removed once again after March,2015. The removal work of rubbles is planed to be started around the spring in 2016.

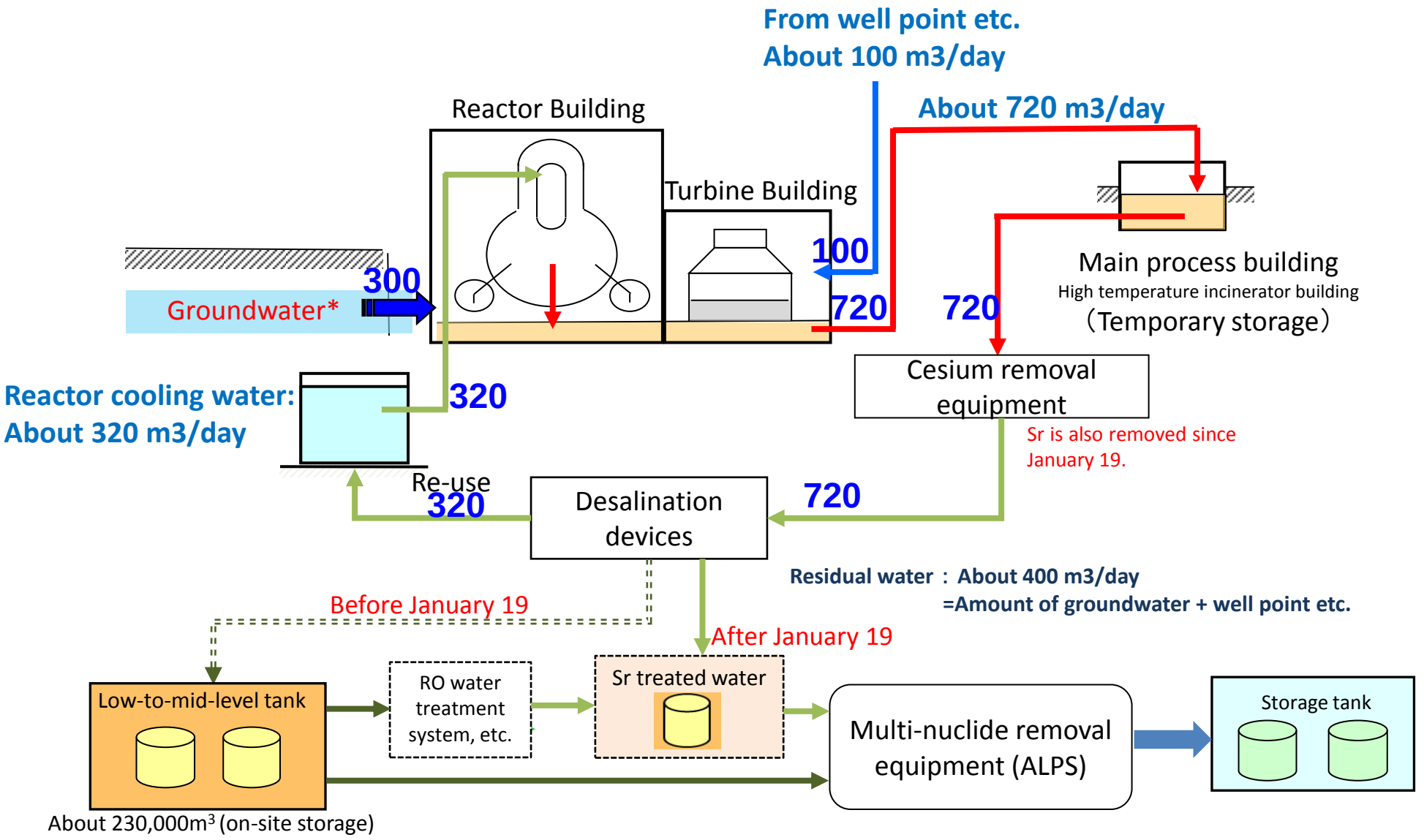


Monitoring system of radioactive material densities related to dismantling of the Unit 1 building cover

[Monitoring system of radioactive materials density]
- Monitoring by dust monitors on operating floors (4 points for each of Units 1 and 3)
- Monitoring by portable continuous dust monitors near Reactor Buildings (3 points)
- Monitoring by portable continuous dust monitors on site (5 points)
- Monitoring posts at site boundaries (8 points)
- Monitoring by portable continuous dust monitors around site boundaries (5 points)
- Measuring by dust samplers around site boundaries (3 points)

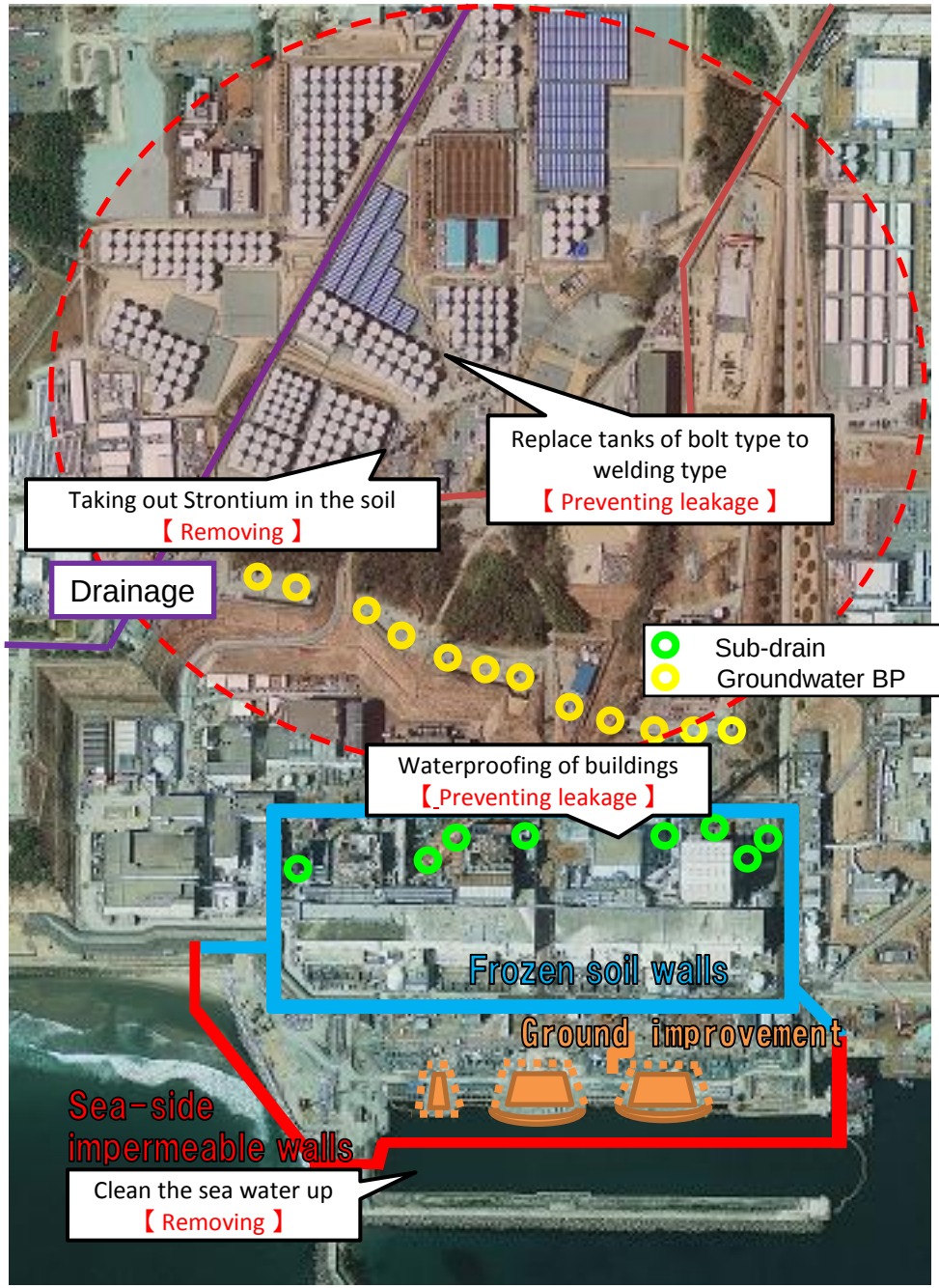
Roof panels removal (2 of 6 panels)

