Status of Progress of the installation of ALPS treated water dilution/discharge facility and related facilities

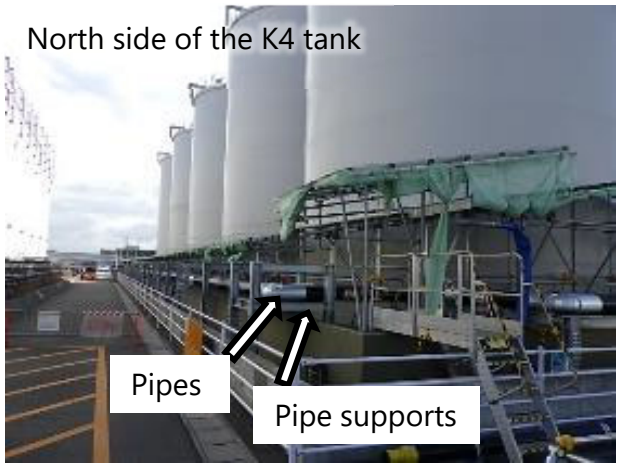
March 30, 2023

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 from the area around K4 tank area.
Pre-service inspection was started on January 16.



Installing circulation pipes and pipe supports

Circulation pump

Installing the piping supports/pipes

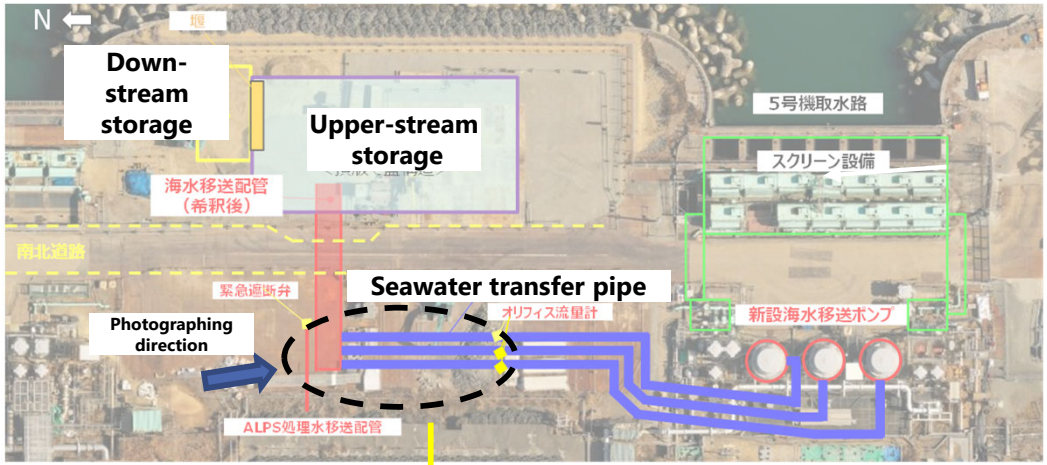
【 Measurement/confirmation facility 】
・Supports
Approx. 540 out of approx. 540m
・Pipes
Approx. 1,000 out of approx. 1,000m

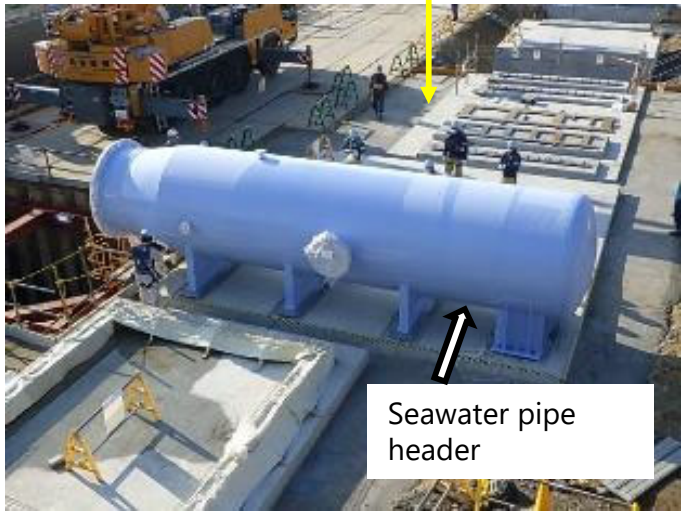
【Transfer facility】
・Supports
Approx. 1,403 out of approx. 1,500m ※1
・Pipes
Approx. 1,363 out of approx. 1,500m ※1
※1 Descriptions have been revised
<As of March 27>

【Measurement/confirmation facility】
March 15
・Received the use inspection completion certificate
March 17～27
・Started circulation/agitation operation
March 27
・Took samples from the B tank group

■ Dilution facilities

The foundation shafts for the seawater transfer pipes have been installed. The frame of the foundation is currently being built.



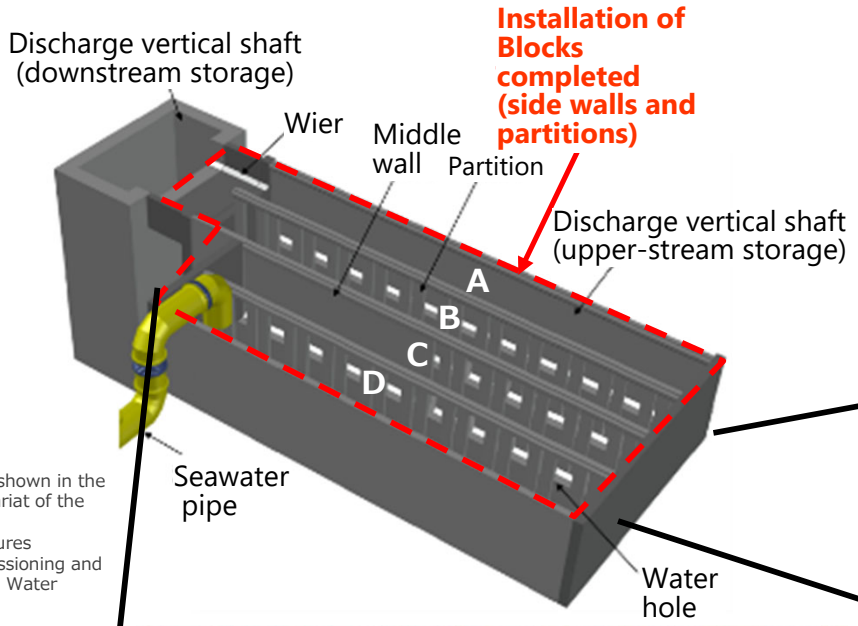


Building the seawater transfer pipes foundation and installing the seawater pipe header

【Dilution facilities】
・Constructing the foundation of pipe foundation
8 out of 11 complete
・Support facility
0 out of 320 m complete
・Pipe facility
0 out of 320 m complete
<as of March 27>

1. Progress in construction (cont.)

- Dilution facility: Discharge vertical shaft (upper-stream storage)
  The installation and assembly of the block (manufactured outside of the premises) was started on January 12. Concrete casting for the base began on February 9.



