Status of Progress with the Installation of ALPS Treated Water Dilution/Discharge Facility and Related Facilities

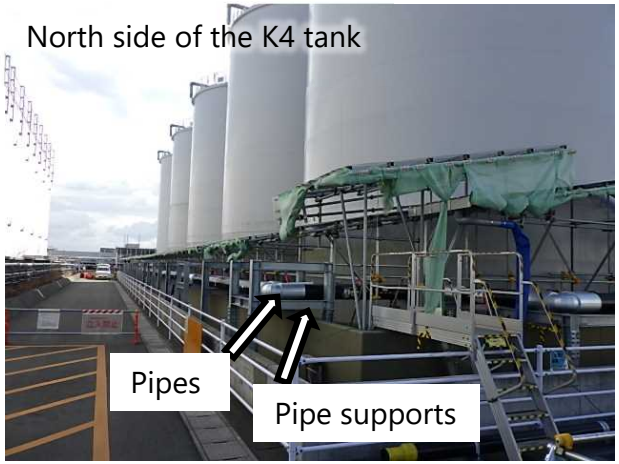
May 25, 2023

Tokyo Electric Power Company Holdings, Inc.

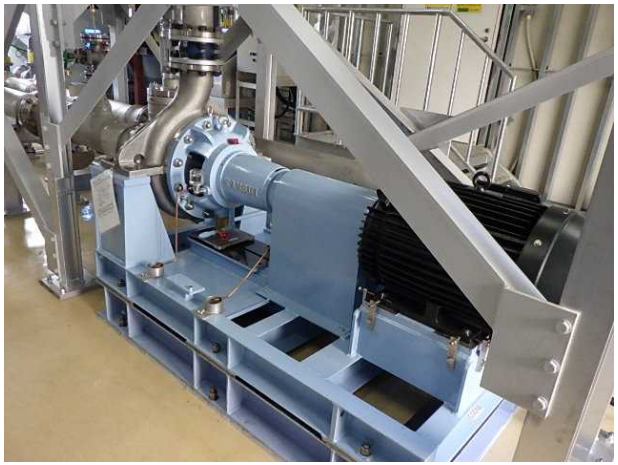
1. Status of construction

■ Measurement/confirmation facility and transfer facility

The Installation of pipe supports and pipes for the measurement/confirmation facility and the transfer facility began on August 4 in the area around K4 tank area.
The Pre-service inspection began on January 16.



Installing circulation pipes and pipe supports



Circulation pump

Installing the piping supports/pipes

[Measurement/confirmation facility] completed
・Supports
Approx. 540m out of approx. 540m
・Pipes
Approx. 1,000m out of approx. 1,000m

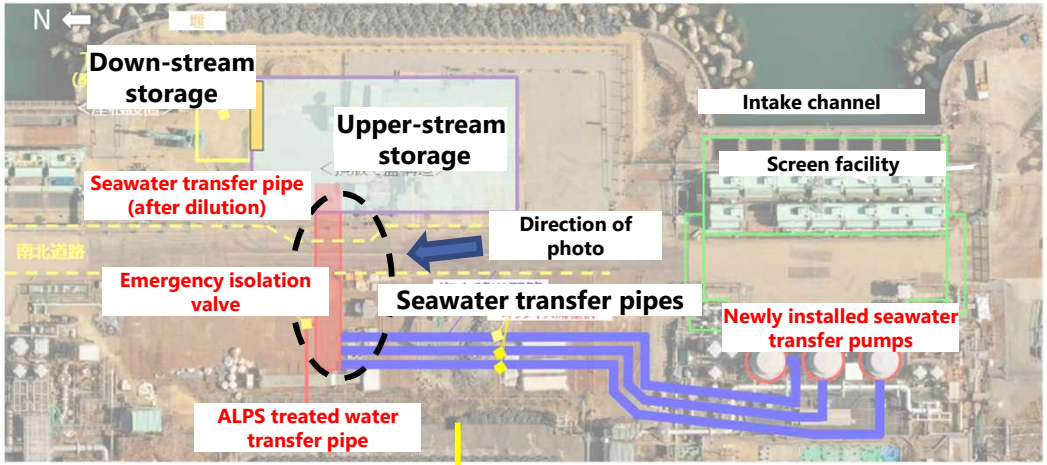
[Transfer facility] completed
・Supports
Approx. 1,500m out of approx. 1,500m *1
・Pipes
Approx. 1,500m out of approx. 1,500m *1

*1 Descriptions have been revised
<As of May 22>

[Measurement/confirmation facility]
March 15
・Service inspection completion certificate received
March 17-27
・Circulation/agitation commenced
March 27
・Samples taken from tank group B

■ Dilution facility

The driving of foundation piles and construction of the foundation frame for the seawater transfer pipes have been completed.
Installation of pipes and other equipment are currently underway.



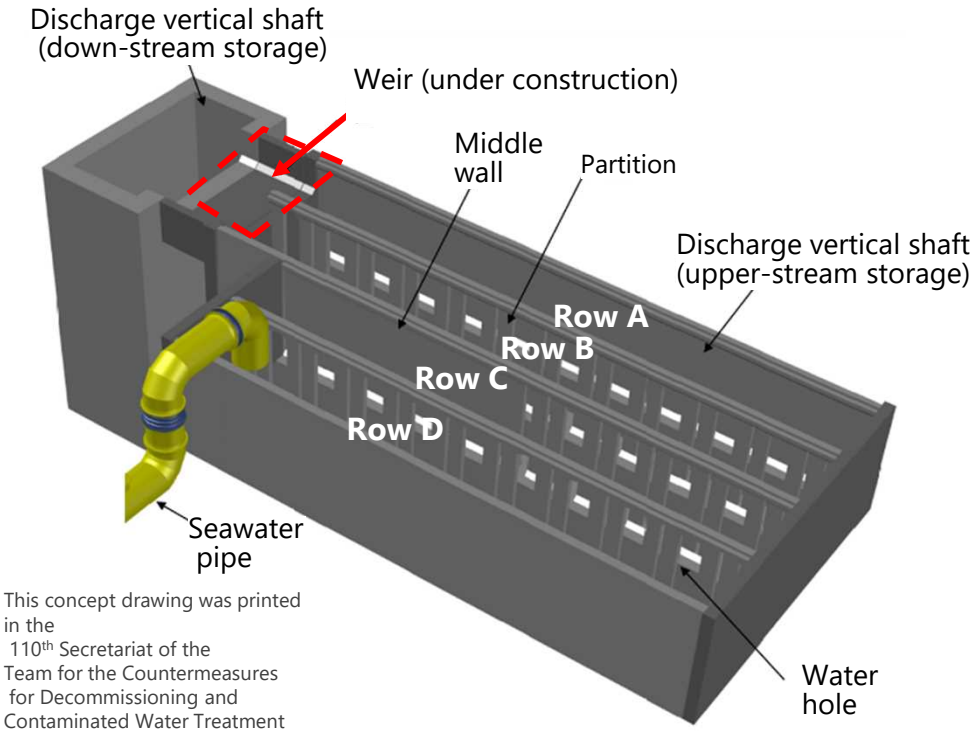
Building the seawater transfer pipe foundation and installing the seawater pipe header

[Dilution facility]
・Pipe foundation construction
11 out of 11 completed
・Support facility
Approx. 273m out of 320m completed
・Pipe facility
Approx. 293m out of 320m completed
<As of May 22>

1. Progress with construction (cont.)

- Dilution facility: Discharge vertical shaft (upper-stream storage)

  The assembly and installation of blocks (manufactured off-site) began on January 12, and concrete pouring for the bottom began on February 9. Assembly and installation, concrete pouring and waterproofing have been completed and the storage have been filled with water. The weirs will be built next.



This concept drawing was printed in the 110th Secretariat of the Team for the Countermeasures for Decommissioning and Contaminated Water Treatment

Picture of the inside (After applying waterproof sealant)

Picture of inside (After filling water)

1. Progress with construction (cont.)

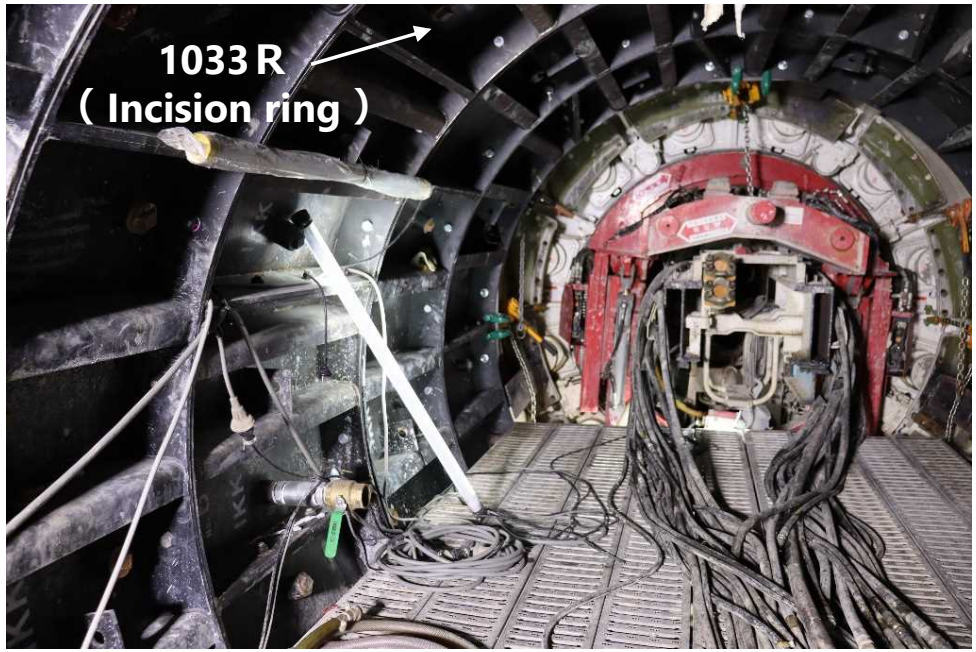
■ Discharge facility: Discharge tunnel

Date	Task (progress)
Apr 1	Recommencement of tunneling
Apr 22	Main tunneling (bedrock portion) completed
Apr 25	Tunneling machine arrives at end point
Apr 26	Tunneling completed