Management of Contaminated Water - Overview of the System -



* Groundwater inflow has decreased from about 400m3/day to about 300m3/day by the operation of groundwater bypassing system etc.

Comprehensive Countermeasures to Manage Contaminated Water



Three measure policy

1. Removing the contamination source

- **Pump-up contaminated water from trench**
- **Clean up of contaminated water by ALPS (Multi-nuclide removal equipment)**
- **Additional and High-performance ALPS**

2. Isolating groundwater from the contamination source

- **Land-side frozen soil impermeable walls**
- **Groundwater bypassing system**
- **Pump-up from sub-drain around the reactor building**
- **Waterproof pavement wide area facing etc.**

3. Preventing leakage of contaminated water

- **Ground solidification by sodium silicate**
- **Sea-side impermeable walls**
- **Construction of welding type tanks including replacement from flange (bolt) type etc.**

Current Status of Countermeasures for the Contaminated Water

		Measures	Progress	
"Removing"	①	**Multi-nuclide removal equipment**	**Operating**	Over 65% of about 580,000m^3 in tanks has treated (As of February 26). With the Sr removal equipment, all of contaminated water in tanks are intended to be treated as early as possible. (It is estimated that the treatment will be completed around the end of May, 2015)
	②	Removal of high-density contaminated water **in the trenches**	**On-going**	4,010 m^3 of 11,300m^3 high-density contaminated water has removed (As of March 2). Planed to be completed within FY2014.
"Isolating"	③	**Groundwater bypassing**	**Completed/ Operating**	Started pumping up from late May, 2014. Increment of contaminated water: 400m^3/d ⇒ 300m^3/d
	④	**Sub-drain**	**On-going**	Explanation the test result of groundwater treatment for stakeholders is underway.
	⑤	**Land-side impermeable frozen walls**	**On-going**	Started construction in June 2014 Planned to start freezing in mountain side by the end of FY2014.
	⑥	**Waterproof pavement**	**On-going**	Planned to be completed by the end of FY2014.
"Preventing leakage"		**Heightening and duplicating tank fences,**	**Completed/ Operating**	Completed in middle July, 2014. Effective for typhoons in FY2014.
	⑦	**Ground solidification** by sodium silicate	**Completed/ Operating**	Completed in March, 2014.
	⑧	**Sea-side impermeable walls**	**On-going**	Over 90% of construction is completed.
	⑨	**Increase tanks**	**On-going**	Planned to install 800,000m^3 of tanks by the end of FY2014 (2 years ahead of roadmap)

Multi-Nuclide Removal Equipment [Removing ①]

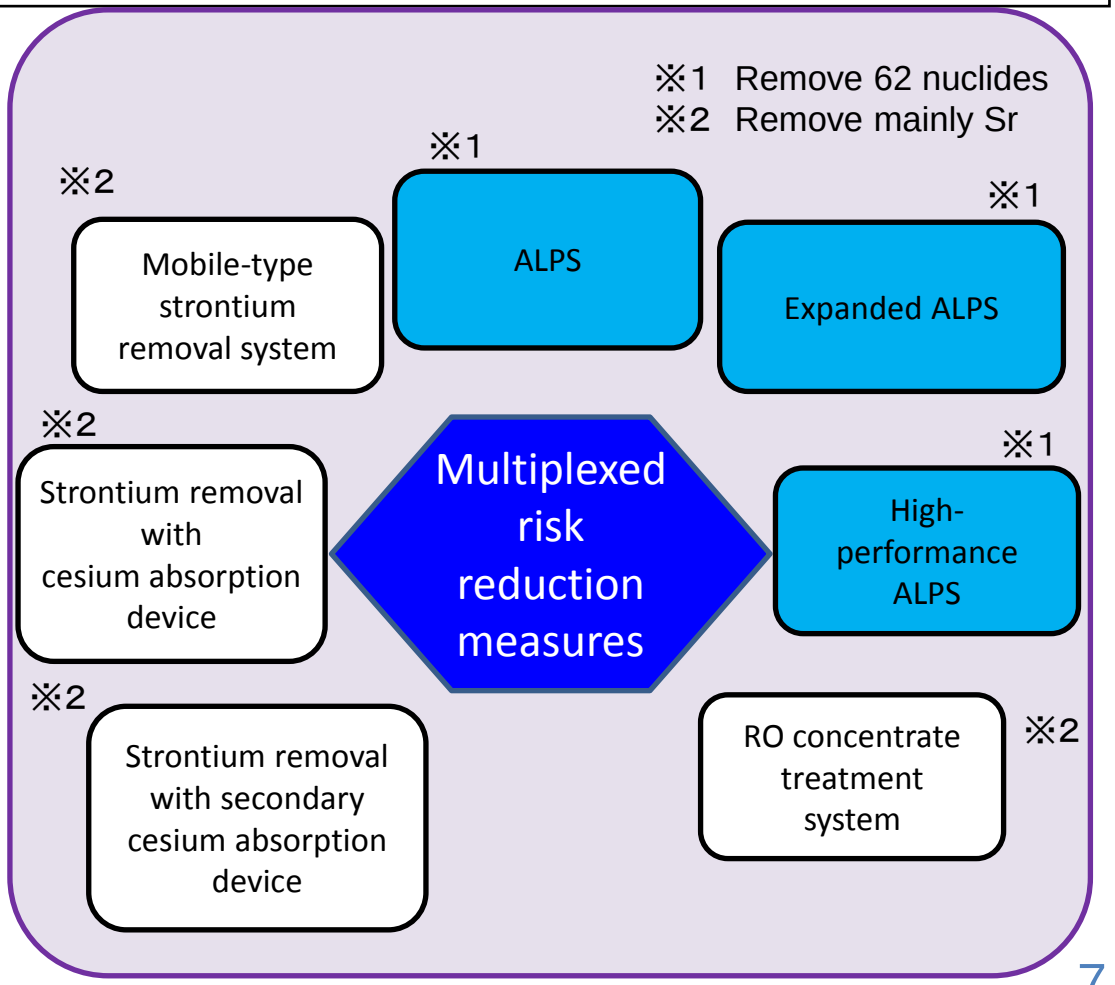
◇ Accelerating the contaminated water treatment by the installation of multiple equipment, and complete the treatment the water in tanks as early as possible.(It is estimated that the treatment will be completed around the end of May, 2015)

