Attachment 2

*Partial Revisions to the Application Document for Approval to Amend the Implementation Plan Regarding the Handling of ALPS Treated Water [Overview]

TEPCO

April 28, 2022

Tokyo Electric Power Company Holdings, Inc.

* This application is to make a partial revision to the application for amendment related to design, facilities and dose assessment, submitted in December 2021. An additional revision on other parts in the implementation plan will be submitted at a later stage for NRA's examination.

1-1. Overview of partial revisions to the implementation plan (1/2)

Newly added

TEPCO

Partial revised points and contents to the implementation plan	Slide No.
Chapter I Overall schedule for the specified nuclear facility and risk assessment	
Description about the placement within the overall schedule of the planned discharge of ALPS treated water into the sea, and the role it is expected to perform in reducing the overall risk in specified nuclear facility as a whole	–
Chapter II Design and facility of the specified nuclear facility	
Finalized the structural design of the discharge vertical shaft (upper-stream storage), in addition the assessment results for mixed dilution to reflect changes in the shape of the seawater pipe	6,10
The methods to homogenize the radioactive concentration of ALPS treated water before discharge into the sea and the appropriateness of the methods	11
The details about the structure and strength of the equipment, protections against natural phenomena such as earthquakes and tsunamis, measures to prevent erroneous operations, reliability etc.	–
Chapter III Security at the specified nuclear facility	
The details about necessary facilities, structure and procedures for responding to events where ALPS treated water is inadvertently discharged into the sea	12
The details about methods for seawater intake and methods for the discharge of ALPS treated water after dilution (including preventing transfer of radioactive materials in the bay to the seawater taken in)	8,10
The analysis methods and structure for ALPS treated water and selection policy for nuclides that could affect assessment	13,14
The methods to control the amount of tritium discharged within 22 trillion Bq/year	15,16

1-1. Overview of partial revisions to the implementation plan (2/2)

Newly added

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Partial revised points and contents to the implementation plan	Slide No.
Chapter VI Fostering understanding towards the implementation of the plan	
Added description of the the roles of the Decontamination & Decommissioning Information & Planning Management Office	–
Reference **Response based on the Japanese Government's "Basic Policy on the handling of ALPS treated water at the Tokyo Electric Power Company Holdings' Fukushima Daiichi Nuclear Power Station"**	
The details about TEPCO's response associated with the implementation plan, made in connection to the government policy	–
Revised the report on the assessment of radiological impact of the discharge into the sea on the surrounding environment	(Attachment 3)

2-1. Overview of ALPS Treated Water Dilution/Discharge Facility

Remain the original (partly erased)