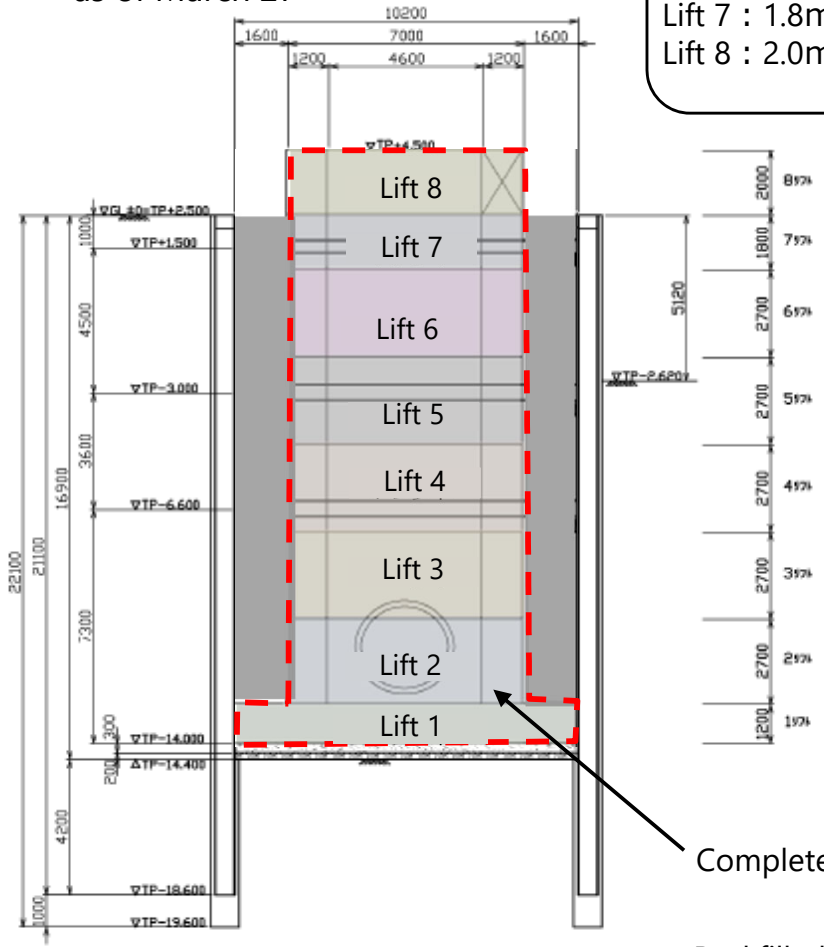
The image is shown in the 110th Secretariat of the Team for the Countermeasures for Decommissioning and Contaminated Water Treatment

1. Progress in construction (cont.)

■ Discharge facility: Discharge vertical shaft (down-stream storage)
Construction of the frame was started on December 18 and completed on March 23.

【Discharge facility】
・Down-stream storage: Frame building
8 out of 8 lifts complete
<as of March 27>

Height
Lift 1：1.2m
Lifts 2 through 6：2.7m
Lift 7：1.8m
Lift 8：2.0m



The image is shown in the 110th Secretariat of the Team for the Countermeasures for Decommissioning, Contaminated Water and Treated Water

Backfilled with slurry (lean-mixed concrete)

1. Progress in construction (cont.)

■ Discharge facility: discharge tunnel

Trial operation of the shield machine will be started on April 1. If there are no problems then, excavation will be restarted.

Tunnel excavation work includes work to connect the tunnel with the discharge outlet caisson and requires care. As such, we will continue to carefully calculate the time it will take to complete the excavation work.

【Discharge facility】

・Discharge tunnel: approx. 827m of digging complete <as of March 27>

Elevator used in tunnel work


Tip of the discharge tunnel

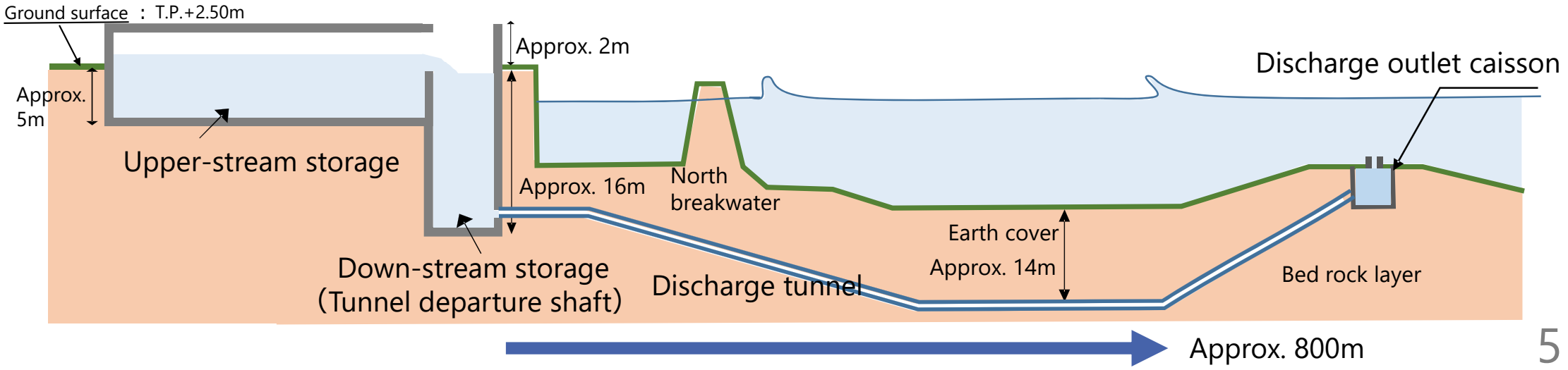

Inside the discharge tunnel

(Reference) Changes in the order of work conducted on the discharge facility

Based on the documents published on November 24, 2022

TEPCO

- Excavation of discharge tunnel work using the shield machine was started on August 4, and is progressing as planned (656 out of 1030 m completed <as of November 21>). There have been no leaks. The discharge outlet caisson installation was completed on November 18 and mortar and concrete will soon be poured around the caisson.
- During back filling around the caisson, the shield machine will be parked at a safe location in front of the caisson. Making full use of the time it takes to backfill the area, we will start working on building down-stream storage ahead of schedule.
- Specifically, the shield machine will be expected to reach the point of 800 m from the entrance of the discharge tunnel at the end of November, at which time excavation of the discharge tunnel will be halted. The preparation of the work on the down-stream storage will be started during the first half of December and the work on building the frame of the down-stream storage will be started in mid-to-late December.
- Once the construction of the down-stream storage is complete, discharge tunnel work will be restarted.