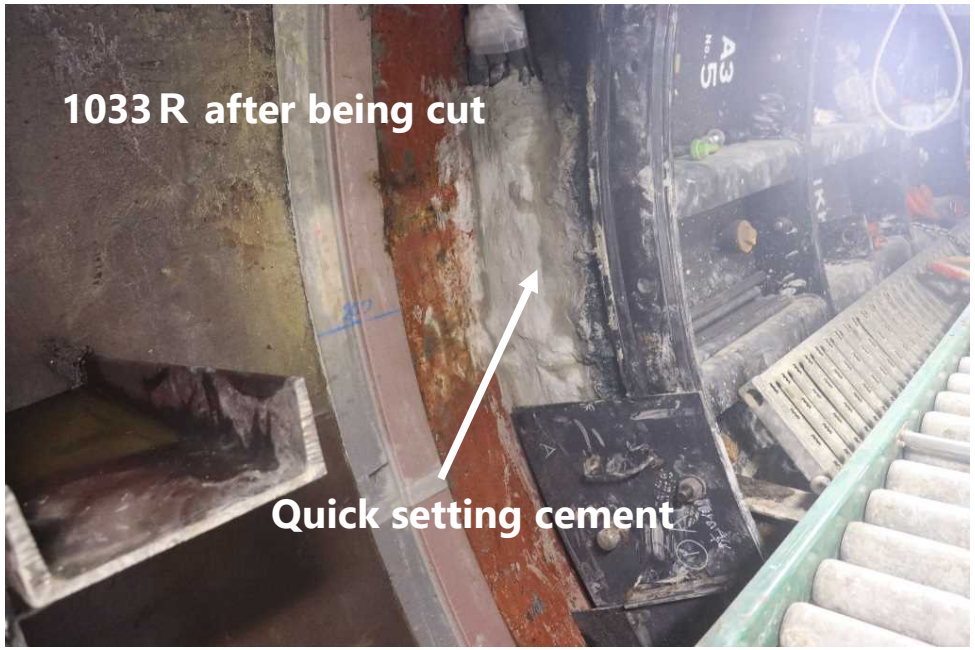
Date	Task (progress)
May 7	Equipment removal completed
May 21	Waterproofing completed

- Going forward, the tunnel will be filled with water after the tunnel and the down-stream storage has been cleaned up.
- After preparations have been completed, the following arrival tube (shield machine) shall be removed while prioritizing safety as always.

*The details of tasks performed after the completion of excavation can be found on pages 4~6



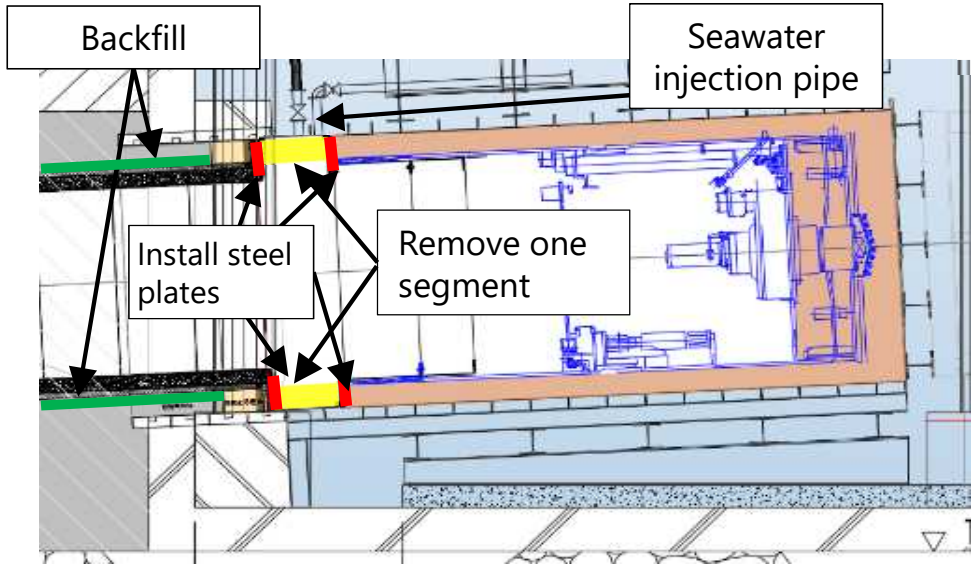
Tunnel endpoint (before waterproofing)



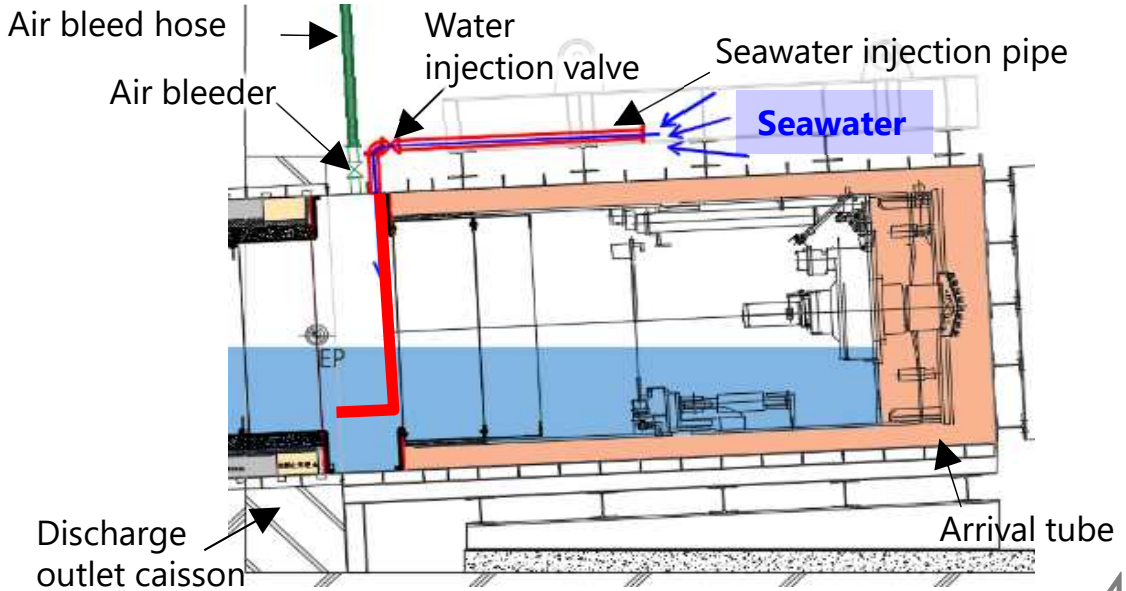
Tunnel endpoint (during waterproofing)

(Reference) Preparations to remove the arrival tube (shield machine)

■ Equipment removal	• Equipment wagons connected behind the shield machine, the overhead crane, and the sludge transfer pipes will be removed.
■ Waterproofing works	• To prevent groundwater within the bedrock, and groundwater caught between the discharge outlet caisson and backfilling (projected water routes), from gushing out, these areas will be waterproofed with backfill and other chemicals (areas in green in the diagram below). • One segment (at the 1,030m mark of the tunnel) near the seawater injection tube will be removed (area in yellow in the diagram below). • Steel plates shall be installed on both sides of the removed segment to make the section watertight (shown in red in the figure below)
■ Cleaning up the inside of the tunnel and the down-stream storage	• Light fixtures, water feed and discharge tubes, rails within the tunnel, and the stairs inside the down-stream storage will be removed.
■ Seawater injection	• Once cleanup inside the tunnel and the down-stream storage are complete, a diver will install an air bleed hose and open the air bleeder. • Once the air bleeder is confirmed to be open, a diver will open the water injection valve to inject water into the tunnel.