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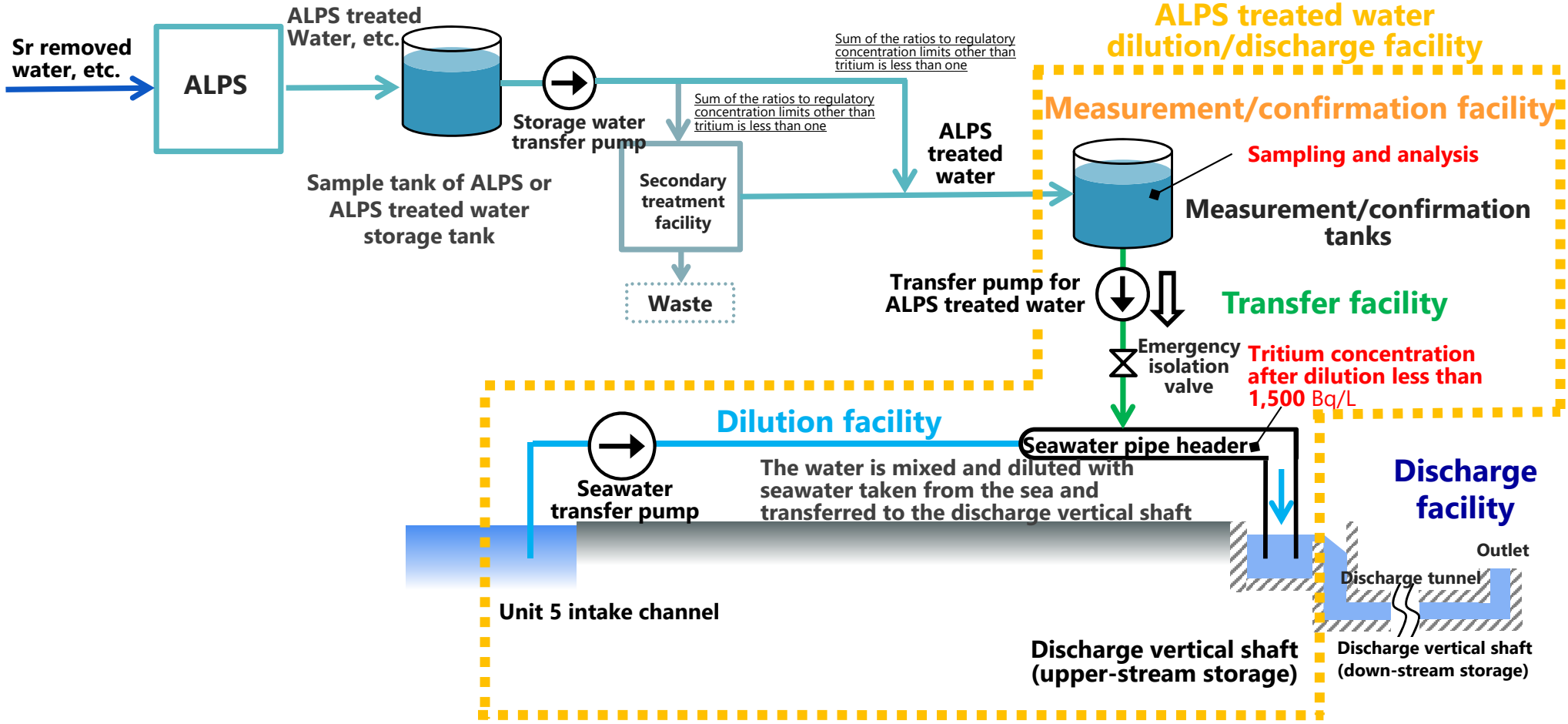
Objective

Water from which radioactive nuclides has been removed using ALPS until the radionuclide concentration is at a sufficiently low concentration, will be diluted with seawater and discharged into the sea after confirming that the water meets the regulatory requirements (water with the sum of ratios to regulatory concentration, excluding tritium, less than 1).

Facility overview

In the measurement/confirmation facility, once the radionuclide in the water in the measurement/confirmation tank are uniformly homogenized, samples are taken and analyzed to confirm the water meets regulatory standards. The ALPS treated water is then transferred to the seawater pipe header using the transfer facility and mixed with the seawater taken from the Unit 5 intake channel using the dilution facility until the tritium concentration is below 1,500 Bq/L. This is then discharged using the discharge facility.



2-2. ALPS Treated Water Dilution/Discharge Facility (Measurement/Confirmation Facility)

Remain the original (partly updated)

Underlined parts: Major areas of updated

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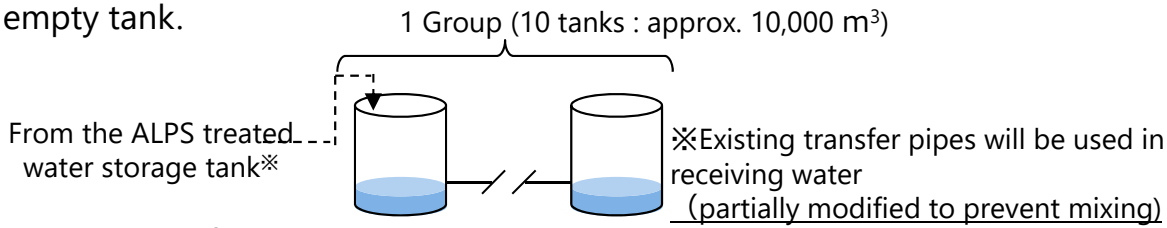
- Measurement/confirmation facility
  - K4 area tanks (total : approx. 30,000 m³) will be used as measurement and confirmation tanks. 10 tanks of each will be taken from groups A, B, and C (each tank has a capacity of around 1,000 m³).
  - Each tank group is charged with processes ① through ③ in rotation, and in the ② Measuring/confirmation process, water that has been made homogenized through circulation and agitating will be sampled and analyzed.