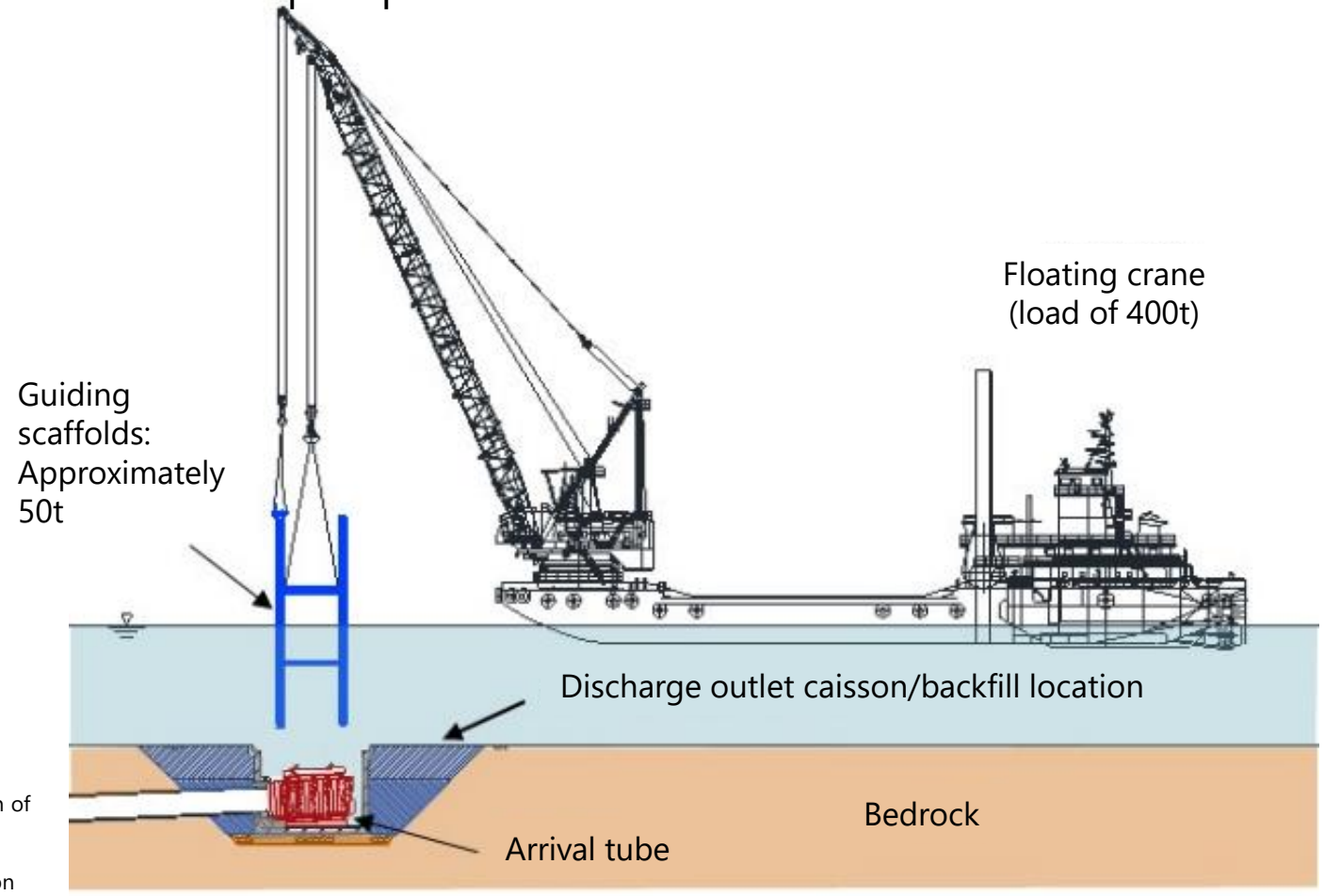
1. Progress in construction (cont.)

■ Discharge facility : discharge outlet caisson

Preparations to remove the temporary guiding scaffolds* for the caisson are underway.

*The guiding scaffolds is used to confirm the installation position of the caisson to ensure that the tunnel will arrive at the correct location.

Surveying equipment installed on the top of the guiding scaffolds, which is only a temporary structure, has been used to acquire positional data.

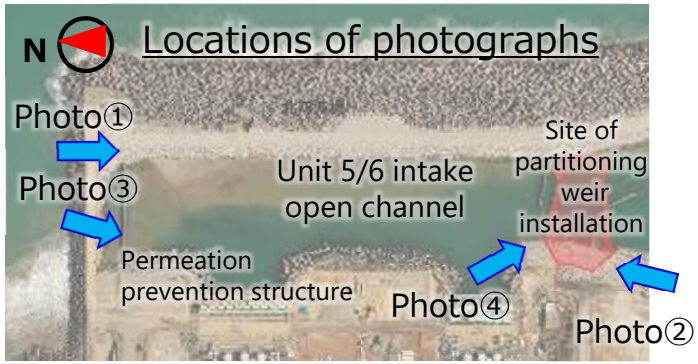


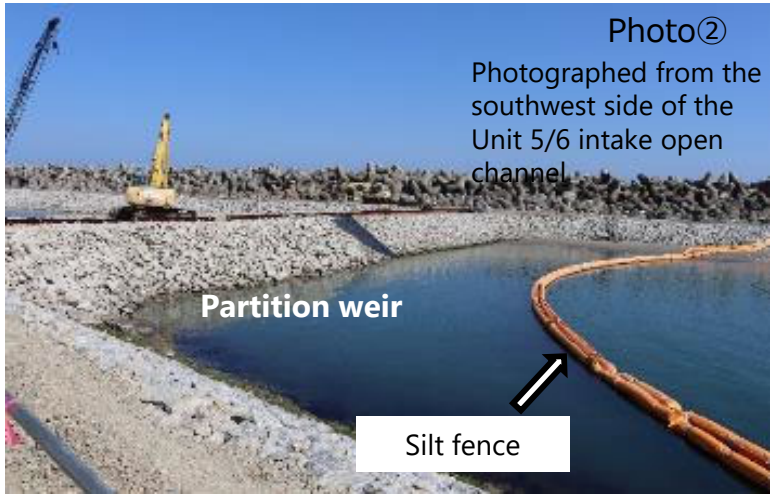
The image is shown in The Construction of ALPS Treated Water Dilution/Discharge Facilities and Ancillary Facilities at the Fukushima Daiichi Nuclear Power Station Commencement of the removal of temporary structures such as the guiding scaffolds (March 13,2023)