Concept drawing of waterproofing

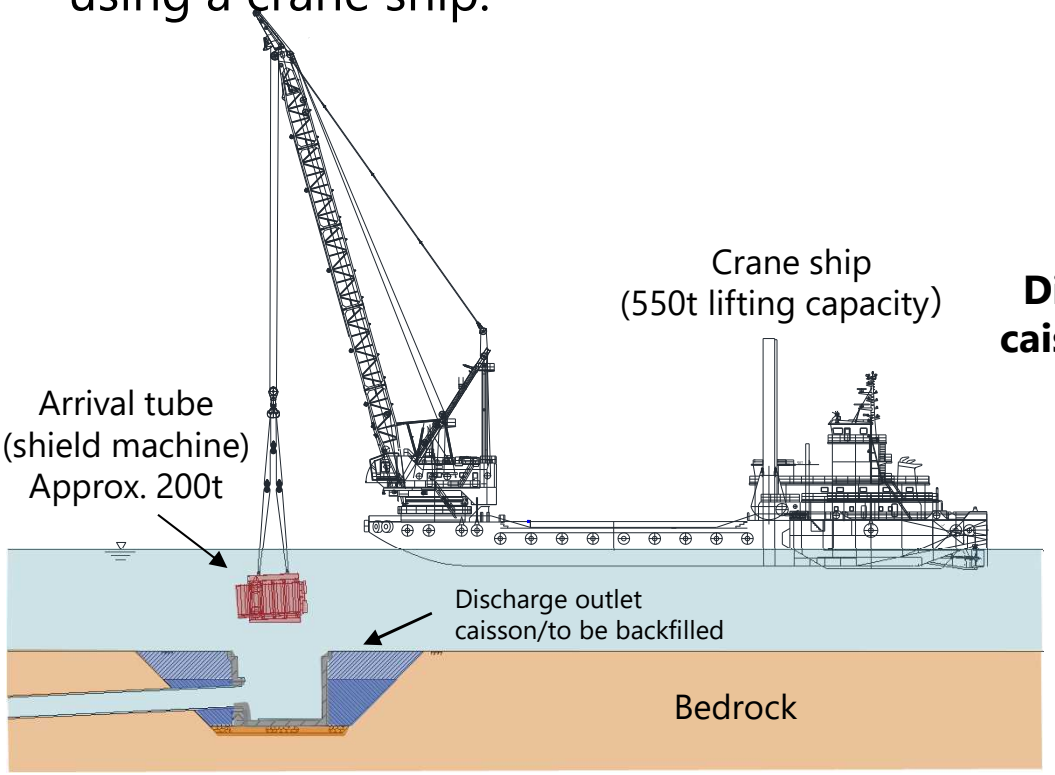


Concept drawing of seawater injection

(Reference) Removal of the arrival tube (shield machine)

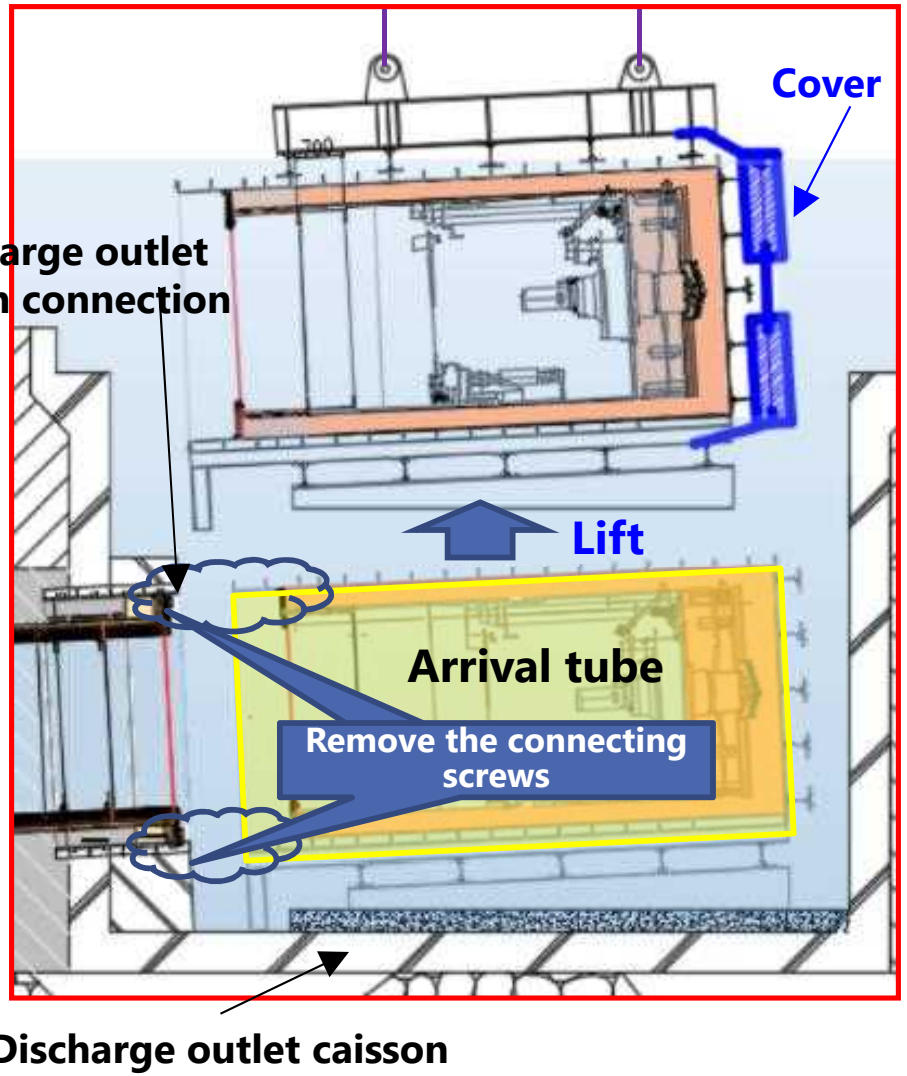
[Removal of the arrival tube (shield machine)]

- Once the tunnel is full of seawater, a diver will separate the arrival tube from the connection for the discharge outlet caisson. The arrival tube will then be removed using a crane ship.



Concept drawing of arrival tube (shield machine) removal

Enlarged



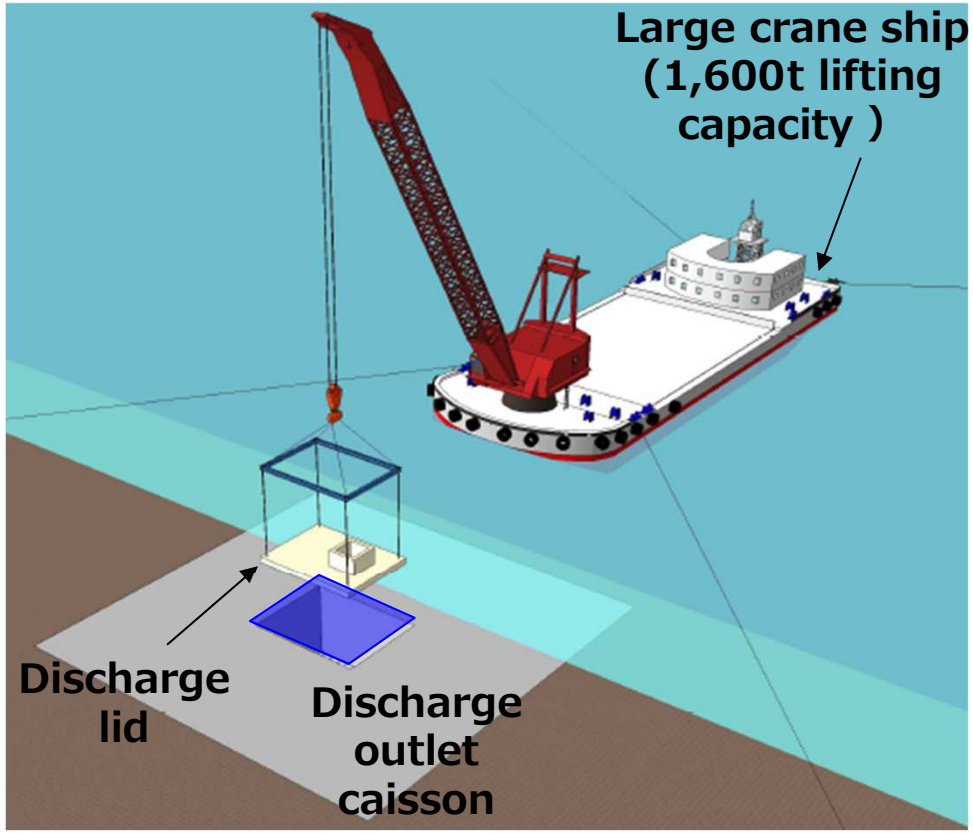
(Reference) Offshore construction (discharge lid installation and cleanup)

【 Discharge lid installation 】

- After removal of the arrival tube (shield machine), a large crane ship will be used to install the discharge lid.
- Mortar will then be poured around the discharge lid to secure it.

【 Removal of sinker blocks and light buoys】

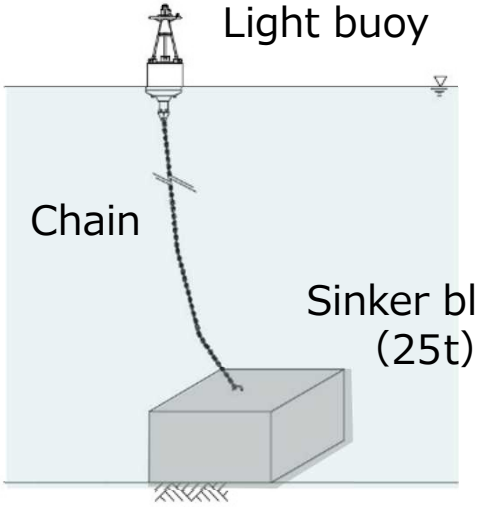
- After construction has been completed, a crane ship shall be used to remove the sinker blocks (110 tons) and light buoys (including steel sinker blocks) after preparations have been made.