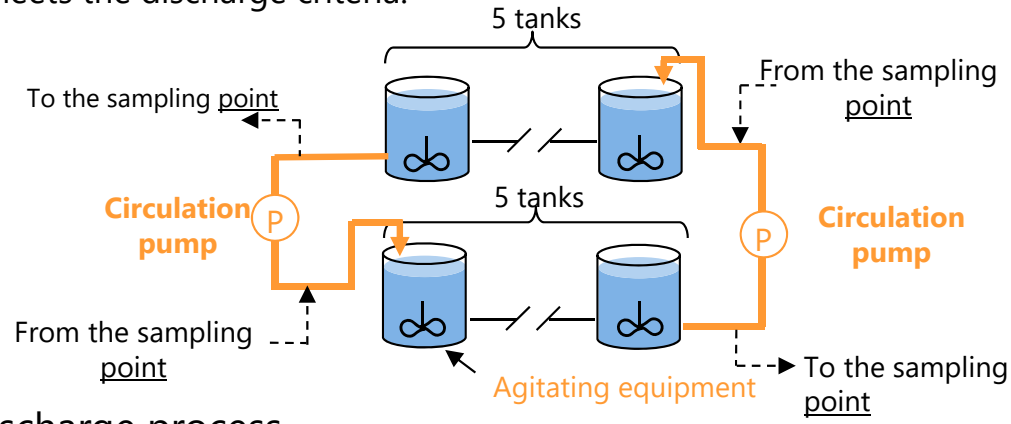
①Receiving process

Receive ALPS treated water from the ALPS treated water storage tank into an empty tank.



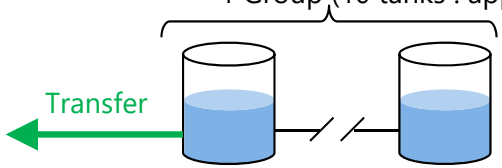
②Measuring/confirmation process

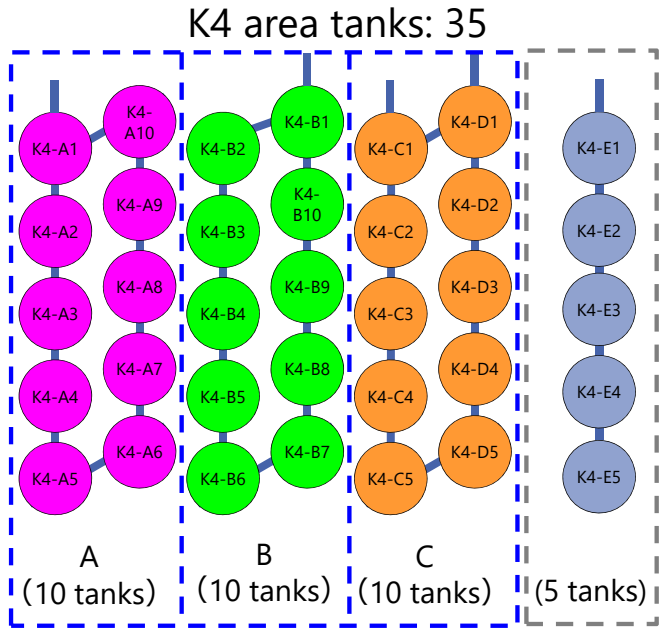
After homogenizing the quality of the water in the tanks using the agitating equipment and circulation pumps, samples are taken to see if the water meets the discharge criteria.



③Discharge process

After confirming the water meets the discharge criteria, the ALPS treated water is transferred via the transfer facility to the dilution facility.