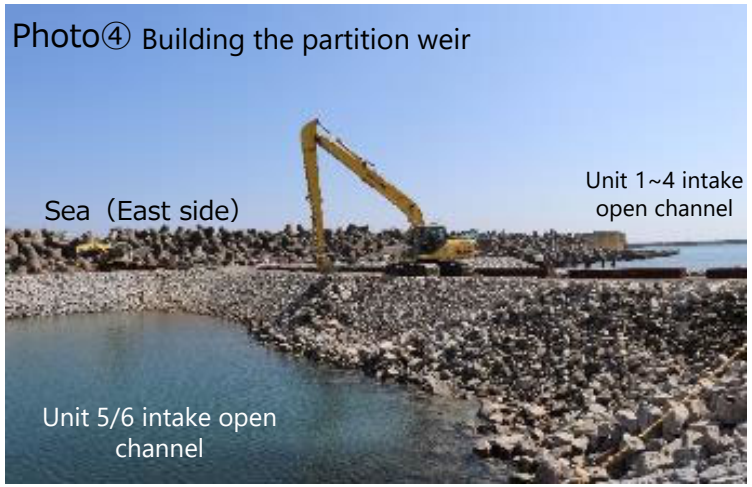
Removing temporary components such as the guiding scaffolds

1. Status of construction (cont.)

- Other (building a partition weir, etc.)
  In the Units 5 and 6 sea-side construction area, the heavy machinery scaffolding was completed on December 29. The scaffolding has been in use for building the upper-stream storage since January 5. The removal of silt from the open intake channel (dredging) and the building of the partition weir are being done simultaneously. Once the partition weir is complete, the permeation prevention wall will be removed.







Work area on the sea side of Units 5/6

(Reference) Results of seawater monitoring during the discharge outlet caisson installation