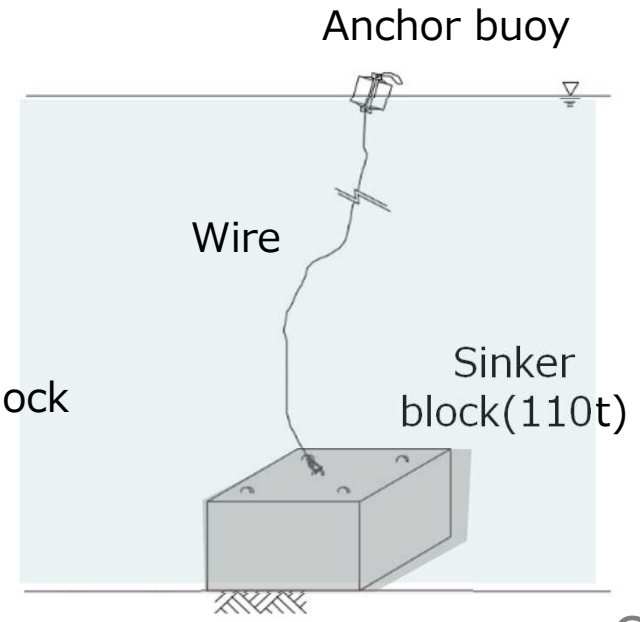


Concept drawing of discharge lid installation

Photographed on June 6, 2022

Light buoy

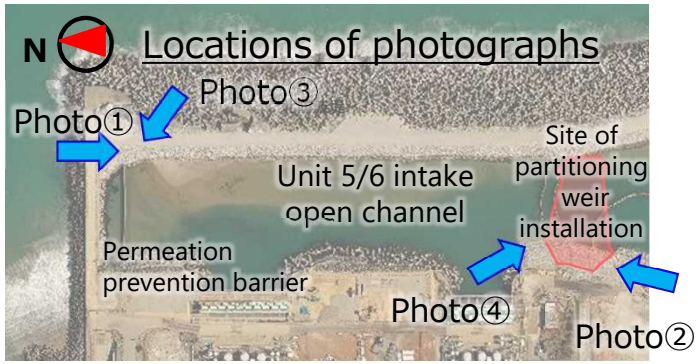


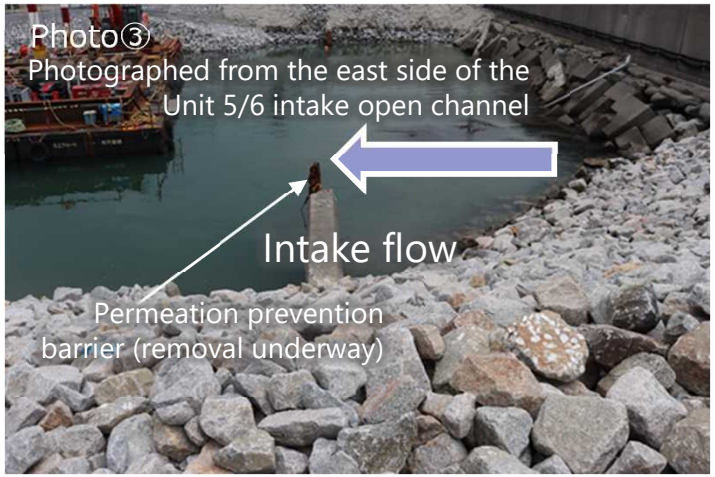


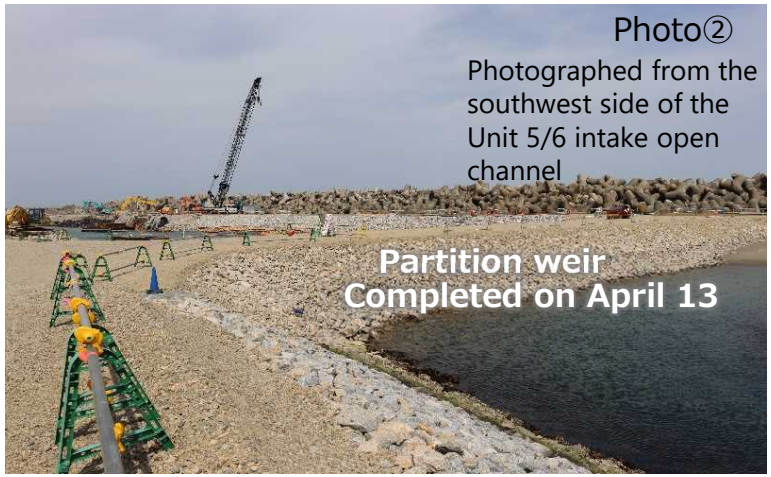
Concept drawing of light buoy and sinker block

1. Status of construction (cont.)

- Other (building a partition weir, etc.)
  In the Unit 5/6 sea-side work area, sediment was removed from the open intake channel (dredging), and construction of the partition weir was completed on April 13. Since April 18, we have been removing a portion of the permeation prevention barrier.
  Sediment removal (dredging) should be completed by the middle of June.







Work area on the sea-side of Units 5/6

(Reference) Results of the seawater monitoring of the Units 5/6 open intake channel while in construction

- Overview

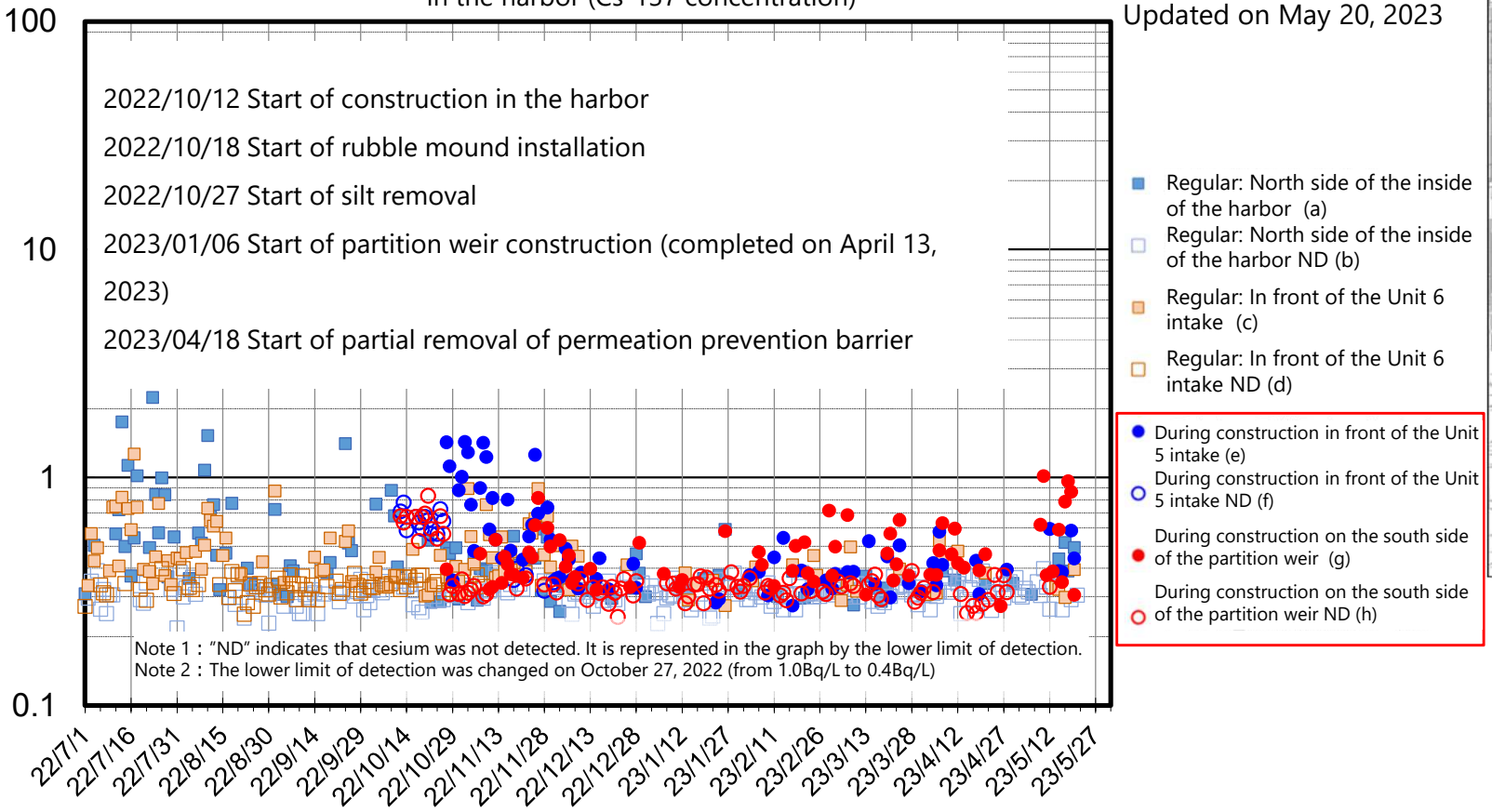
While construction was being performed inside the Unit 5/6 open intake channel, a pollution prevention fence was installed in front of the intake to reduce the amount of radioactive materials in the water taken into Units 5/6. Seawater sampling found that the concentration of cesium in the seawater did not increase due to construction.

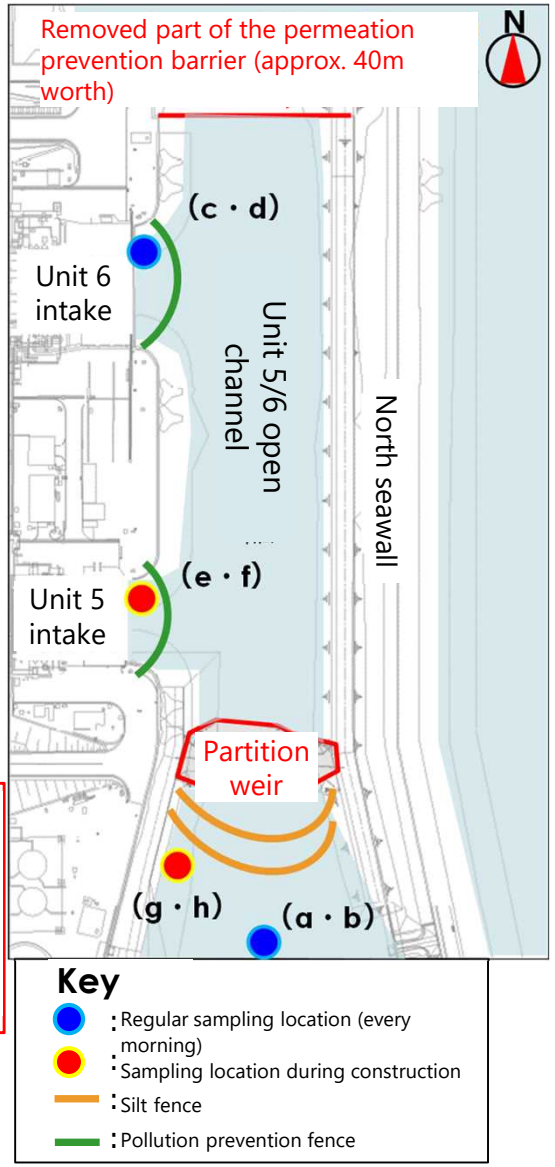
- Results

As of May 20, 2023, no significant fluctuation in the cesium concentration in seawater has been found. We will continue to suitably monitor seawater while working on the Unit 5/6 open intake channel.