◇ By introducing more multiplexed risk reduction measures, accelerate the water treatment and the reduction of the effective dose.

Target level of the effective dose at the site boundary (Nuclear Regulation Authority)

Period	End of March, 2015	End of March, 2016
Target	Under 2mSv/year※	Under 1mSv/year

※Reduce the effective dose (evaluated value) at the site boundary, due to except the contaminated water in tanks, to 1mSv/year by the end of March, 2017.



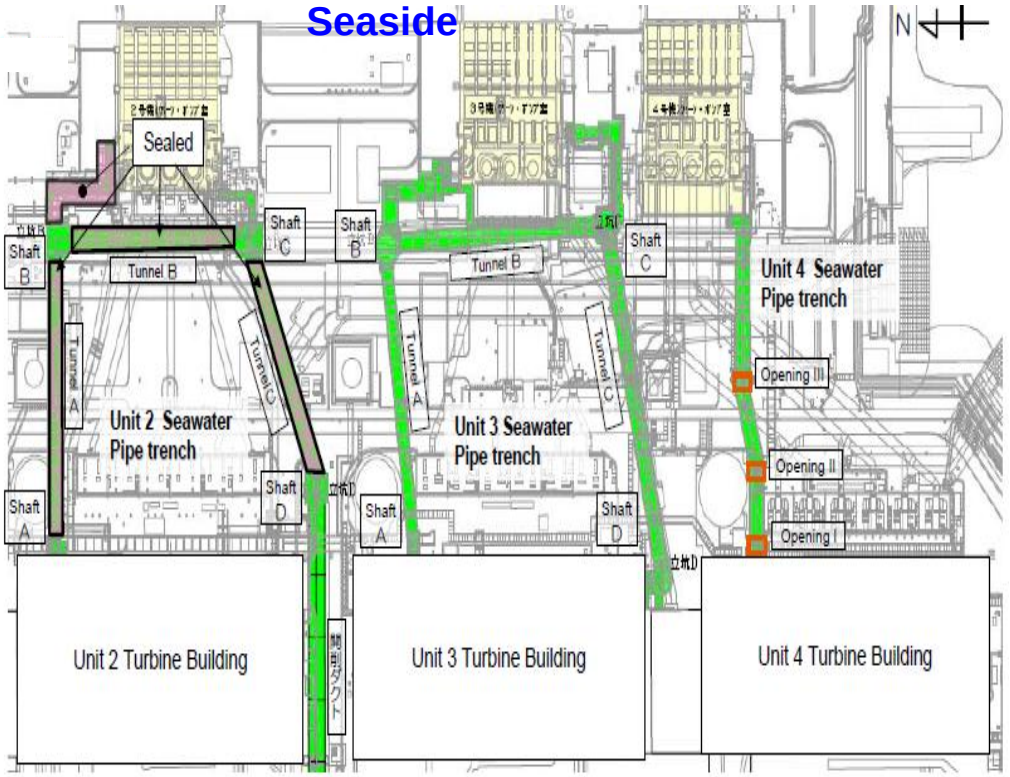
Removal of contaminated water seawater pipe trenches [Removing ②]

◇ High-density contaminated water at the time of accident still remains in the underground tunnel (Trench) beside the turbine building.（High risk in case of the leakage）

◇From November 25,contaminated water is being removed from seawater pipe trenches, and the trenches are being filled with cement based materials.

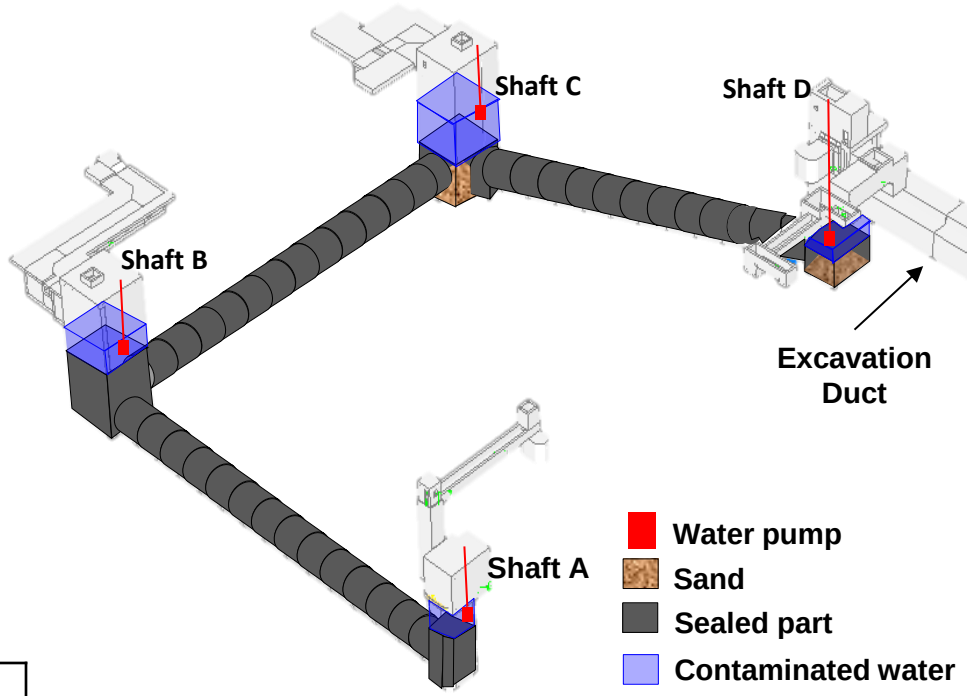
(Regarding the Unit 2 trench, filling of the tunnel sections was completed on December 18, 2014. Regarding the Unit 3 seawater-pipe trench, filling of the tunnel sections has commenced on February 5, 2015)

◇It is aimed that removal of the contaminated water in trenches will be completed as early as possible.