TEPCO

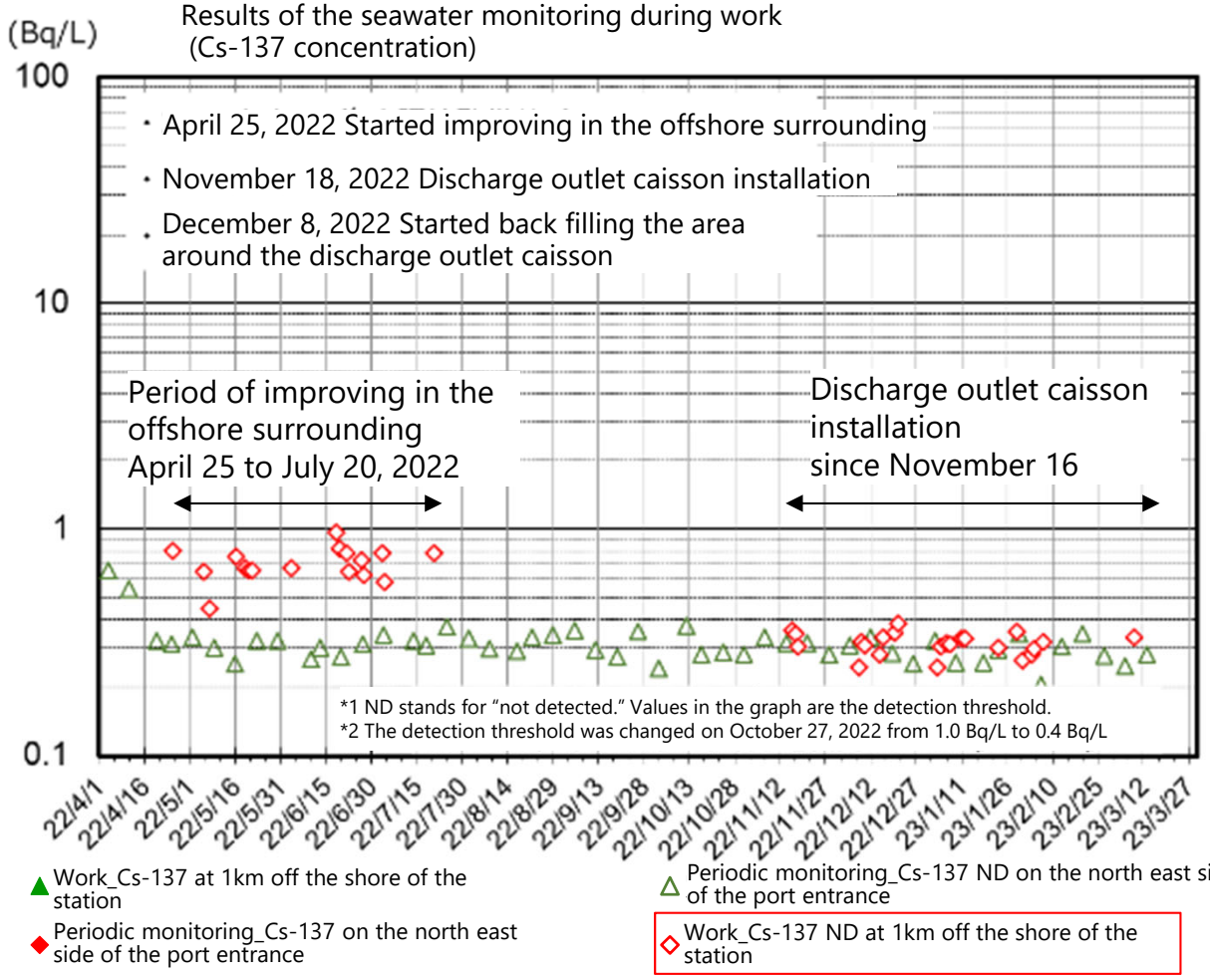
Overview

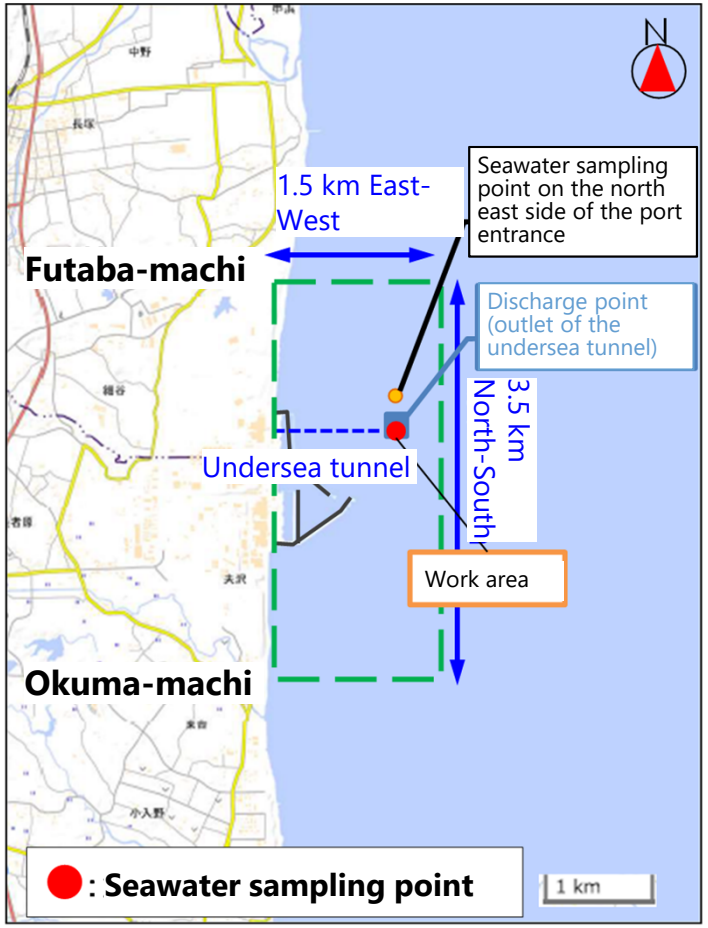
Seawater was sampled during the discharge outlet caisson installation, etc. *1 conducted offshore, and results confirmed that cesium concentration had not risen due to the work.

Results

*1 Discharge outlet caisson installation and backfilling work and associated preparation and cleanup work

Cesium up to the most recent samples taken March 27, 2023 have not been detected (ND) and there have been no significant fluctuations in seawater cesium concentrations. We will continue to appropriately monitor the seawater during the plant offshore work.





(Reference) Results of turbidity measurement during discharge outlet caisson installation

➢ Overview

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

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

➢ Results

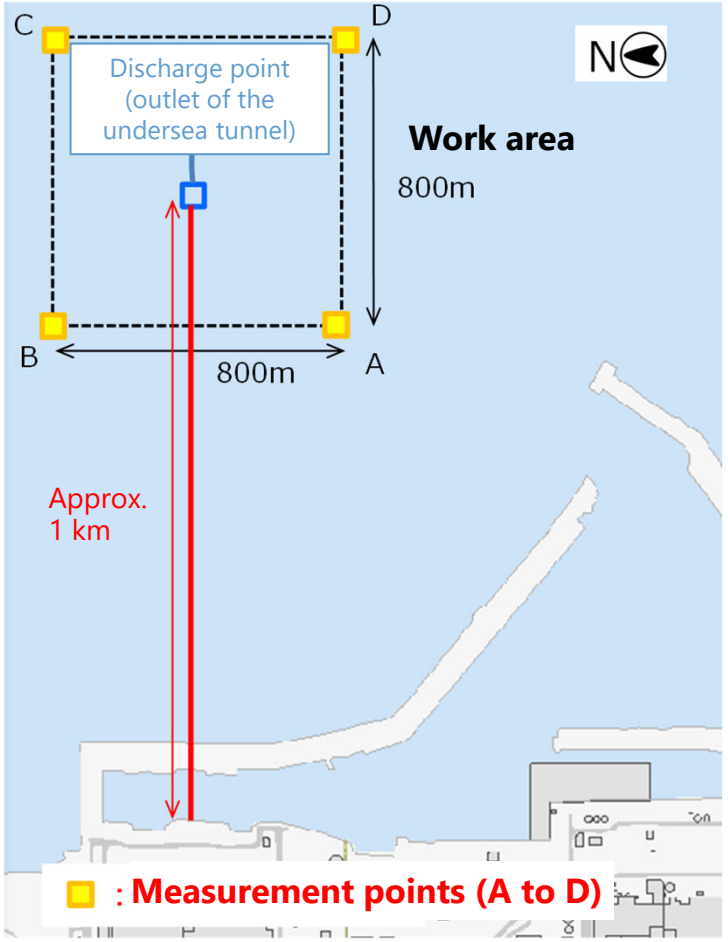
The turbidity measurements taken until March 27, 2023 were all below the control value*2. Visual inspection of turbidity has found that turbidity had not increased due to the work outside of the work area. We will continue to measure turbidity during the plant offshore work appropriately.

*2 Control value
Turbidity is converted to SS (suspended solids; mg/L). It is confirmed that SS does not exceed the threshold of BG value (measurement before work started) + 10mg/L.

Work date (measurement date)	Turbidity measurement results							
	A		B		C		D	
Jan 7, 2023	○	(1.8)	○	(1.7)	○	(1.8)	○	(1.5)
Jan 11, 2023	○	(2.2)	○	(1.6)	○	(1.6)	○	(1.5)
Jan 12, 2023	○	(2.3)	○	(4.4)	○	(2.8)	○	(2.7)
Jan 23, 2023	○	(2.9)	○	(4.1)	○	(1.8)	○	(2.4)
Jan 29, 2023	○	(2.5)	○	(1.5)	○	(1.5)	○	(1.6)
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)

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

*Results for the last ten days. The measurement results were less than the control values going back past the last ten days.



(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)

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)

Transfer facility

ALPS treated water, etc. tanks

Rotation

Discharge

Receiving

Measurement/ confirmation

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

Discharge vertical shaft (Down-stream storage)

EL 11.5m

Road

EL 2.5m

Seawater transfer pump (3 units)

Discharge to sea

Unit 5 intake

Dilution facility

Discharge vertical shaft (upper-stream storage)

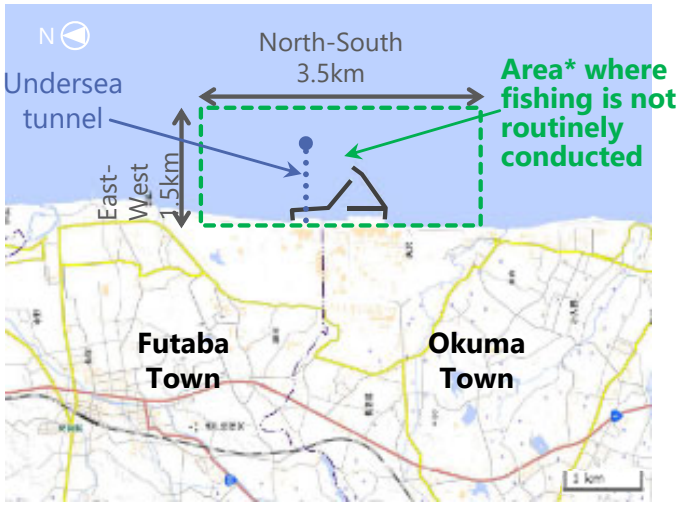
Discharge facility

Discharge tunnel (approx. 1km)

Use the differential head equivalent to the loss in the discharge tunnel (difference between the water surface in the down-stream storage and the sea surface) to discharge water naturally.