Results of seawater monitoring during construction in the harbor (Cs-137 concentration)

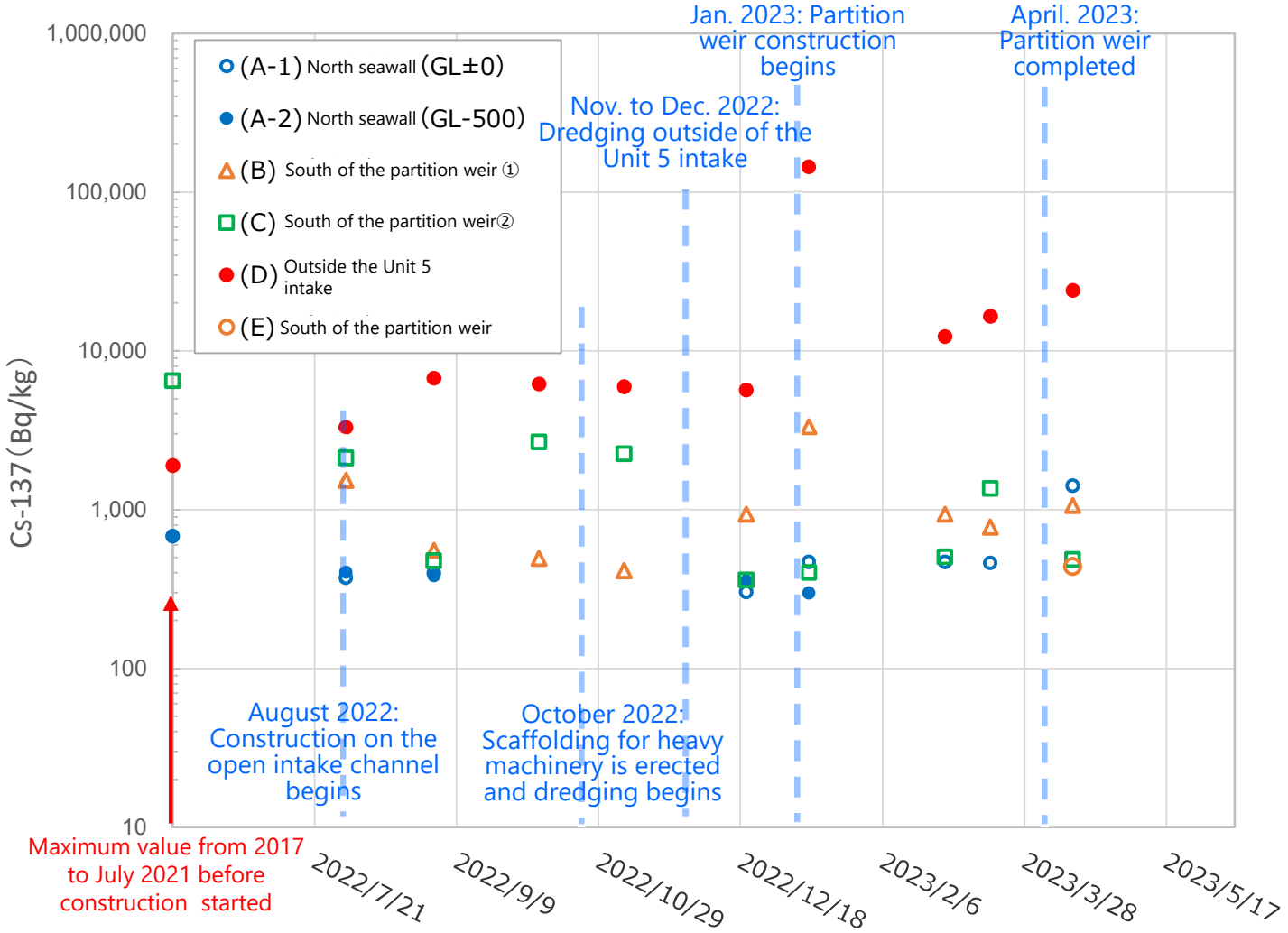
Updated on May 20, 2023

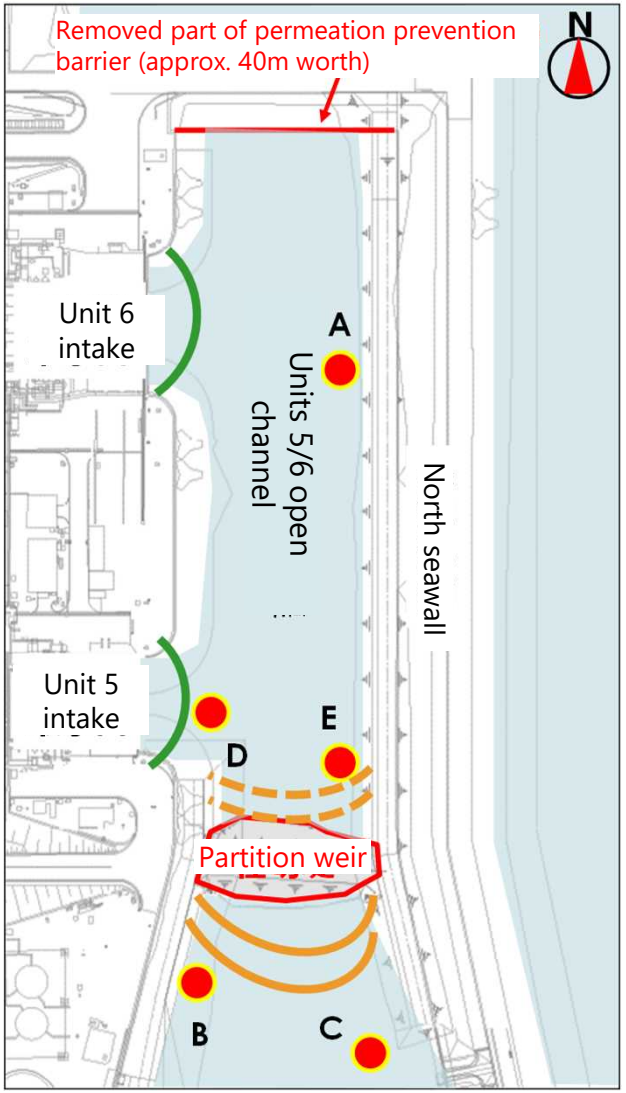




(Reference) Results from seabed soil monitoring during Unit 5/6 open intake channel construction

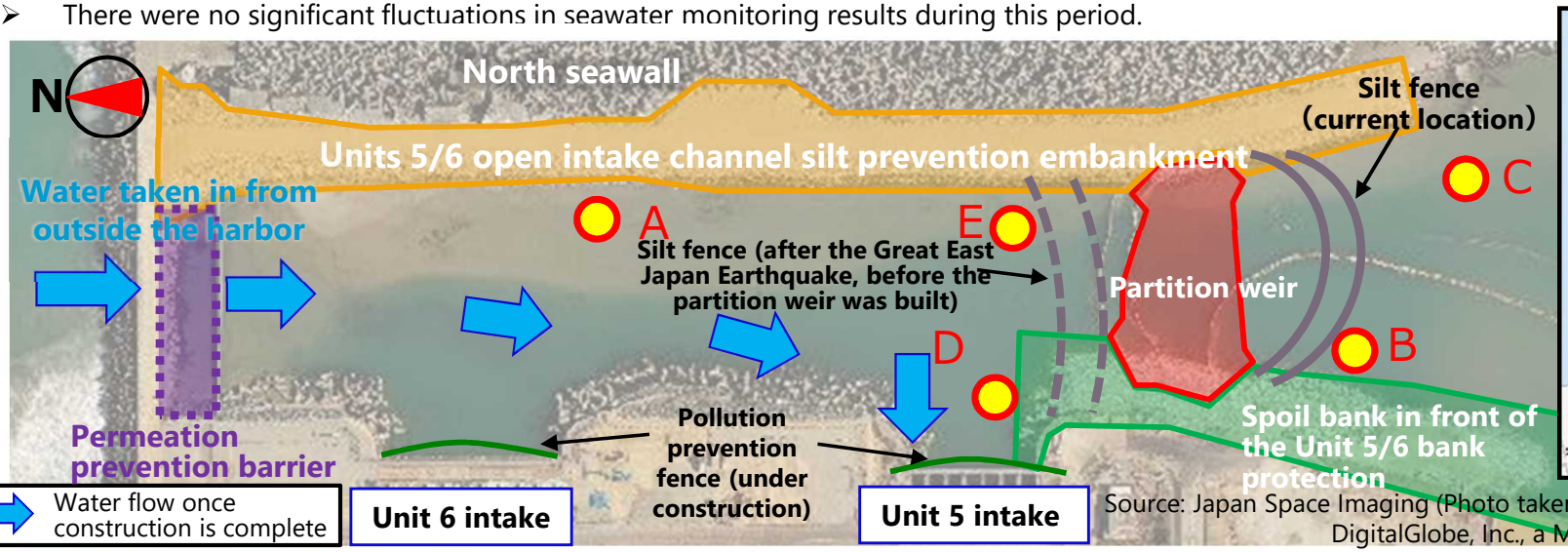
- Results from seabed soil monitoring performed before and during construction are shown below.
- While there had been no significant fluctuations in measurements taken near the Unit 5 intake until December 2022, after construction began values increased in January 2023 and have been high ever since.
- There have been no significant change in the seawater values measured in the same period.