Removed 2520/4500m³	Removed 1200/5900m³	Removed 290/900m³

Birds eye view of Unit 2 Trench



Sub-Drains [Isolating ④]

◇ By pumping up groundwater through the sub-drain, the level of groundwater around buildings can be lowered, inflow to the buildings and outflow to the seaside can be inhibited. Pumping up groundwater near buildings enables groundwater flow to be reduced effectively.

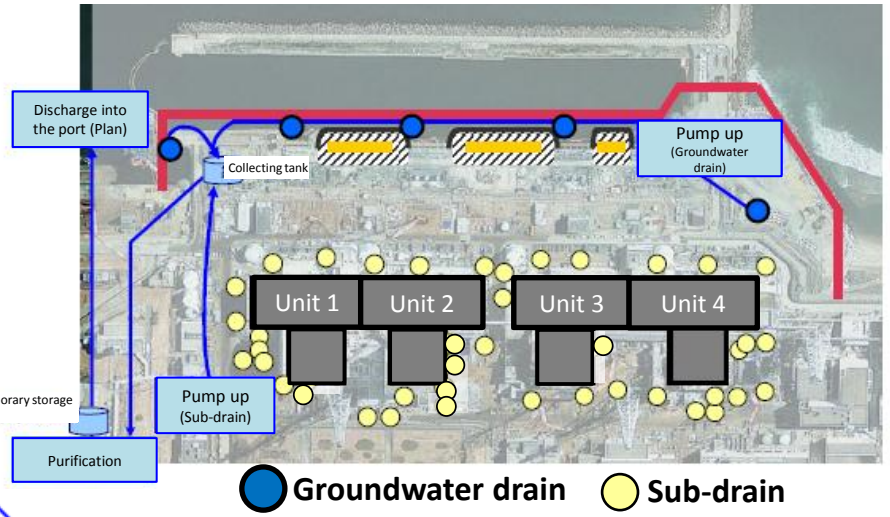
◇ The consultation with relevant stakeholders such as fishermen's associations is now on going.
There should be no discharge without stakeholder's understanding.

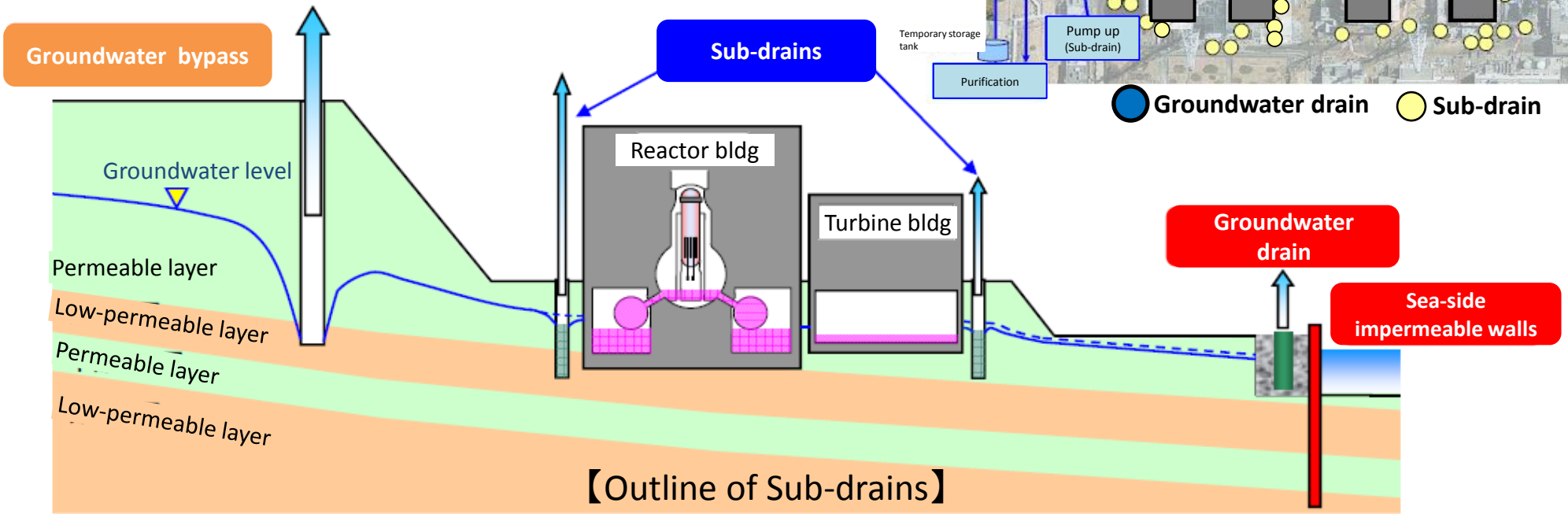
Operational target of Sub-drain and Groundwater drain, regulation

(Unit: Bq / L)

	Cs 134	Cs 137	Gross β	Tritium
Operational target	1	1	3(1)	1，500
Legal discharge limit	60	90	30	60，000
WHO Guidelines for Drinking Water Quality	10	10	10	10，000

Layout of Sub-drain and Groundwater drain





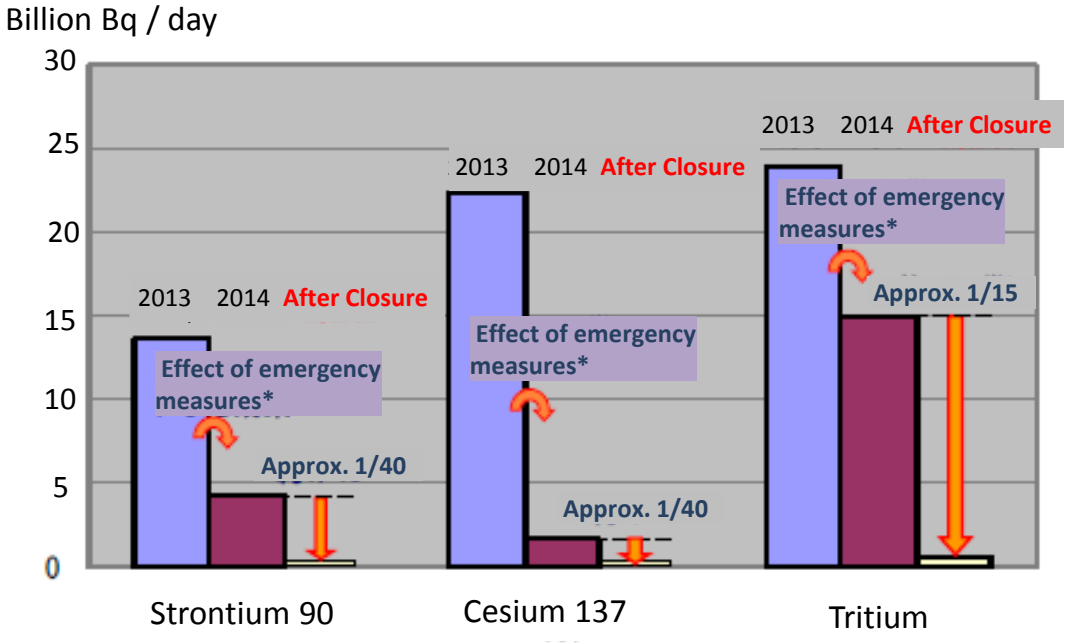
【Outline of Sub-drains】

Sea-side impermeable walls [Preventing leakage ⑧]