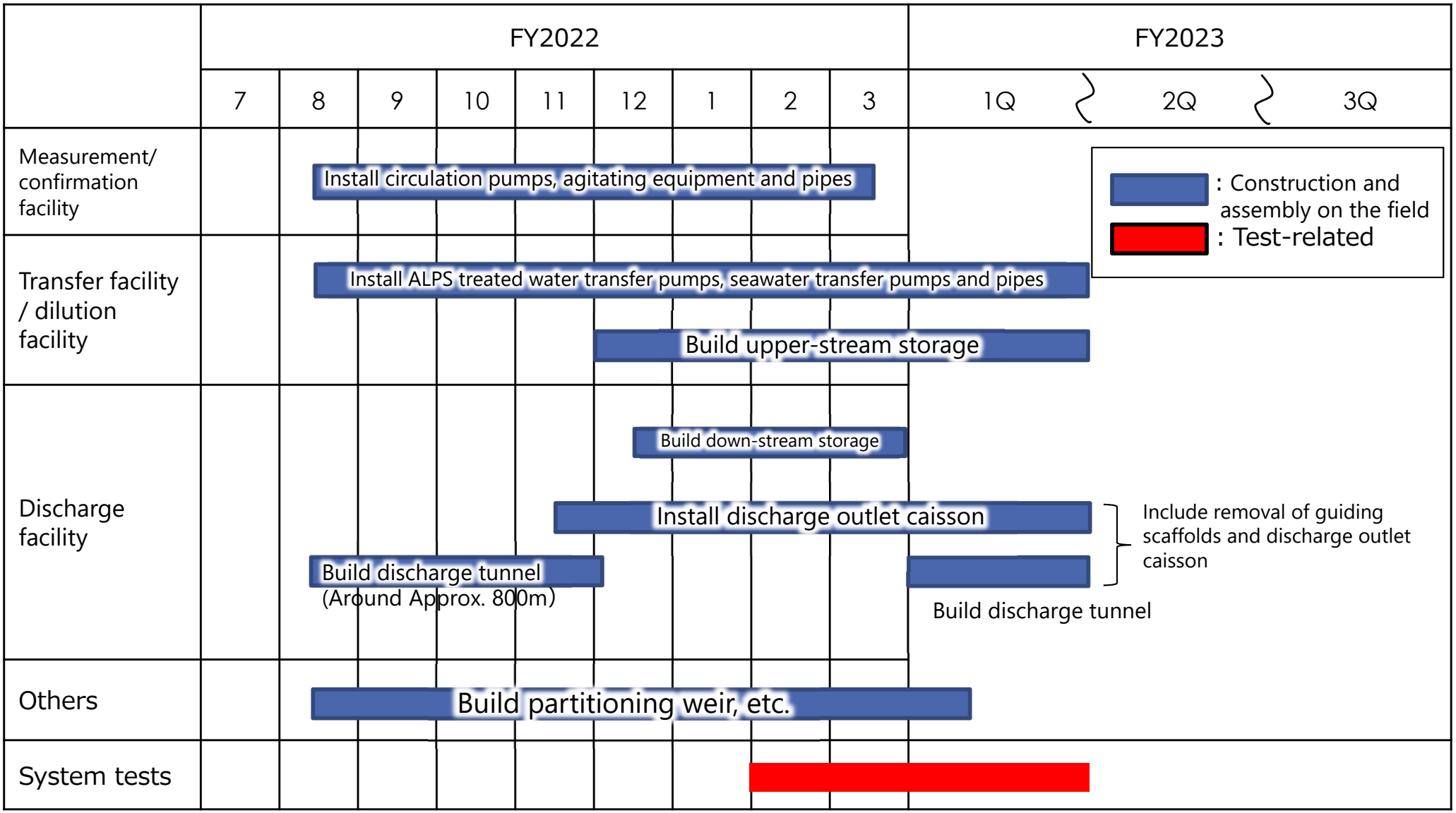
Seawater used for dilution (intake from outside the harbor)

Source: Developed by Tokyo Electric Power Company Holdings, Inc. based on the map developed by the Geospatial Information Authority of Japan (electronic territory web)
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