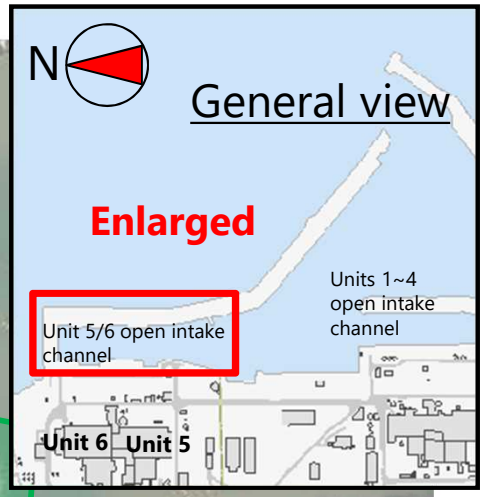




(Reference) Results from seabed soil monitoring during Unit 5/6 open intake channel construction

- Point A is where sand with relatively low concentrations of radioactive material flowed in from the north seawall side and accumulated after the Great East Japan Earthquake.
- Points B and C are where sand with relatively high concentrations of radioactive material flowed in from the Units 1~4 open intake channel side and accumulated.
- Point D is where the silt fence was located immediately after the Great East Japan Earthquake. Sand with relatively high concentrations of radioactive material from the Units 1~4 open intake channel side was caught in the silt fence and accumulated in the vicinity.
- There were no significant fluctuations in seawater monitoring results during this period.





Sampling points		Before construction	2022					2023			
		2017 to July 2021	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
A-1 North side of the Unit 5/6 open channel (North side of the silt fence GL±0m)	Cs-134	4.4～52.3	33.2	36.0	–	–	31.5	37.2	39.8	39.8	40.1
	Cs-137	163.6～678.6	371.6	398.8	–	–	303.2	468.1	460.2	460.2	1,414.0
A-2 North side of the Unit 5/6 open channel (North side of the silt fence GL-0.5m)	Cs-134	14.4～58.5	33.6	32.5	–	–	38.3	33.4	※Only sampled from the surface (GL±0m) since sand was removed during dredging		
	Cs-137	310.0～689.8	404.0	383.2	–	–	356.4	299.1			
B South side of the partition weir ① (South side of the silt fence)	Cs-134	723.0	34.5	42.1	65.6	55.4	46.7	73.9	49.1	43.1	62.6
	Cs-137	6,475.0	1,528.0	553.9	492.4	412.8	936.0	3,331.0	936.1	777.0	1,061.0
C South side of the partition weir ② (South side of the silt fence)	Cs-134	183.0	51.3	47.2	68.7	59.7	51.8	40.3	30.9	40.3	44.6
	Cs-137	1,893.0	2,114.0	476.0	2,671.0	2,242.0	360.8	400.5	503.5	1,356.0	485.9
D Unit 5 intake	Cs-134	—	101.6	184.0	213.7	160.4	108.7	3,546.0	167.4	472.0	690.7
	Cs-137	—	3,301.0	6,714.0	6,198.0	5,941.0	5,678.0	144,000.0	12,290.0	16,972.0	24,760.7
E North side of the partition weir	Cs-134	—									42.8
	Cs-137	—									437.1

※Figures in grey were below the detection threshold.

Within the Unit 5/6 open intake channel, the area near the partition weir (silt fence) is showing relative high concentrations of radioactive material.

(Reference) Results from seawater monitoring during discharge outlet caisson installation

TEPCO

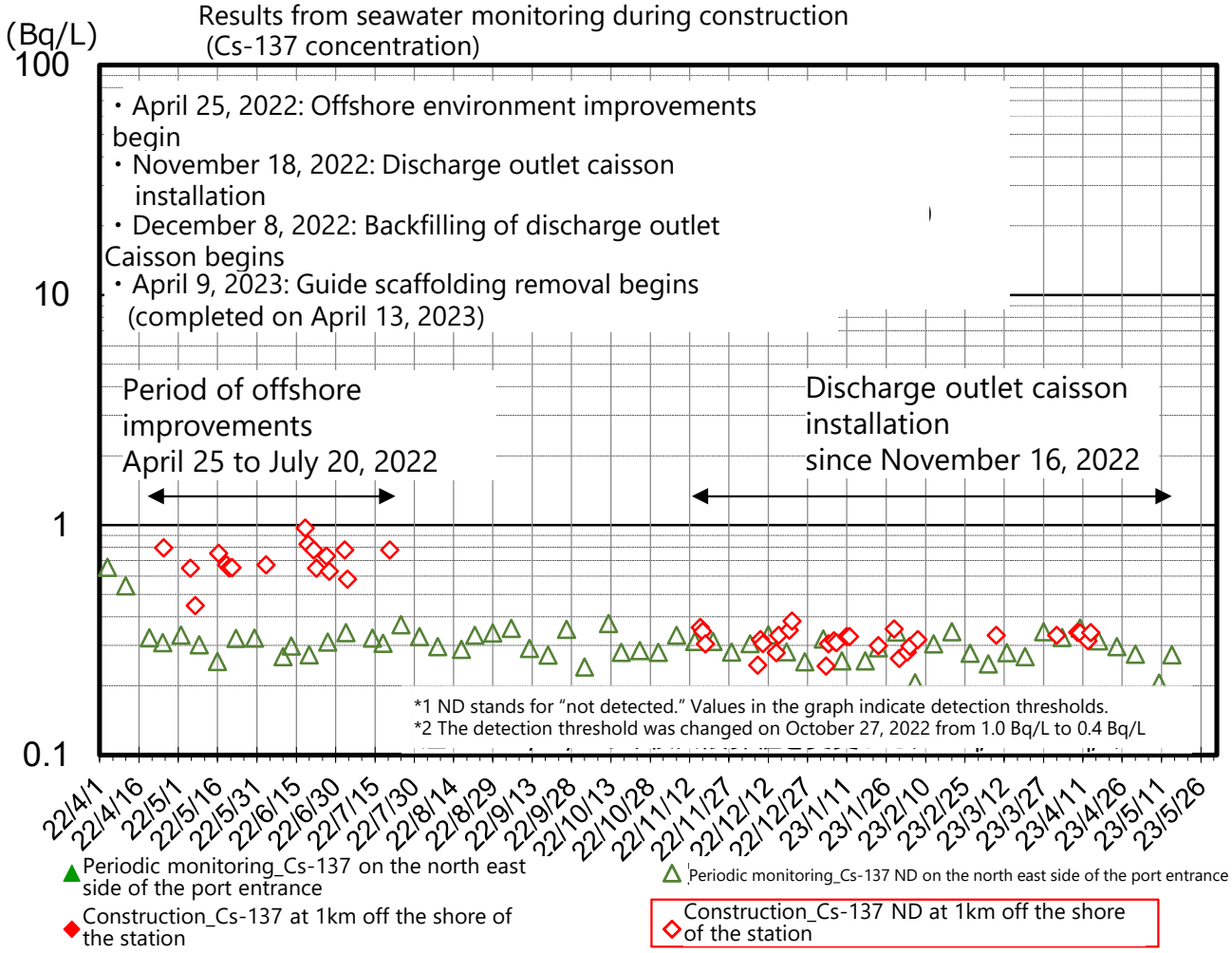
➢ Overview

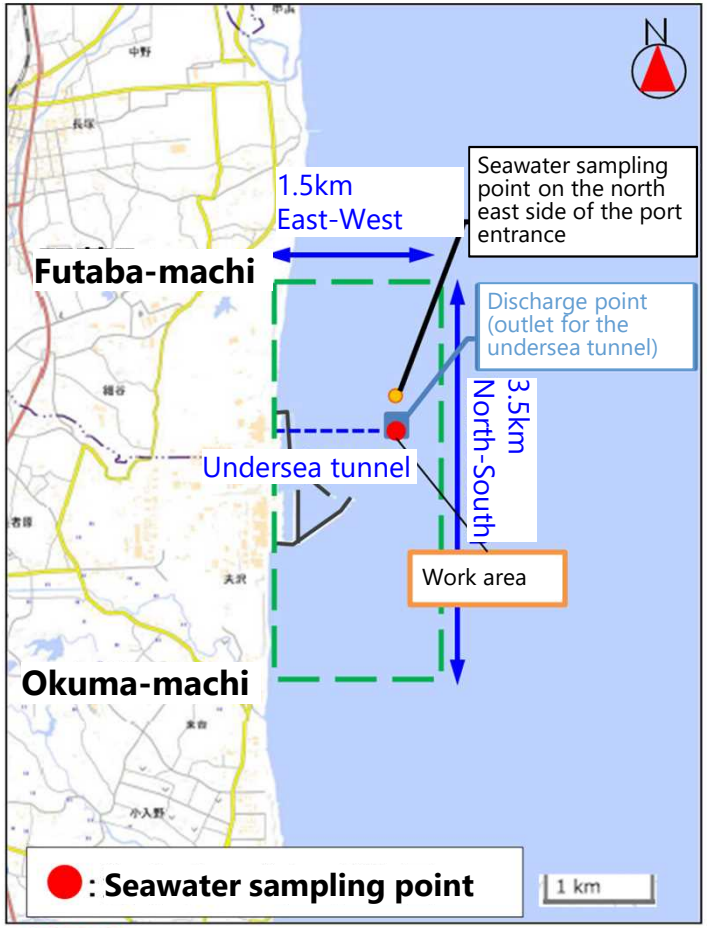
Seawater was sampled during offshore discharge outlet caisson installation, etc. *1 and results confirmed that cesium concentrations did not increase in conjunction with the construction.