- Water shut-off walls will be installed outside of the shore protection in order to prevent contaminated groundwater flow into the sea.
- The construction work started in October 2011, and installation of steel sheet piles has almost been completed (approx. 98% completion).
- Explanation to stakeholders about the treatment and the discharge of pumped up groundwater is on going.

Recent situation of the sea-side impermeable walls

Suppressing effect for the radioactive material's outflow to the sea by Sub-drain, Groundwater drain and Sea-side impermeable wall

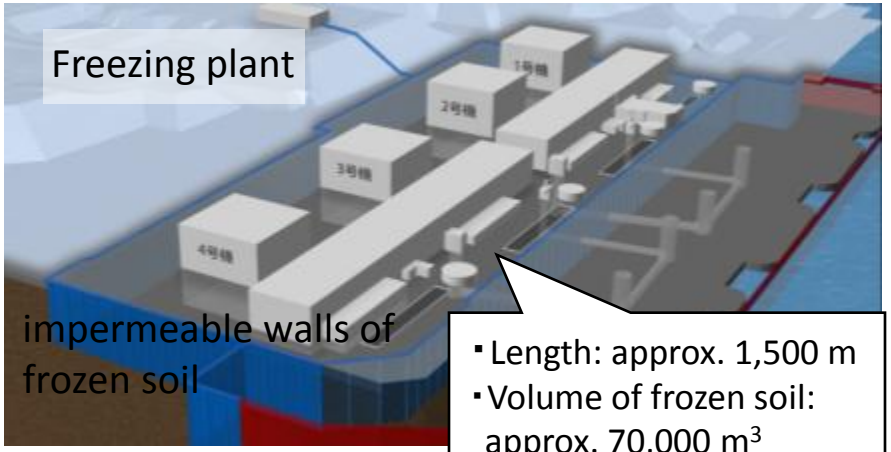


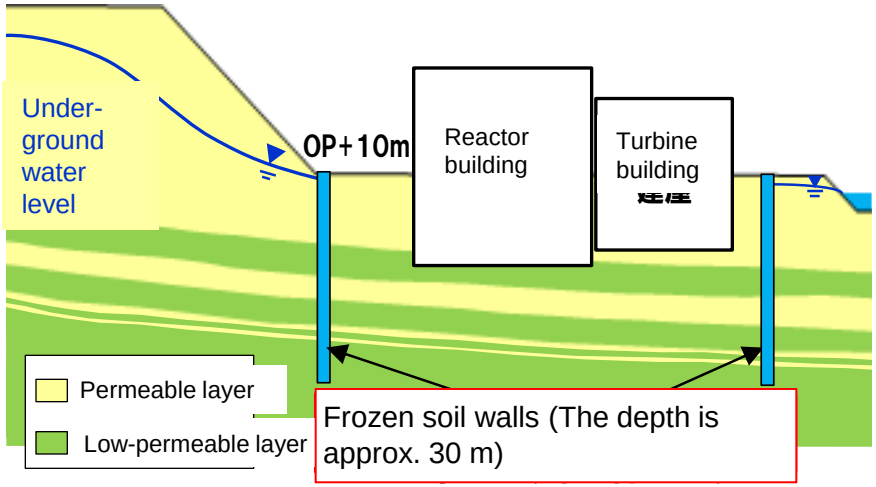
* Ground improvement of contaminated seawall and pumping up at well points, etc.

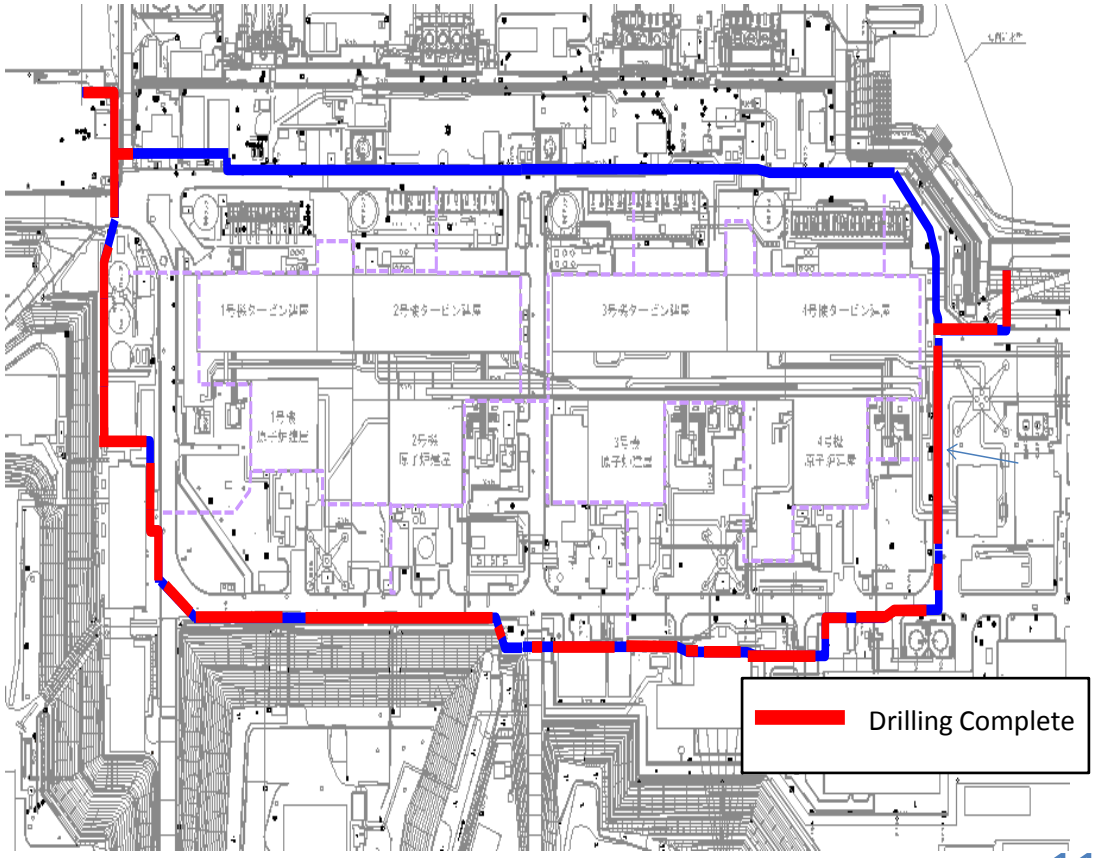
Land-side impermeable walls of frozen-soil method [Isolating ⑤]