（Reference）The whole process



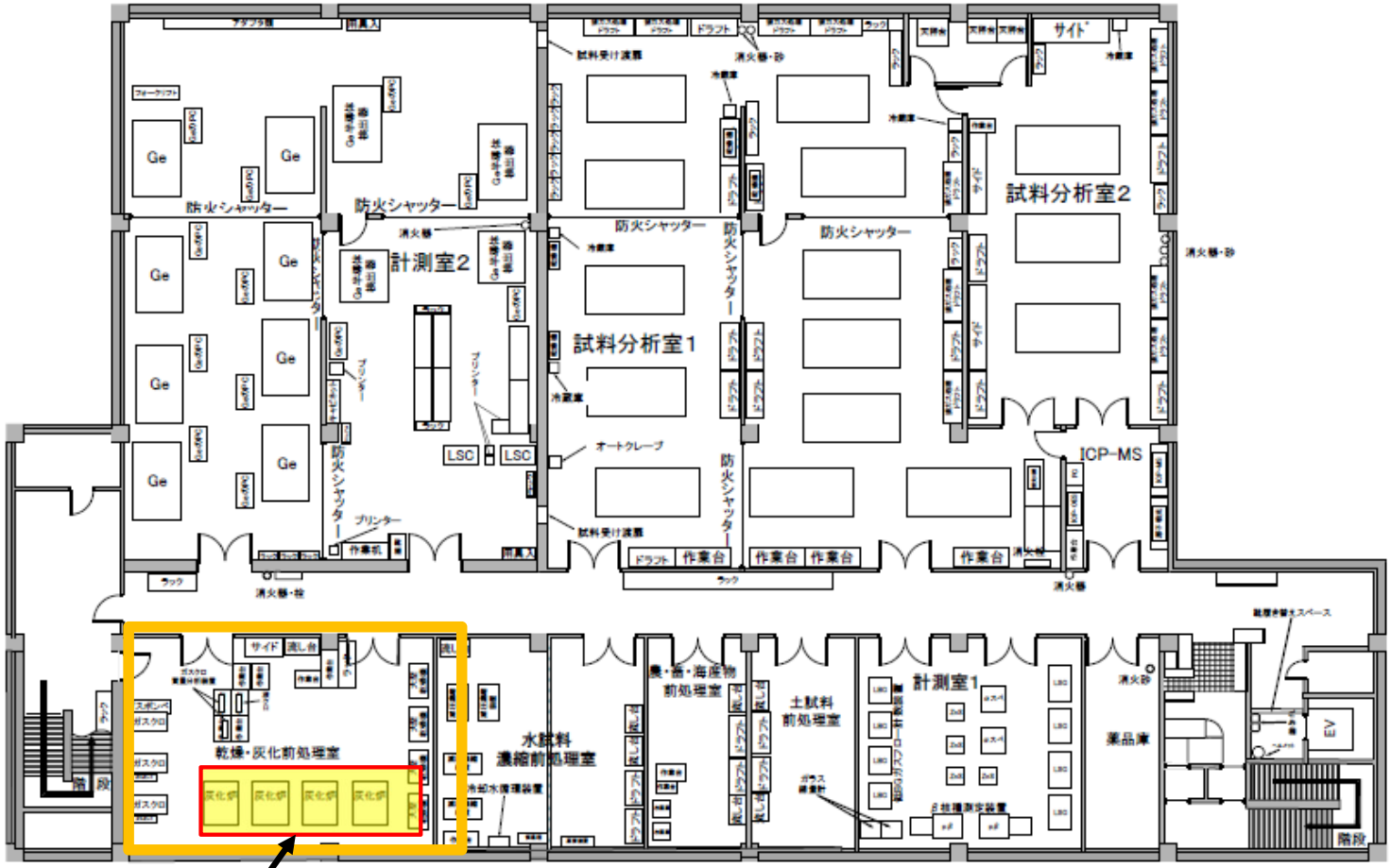
※The schedule may be revised based on progress made and other factors.

2. Installation of electrolytic accumulation devices

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

TEPCO

- The four incinerators in the drying and incineration pre-processing room in the chemical analysis building were removed to install the electrolytic accumulation devices*.
- 8 electrolytic accumulation devices have been delivered to the site as of December 2022 and concentration tests are scheduled to be completed by the end of March. Once comparison tests using actual samples are complete, the devices will be used in analyzing seawater.



Electrolytic accumulation devices to be installed here

Chemical analysis building B1F

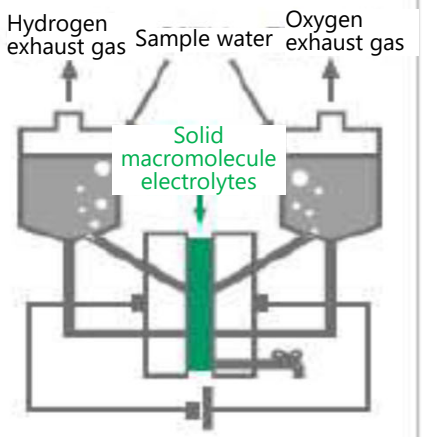
*Pre-processing device to analyze tritium in extremely low concentrations

2. Installation of electrolytic accumulation devices （cont.）

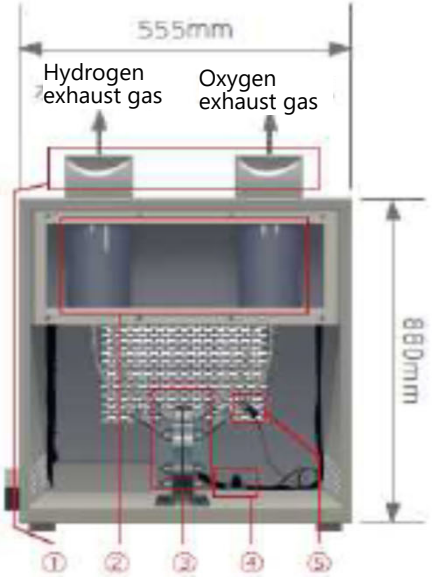
TEPCO

- To detect tritium that may exist in background levels in surface seawater, the tritium needs to be concentrated through electrolysis of the water*.
- The number of days required for analysis takes a month to 45 days more because of the electrolysis but this allows measurement with a lower detection limit.
- This method will be introduced in tritium analysis conducted at 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 gas through electrolysis. The reaction rate of becoming hydrogen gas is as follows:

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

This means that tritium water is less easily electrolyzed. Tritium is concentrated through electrolysis using this characteristic.

【Specifications】

- It can concentrate 1,000 mL of distilled sample water to 50 mL with around 60 hours.
- Hydrogen and oxygen are released as the electrolysis products.