➢ Results

*1 Discharge outlet caisson installation and backfilling, and related preparation and cleanup work

Monitoring results taken as of May 20, 2023 cesium has not been detected (ND) and there have been no significant fluctuations in seawater cesium concentrations. We will continue to appropriately monitor seawater during offshore construction.





(Reference) Results from turbidity measurements during discharge outlet caisson installation

TEPCO

➢ Overview

Turbidity measurements were taken using a turbidity meter at four locations at the work area boundary during offshore discharge outlet caisson installation, etc. *1, and results confirmed that turbidity outside of the work area had not increased in conjunction with the construction.

*1 Discharge outlet caisson installation, backfilling, and related preparation and cleanup work

➢ Results

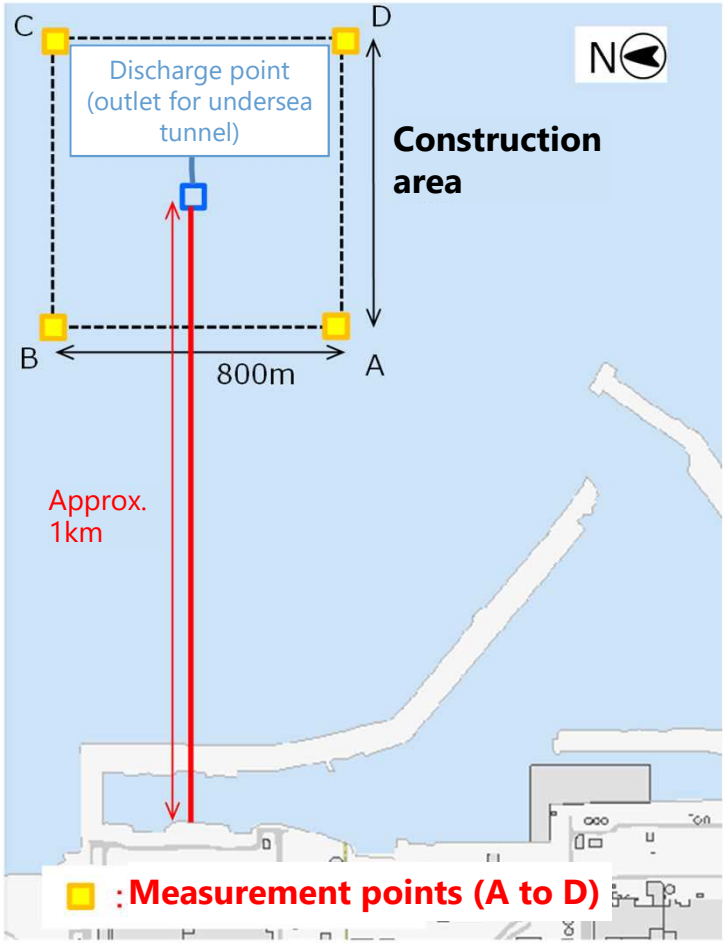
Turbidity measurement results taken as of May 20, 2023 were all below the control value*2. Visual inspection of turbidity has found that turbidity outside of the work area has not increased in conjunction with construction. We will continue to suitably measure turbidity during offshore construction.

*2 Control value
Turbidity has been converted to SS (suspended solids; mg/L). It is confirmed that SS do not exceed the BG threshold (measurement taken before construction began) +10mg/L.

Work date (measurement date)	Turbidity measurement results							
	A		B		C		D	
Jan 31, 2023	○	(2.3)	○	(2.1)	○	(1.5)	○	(1.5)
Feb 3, 2023	○	(1.7)	○	(1.5)	○	(1.8)	○	(1.6)
Feb 4, 2023	○	(1.8)	○	(1.6)	○	(1.5)	○	(1.5)
Feb 7, 2023	○	(2.2)	○	(2.1)	○	(1.5)	○	(1.5)
March 9, 2023	○	(6.4)	○	(4.9)	○	(3.4)	○	(3.1)
April 1, 2023	○	(3.9)	○	(4.5)	○	(3.7)	○	(4.8)
April 9, 2023	○	(15.2)	○	(15.6)	○	(8.9)	○	(8.8)
April 10, 2023	○	(8.1)	○	(7.9)	○	(6.2)	○	(7.9)
April 13, 2023	○	(13.6)	○	(9.4)	○	(7.7)	○	(7.2)
April 14, 2023	○	(8.3)	○	(7.6)	○	(6.9)	○	(9.4)

Criteria: Less than control value ○; More than control value ×

*Results for the last ten days. It is also confirmed that past results are below the control value.



(Reference) Overview of the ALPS treated water dilution/discharge facility and related facilities

TEPCO

Secondary treatment facility（newly installed reverse osmosis membrane facility）

Secondary treatment of treated water to be re-purified (sum of the ratios of nuclides, excluding tritium, is between 1 and 10)

Secondary treatment facility（ALPS）

Secondary treatment of Treated water to be re-purified (sum of the ratios of nuclides, excluding tritium, is 1 or higher)

ALPS treated water, etc. tanks

Measurement/confirmation facility (K4 tank group)

Comprised of three sets of tank groups each with the role of receiving, measurement/confirmation, and discharge. In the Measurement/confirmation stage, water that has been made homogenized through circulation and agitating is sampled and analyzed (approx. 10,000m³×3 groups)

Rotation

Discharge

Receiving

Measurement/ confirmation

Transfer facility

ALPS treated water transfer pump

Seawall

Installed around emergency isolation valves and transfer pipes

Flow meter/water flow rate control valve/ Emergency isolation valve (tsunami prevention measure)

Seawall

Header pipe

(diameter approx. 2m by length approx. 7m)

Emergency isolation valve

EL 33.5m

Seawater flow meter

Seawater pipe

EL 11.5m

Road

Vertical discharge shaft (Downstream storage)

EL 2.5m

Seawater transfer pump (3 units)

Discharge to sea

Unit 5 intake

Dilution facility

Vertical discharge shaft (upstream storage)

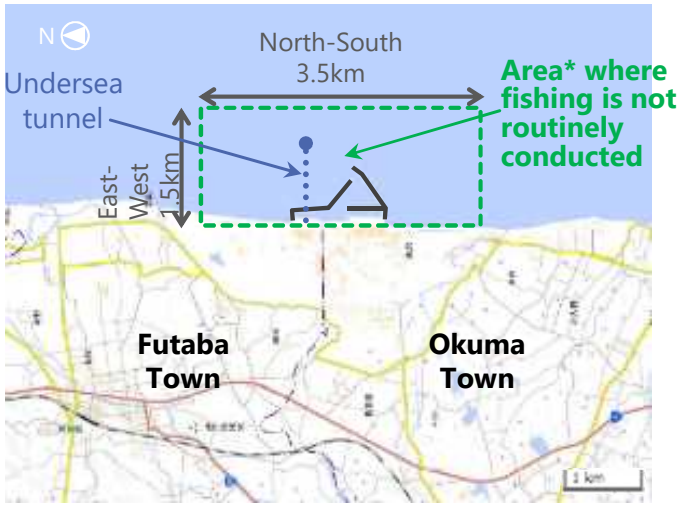
Discharge facility

Discharge tunnel (approx. 1km)

Uses the head differential equivalent to the loss in the discharge tunnel (difference between the height of the water in the downstream storage and the sea surface) to discharge water naturally.

Seawater used for dilution (intake from outside the harbor)