- This measure aims to reduce the volume of groundwater inflow into the buildings by surrounding the buildings with froze-soil walls (approx. 1,500m).
- 10m square on-site test succeeded in April 2014.
- The construction work began from June 2, 2014 with the aim of starting the freezing operation promptly.
- As of March 1, drilling at 1,017 of 1,551 points (approx. 66%) is completed. Regarding the mountain side, drilling at 1,005 of 1,036 point (approx. 97%) is completed.

Overall view and sectional view of the walls



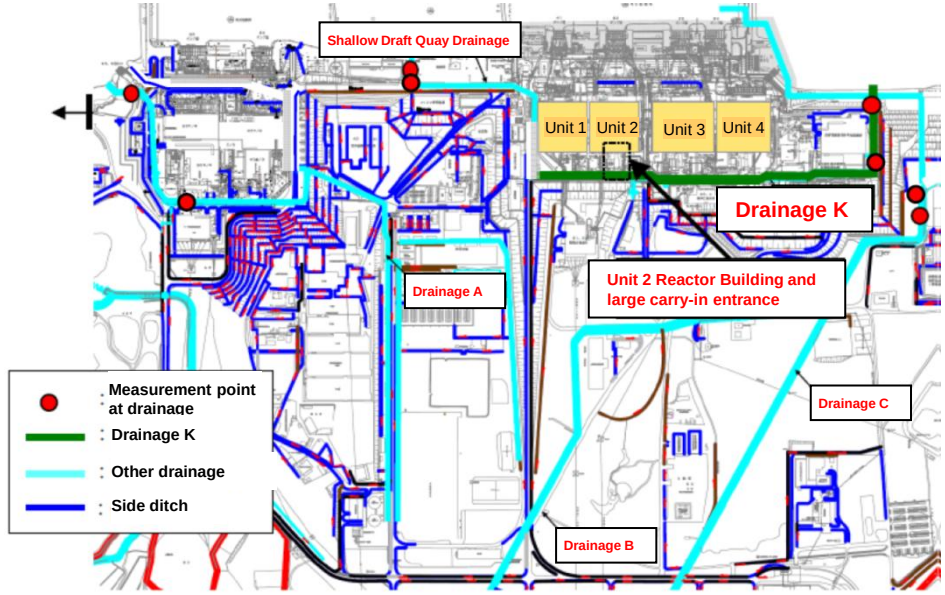




Actions regarding rainwater drainage (Drainage K) on Fukushima-Daiichi

Outline

- Before the accident, the rainwater drainage channels were not a target for control. After the accident, measures for the high-density contaminated water were implemented on a priority basis. At the drainage, the monitoring which was necessary for assessing the leakage of high-density contaminated water had been implemented.
- On Feb. 2014, TEPCO reported/announced about monitoring data (non-rainfall day), drainage flow-route, possible contamination sources and countermeasures to NRA's Committee, etc. On the same month, NRA requests drainage controlling and challenging to site boundary effective dose target (e.g. Including the result from the contaminated water in tanks, 2mSv/year by the end of March, 2017).
- Though TEPCO has implemented the measures which had been already announced (decontamination of the mountain side and clean-up of drainages), but Drainage K doesn't become low contamination level, so potential inlets to Drainage K have been additionally investigated. As the result of the investigation, relatively high dose level rainwater detected at roof of large carry-in entrance in Unit 2 on 24th Feb. 2015, so TEPCO reported the result to NRA and announced the public on the same day.
- Simultaneously other sampling data of drainage since Apr. 2014 were announced. (Data after Apr. 2014 were not made in public)



Cs134	6, 400
Cs137	23, 000
Gross β	52, 000
H−3	600

(Unit) Bq／L

Action after publication of investigation result

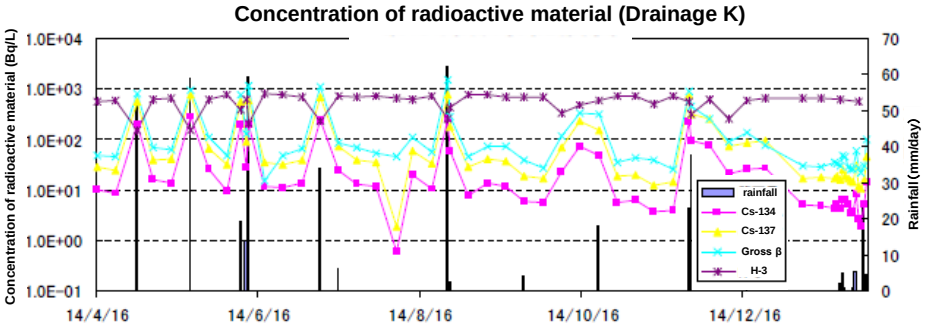
1) Direction from Mr Takagi, Senior Vice Minister of Economy, Trade and Industry, to TEPCO (25th Feb. 2015)

✓Direction TEPCO to conduct a review covering all the possible risks at Fukushima Daiichi at this moment, having view of the victim and the nation, and to present countermeasures which is suitable for current site situation with providing necessary information.

✓In reviewing the risks, the development of the decontamination and decommissioning work and the risks which have an impact on the environment outside Fukushima Daiichi should be extensively included.

2) TEPCO's actions

With review all the possible risks, TEPCO will conduct the installation of clarification materials and pumps for transferring drainage water outlet to inside of the port, and the removal of contaminated source, etc.