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

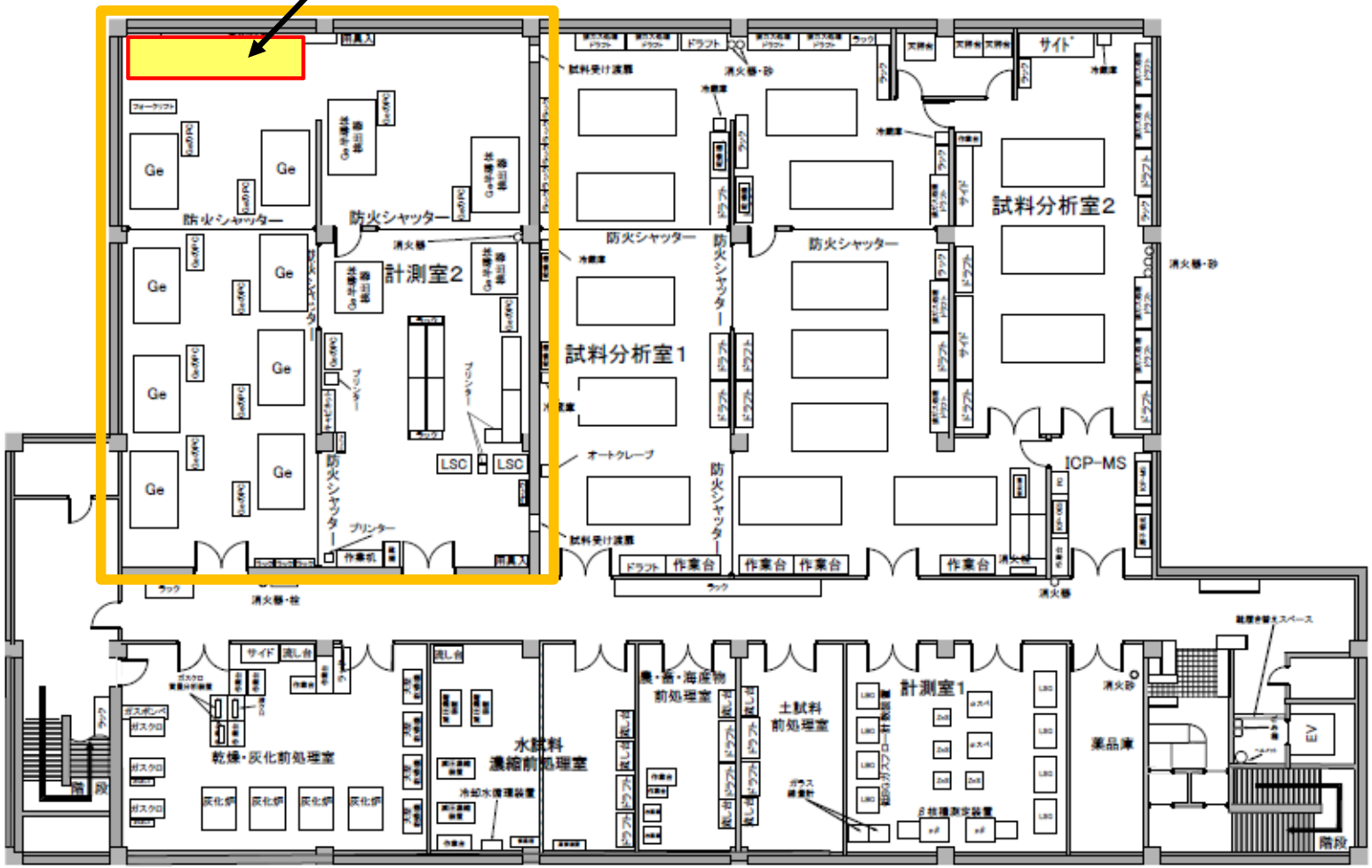
3. Low-energy photon germanium semiconductor detector (LEPS)

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

TEPCO

- Two low-energy photon germanium semiconductor detectors (LEPS) were installed in the measurement room in the chemical analysis building in December 2022. Once verification tests are completed at the end of March, the detectors will be used to measure ALPS treated water.

LEPS were installed here

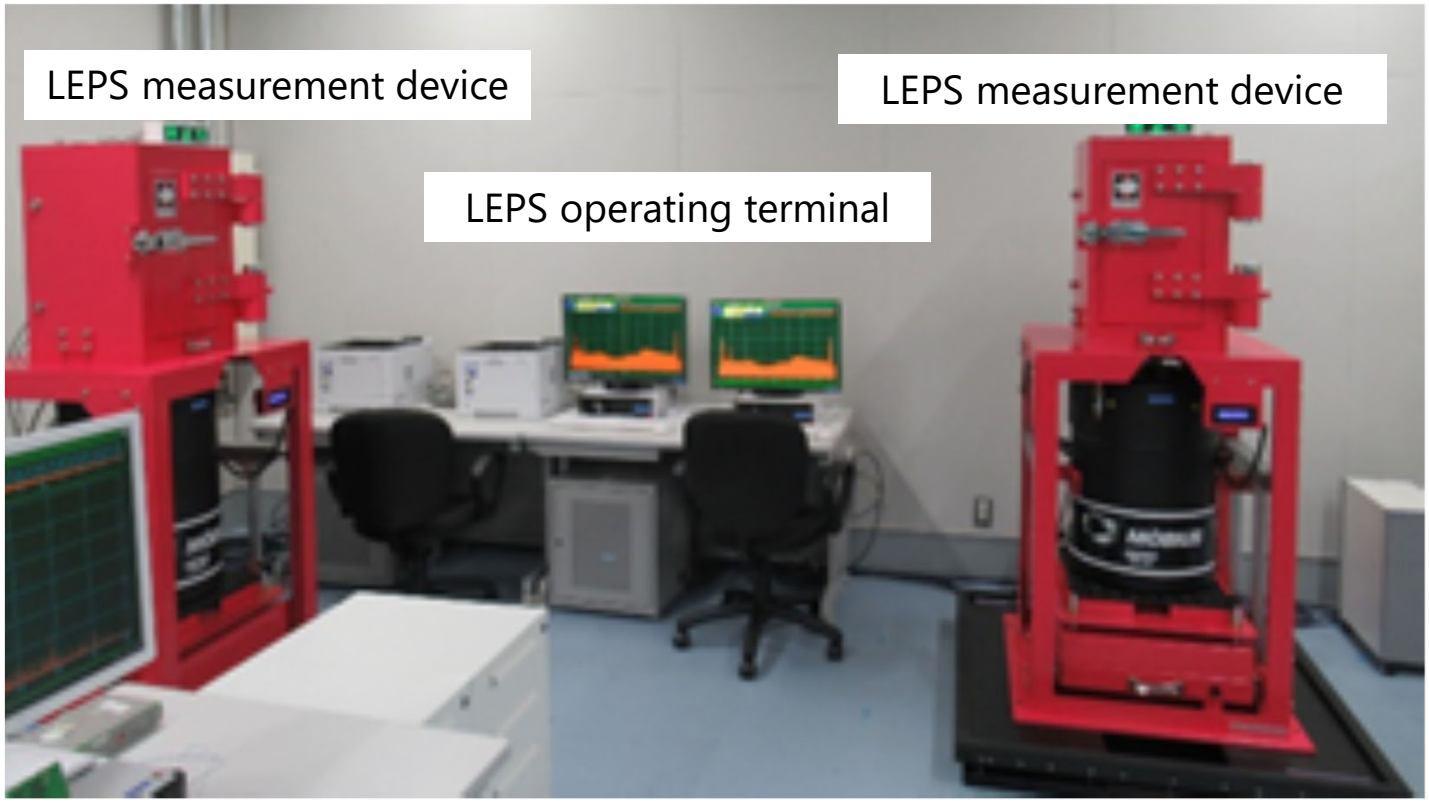


Chemical analysis building B1F

3. Low-energy photon germanium semiconductor detector (LEPS) (cont.)

TEPCO

- Nuclide analysis for those emit low-energy radiation such Fe-55 (nuclides other than the 62 nuclides subject to removal by ALPS) is required in ALPS treated water analysis.
- To conduct the nuclide analysis on Fukushima Daiichi premises, low-energy photon germanium semiconductor detectors (LEPS) will be newly installed.



LEPS
(Device in the chemical analysis building measurement room)

Reference: existing germanium semiconductor detector
(Photo of the device in the chemical analysis building measurement room)