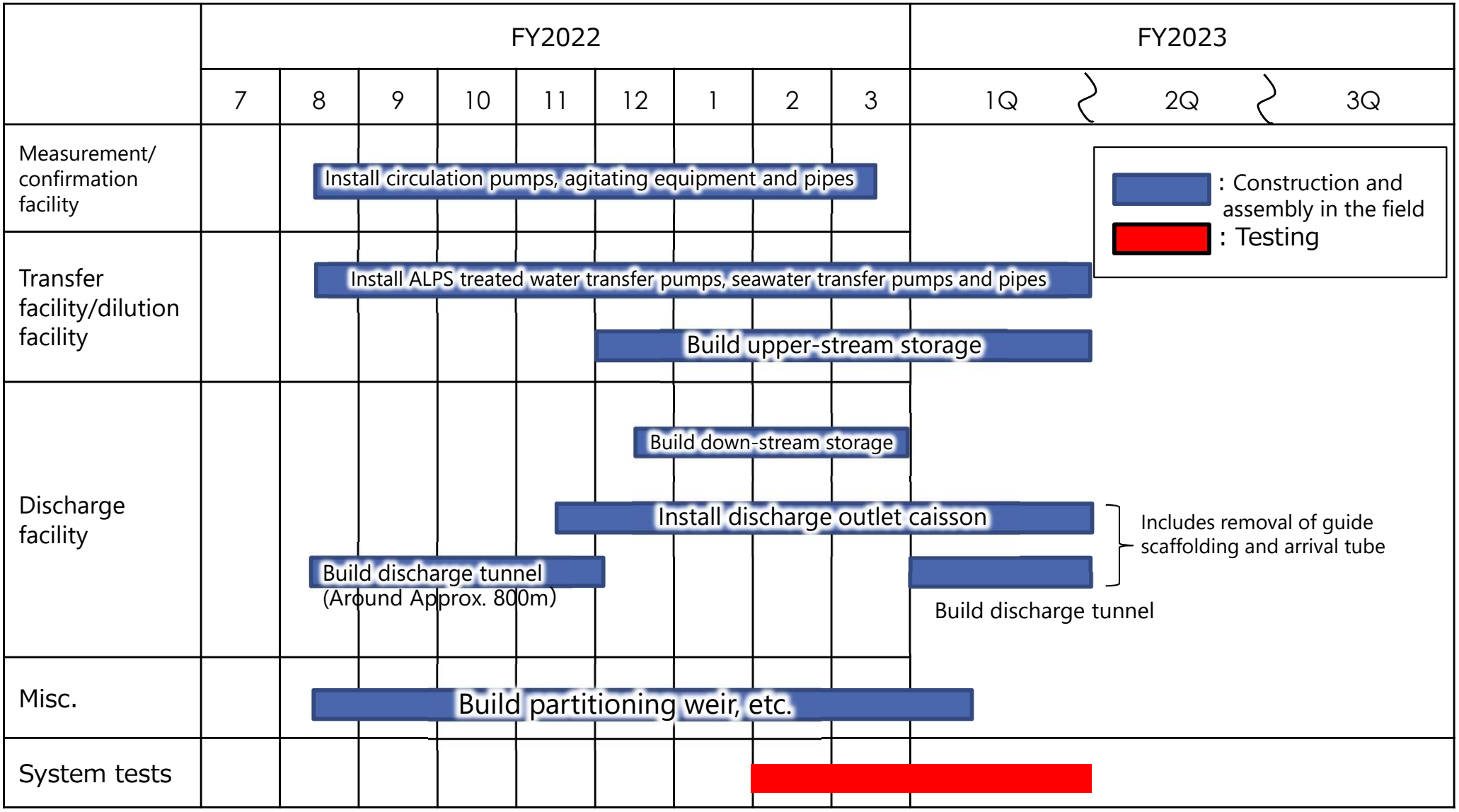
Source: Created by Tokyo Electric Power Company Holdings, Inc. based on a map from the Geospatial Information Authority of Japan (digital territory website) https://maps.gsi.go.jp/#13/37.422730/141.044970/&base=std&ls=std&disp=1&vs=c1j0h0k0l0u0t0z0r0s0m0f1



*Area where common fishery rights are not set

This diagram was printed in Document 1-1 used at the 8th Review Meeting on the Implementation Plan for the Handling of ALPS Treated Water

（Reference）Master Schedule



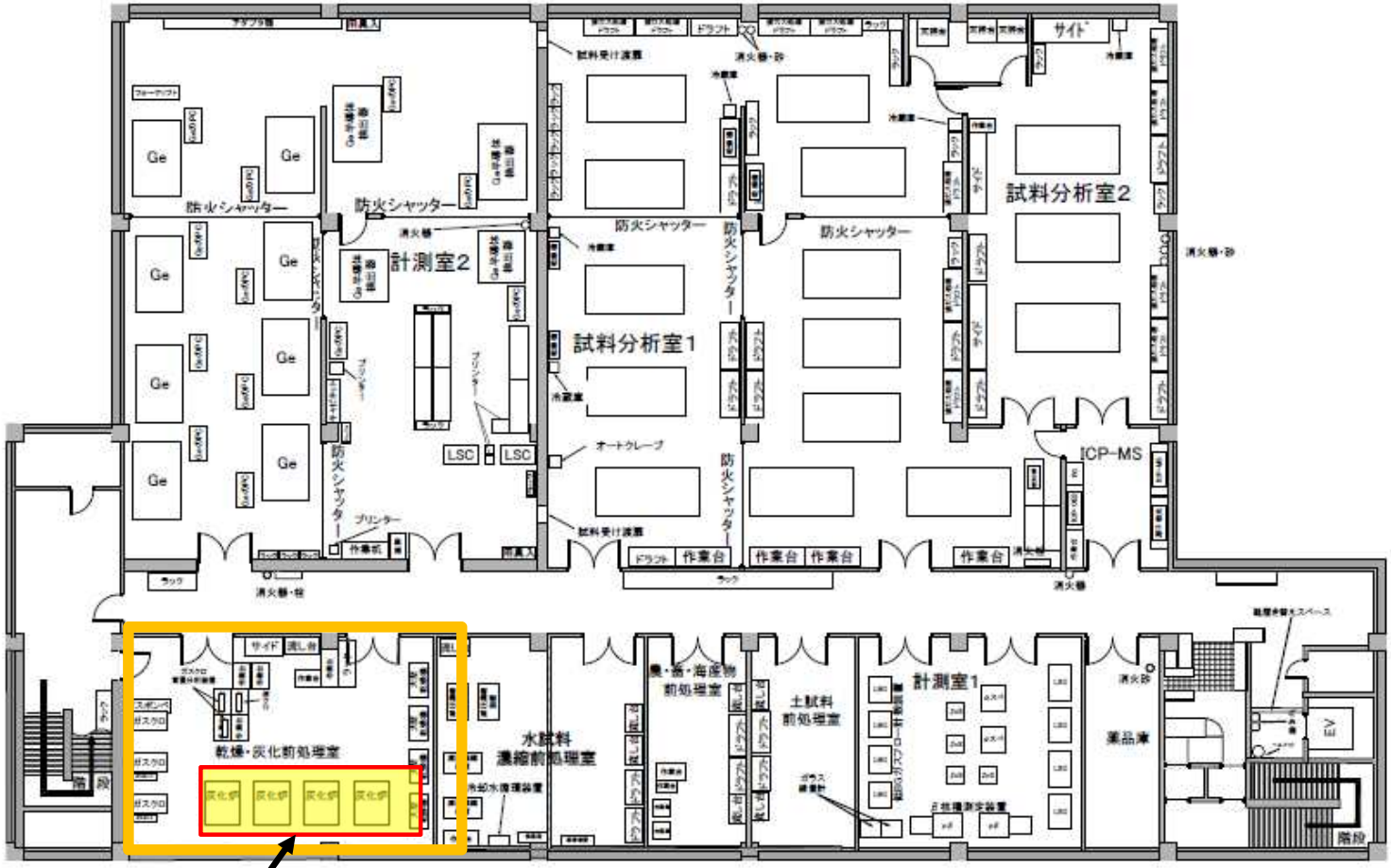
※The schedule may be revised based on progress and other factors.

2. Installation of electrolytic concentration devices

The 110th Secretariat of the Team for the Countermeasures for Decommissioning, Contaminated Water and Treated Water
January 26, 2023 (Partially revised)

TEPCO

- The four incinerators in the drying and incineration pre-processing room in the chemical analysis building were removed to install electrolytic concentration devices*.
- Eight electrolytic concentration devices were delivered to the site in December 2022 and concentration tests were completed in March 2023. Once comparison tests using actual samples have been completed, the devices will be used for analyzing seawater.



Electrolytic concentration devices were installed here

Chemical analysis building B1F

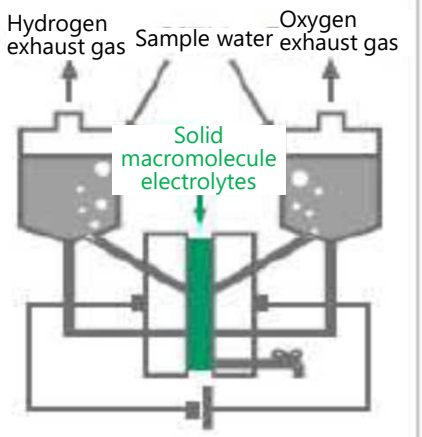
*Pre-processing device to analyze tritium in extremely low concentrations

2. Installation of electrolytic concentration devices （cont.）

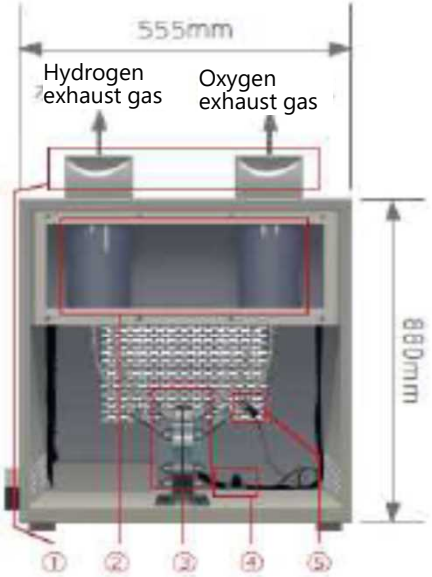
TEPCO

- To detect tritium that may exist at background levels in surface seawater, the tritium needs to first be concentrated through electrolysis*.
- The time required for analysis can take approximately one month to 45 days because of the electrolysis process but this allows measurements to be taken with lower detection limits.
- This method will also be used in the future for tritium analysis conducted at the Fukushima Daiichi NPS (analysis of free water tritium in marine organisms).

Device schematic



Electrolysis concentration unit



1) Electronic cooler
2) Sample water tank
3) Electrolysis tank
4) Sample water outlet
5) Liquid level sensor

(*) Concentration through electrolysis

Water releases hydrogen and oxygen during electrolysis. The reactivity speed of hydrogen is as follows:

$^{1}H > {}^{2}H > {}^{3}H$ (tritium)

This means that tritium water is less easily electrolyzed. This attribute of tritium is leveraged to concentrate the tritium through electrolysis.

【Specifications】

- Concentrates 500mL of distilled sample water into 60mL over three days through electrolysis
- Hydrogen and oxygen are released as electrolysis products.

*Descriptions taken from the De Nora Permelec, Ltd. website