※During period, outside port dosage levels have been very low level and there was also no substantial concentration increase identified inside and outside port.
※Automatic sampling after January 19, 2015 (trial / require a further checking)

[Reference] Seawater Monitoring around the Port ① (the highest and latest values)

(The latest values sampled during February 16-24)

Unit (Bq/L); ND represents a value below the detection limit; values in ( ) represent the detection limit; ND (2013) represents ND throughout 2013

【Northeast side of port entrance(offshore 1km)】

Cesium-134:	ND (2013) → ND (0.79)	
Cesium-137:	ND (2013) → ND (0.60)	
Gross β:	ND (2013) → ND (16)	
Tritium:	ND (2013) → ND (1.5)	

【East side of port entrance (offshore 1km)】

Cesium-134:	ND (2013)	→ ND (0.77)	
Cesium-137:	1.6 (2013/10/18)	→ ND (0.50)	Below 1/3
Gross β:	ND (2013)	→ ND (16)	
Tritium:	6.4 (2013/10/18)	→ ND(1.5)	Below 1/4

【Southeast side of port entrance(offshore 1km)】

Cesium-134:	ND (2013)	→ ND (0.63)
Cesium-137:	ND (2013)	→ ND (0.53)
Gross β:	ND (2013)	→ ND (16)
Tritium:	ND (2013)	→ ND (1.5)

Cesium-134:	ND (2013)	→ ND (0.73)	
Cesium-137:	ND (2013)	→ ND (0.59)	
Gross β:	ND (2013)	→ ND (16)	
Tritium:	4.7 (2013/ 8/18)	→ ND(1.5)	Below 1/3

【North side of north breakwater(offshore 0.5km)】

【Port entrance】

Cesium-134:	3.3 (2013/12/24)	→ ND (1.2)	Below 1/2
Cesium-137:	7.3 (2013/10/11)	→ ND (1.4)	Below 1/6
Gross β:	69 (2013/ 8/19)	→ 16	Below 1/4
Tritium:	68 (2013/ 8/19)	→ 2.0	Below 1/30

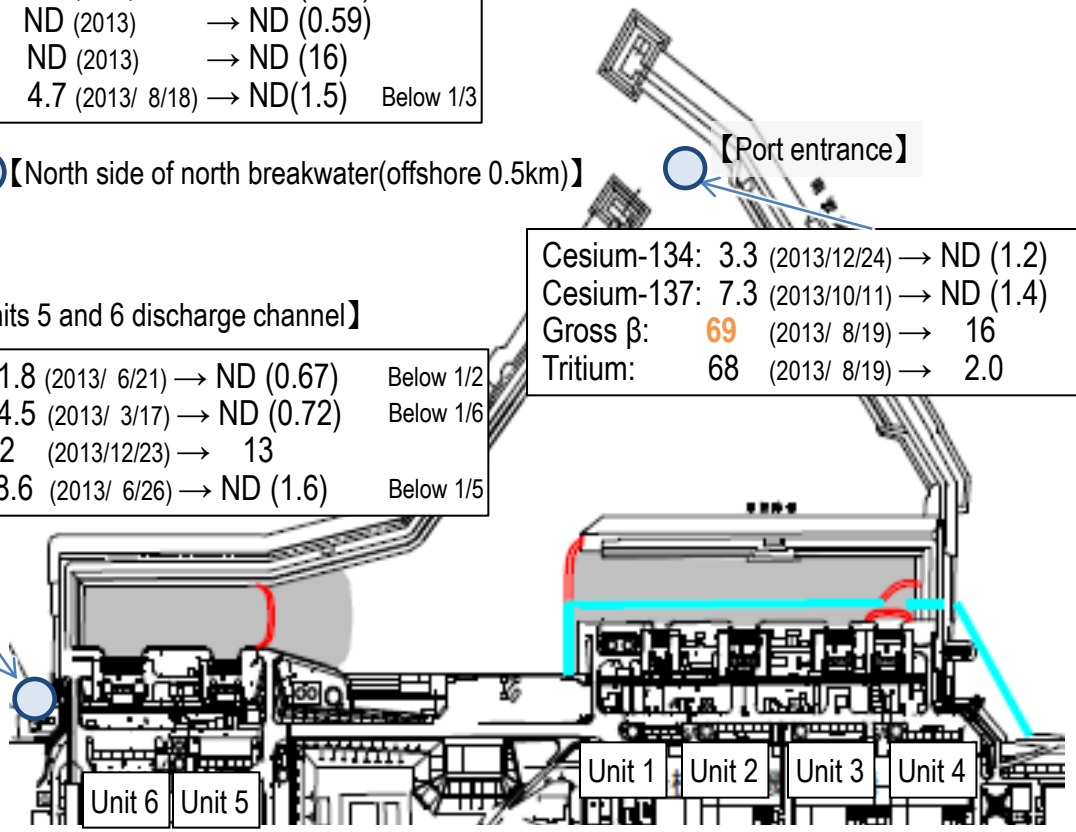
【South side of south breakwater(offshore 0.5km)】

Cesium-134:	ND (2013)	→ ND (0.63)
Cesium-137:	ND (2013)	→ ND (0.62)
Gross β:	ND (2013)	→ ND (16)
Tritium:	ND (2013)	→ ND (1.5)

【North side of Units 5 and 6 discharge channel】

Cesium-134:	1.8 (2013/ 6/21)	→ ND (0.67)	Below 1/2
Cesium-137:	4.5 (2013/ 3/17)	→ ND (0.72)	Below 1/6
Gross β:	12 (2013/12/23)	→ 13	
Tritium:	8.6 (2013/ 6/26)	→ ND (1.6)	Below 1/5

Cesium-134:	ND (2013)	→ ND (0.79)	
Cesium-137:	3.0 (2013/ 7/15)	→ ND (0.60)	Below 1/5
Gross β:	15 (2013/12/23)	→ 13	
Tritium:	1.9 (2013/11/25)	→ ND (1.6)	



Sea side impermeable wall

Silt fence

【Around south discharge channel】

Summary of TEPCO data as of February 25

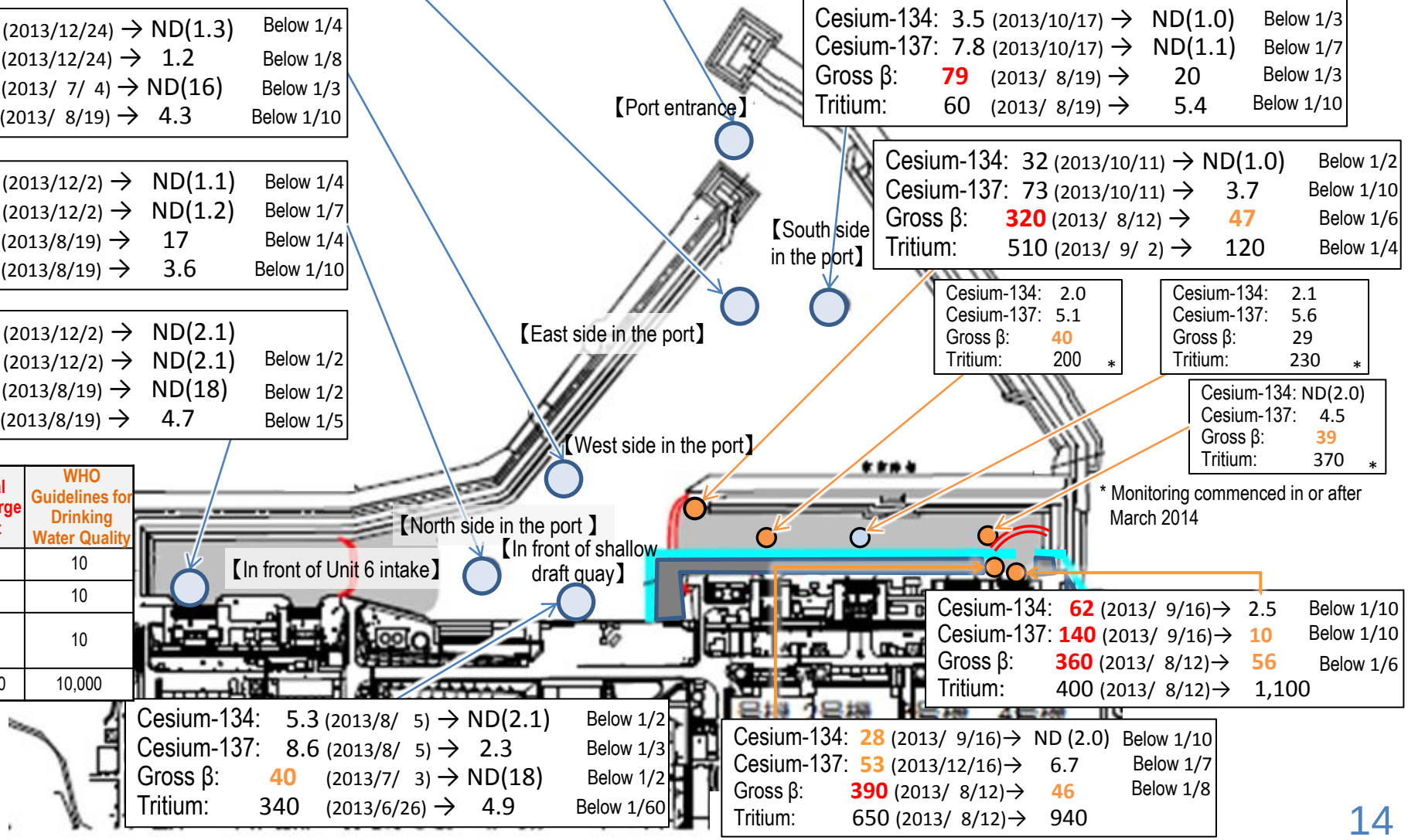
Source: TEPCO website, Analysis results on nuclides of radioactive materials around Fukushima Daiichi Nuclear Power Station, http://www.tepco.co.jp/nu/fukushima-np/f1/smp/index-j.html

[Reference] Seawater Monitoring in the Port ② (the highest and latest values)

"The highest value" → "the latest value (sampled during February 16-24)"; unit (Bq/L); ND represents a value below the detection limit

Source: TEPCO website
Analysis results on nuclides of radioactive materials around Fukushima Daiichi Nuclear Power Station
http://www.tepco.co.jp/nu/fukushima-np/f1/smp/index-j.html

Sea side impermeable wall
Silt fence



Cesium-134:	3.3 (2013/10/17) → ND(1.2) Below 1/2
Cesium-137:	9.0 (2013/10/17) → 1.3 Below 1/6
Gross β:	74 (2013/ 8/19) → ND(16) Below 1/4
Tritium:	67 (2013/ 8/19) → 6.6 Below 1/10

Cesium-134:	3.3 (2013/12/24) → ND(1.2) Below 1/2
Cesium-137:	7.3 (2013/10/11) → 1.4 Below 1/5
Gross β:	69 (2013/ 8/19) → 16 Below 1/4
Tritium:	68 (2013/ 8/19) → 2.0 Below 1/30

Cesium-134:	4.4 (2013/12/24) → ND(1.3) Below 1/4
Cesium-137:	10 (2013/12/24) → 1.2 Below 1/8
Gross β:	60 (2013/ 7/ 4) → ND(16) Below 1/3
Tritium:	59 (2013/ 8/19) → 4.3 Below 1/10

Cesium-134:	3.5 (2013/10/17) → ND(1.0) Below 1/3
Cesium-137:	7.8 (2013/10/17) → ND(1.1) Below 1/7
Gross β:	79 (2013/ 8/19) → 20 Below 1/3
Tritium:	60 (2013/ 8/19) → 5.4 Below 1/10

Cesium-134:	5.0 (2013/12/2) → ND(1.1) Below 1/4
Cesium-137:	8.4 (2013/12/2) → ND(1.2) Below 1/7
Gross β:	69 (2013/8/19) → 17 Below 1/4
Tritium:	52 (2013/8/19) → 3.6 Below 1/10

Cesium-134:	32 (2013/10/11) → ND(1.0) Below 1/2
Cesium-137:	73 (2013/10/11) → 3.7 Below 1/10
Gross β:	320 (2013/ 8/12) → 47 Below 1/6
Tritium:	510 (2013/ 9/ 2) → 120 Below 1/4

Cesium-134:	2.8 (2013/12/2) → ND(2.1)
Cesium-137:	5.8 (2013/12/2) → ND(2.1) Below 1/2
Gross β:	46 (2013/8/19) → ND(18) Below 1/2
Tritium:	24 (2013/8/19) → 4.7 Below 1/5

Cesium-134:	2.0
Cesium-137:	5.1
Gross β:	40
Tritium:	200 *

Cesium-134:	2.1
Cesium-137:	5.6
Gross β:	29
Tritium:	230 *

Cesium-134:	ND(2.0)
Cesium-137:	4.5
Gross β:	39
Tritium:	370 *

* Monitoring commenced in or after March 2014

	Legal discharge limit	WHO Guidelines for Drinking Water Quality
Cesium-134	60	10
Cesium-137	90	10
Strontium-90 (strongly correlate with Gross β)	30	10
Tritium	60,000	10,000

Cesium-134:	62 (2013/ 9/16)→ 2.5 Below 1/10
Cesium-137:	140 (2013/ 9/16)→ 10 Below 1/10
Gross β:	360 (2013/ 8/12)→ 56 Below 1/6
Tritium:	400 (2013/ 8/12)→ 1,100

Cesium-134:	5.3 (2013/8/ 5) → ND(2.1) Below 1/2
Cesium-137:	8.6 (2013/8/ 5) → 2.3 Below 1/3
Gross β:	40 (2013/7/ 3) → ND(18) Below 1/2
Tritium:	340 (2013/6/26) → 4.9 Below 1/60

Cesium-134:	28 (2013/ 9/16)→ ND (2.0) Below 1/10
Cesium-137:	53 (2013/12/16)→ 6.7 Below 1/7
Gross β:	390 (2013/ 8/12)→ 46 Below 1/8
Tritium:	650 (2013/ 8/12)→ 940

Summary of TEPCO data as of February 25