2.50 ALPS treated water dilution/discharge facility

2.5 Multi-nuclide treated water storage tanks

	A	B	C
1st round	Receiving	—	—
2nd round	Measurement and confirmation	Receiving	—
3rd round	Discharge	Measurement and confirmation	Receiving
4th round	Receiving	Discharge	Measurement and confirmation
…	Measurement and confirmation	Receiving	Discharge

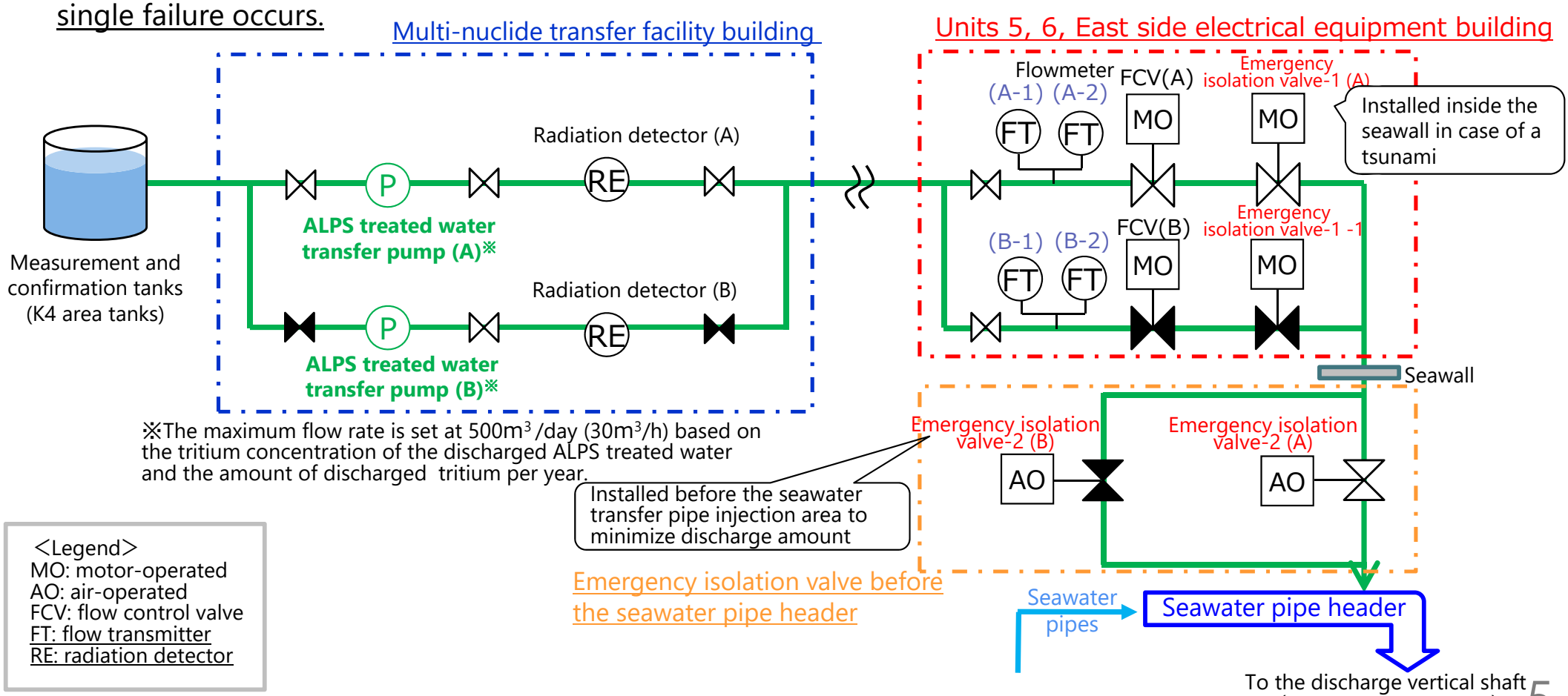
2-3. ALPS Treated Water Dilution/Discharge Facility (Transfer Facility)

Underlined parts: Major areas of updated

Updated

TEPCO

- Transfer facility
  - The transfer facility is comprised of the ALPS treated water transfer pumps, transfer pipes and emergency isolation valves.
  - ALPS treated water transfer pump is comprised of two units, the operating unit and the reserve. It transfers the ALPS treated water from the measurement and confirmation tank to the dilution facility.
  - Two emergency isolation valves will be installed, one before the seawater pipe header to be able to stop transfer swiftly in an emergency and another inside the seawall, as a tsunami measure.
  - The ALPS treated water flow meter will be duplexed to ensure flow can be accurately measured even when a single failure occurs.



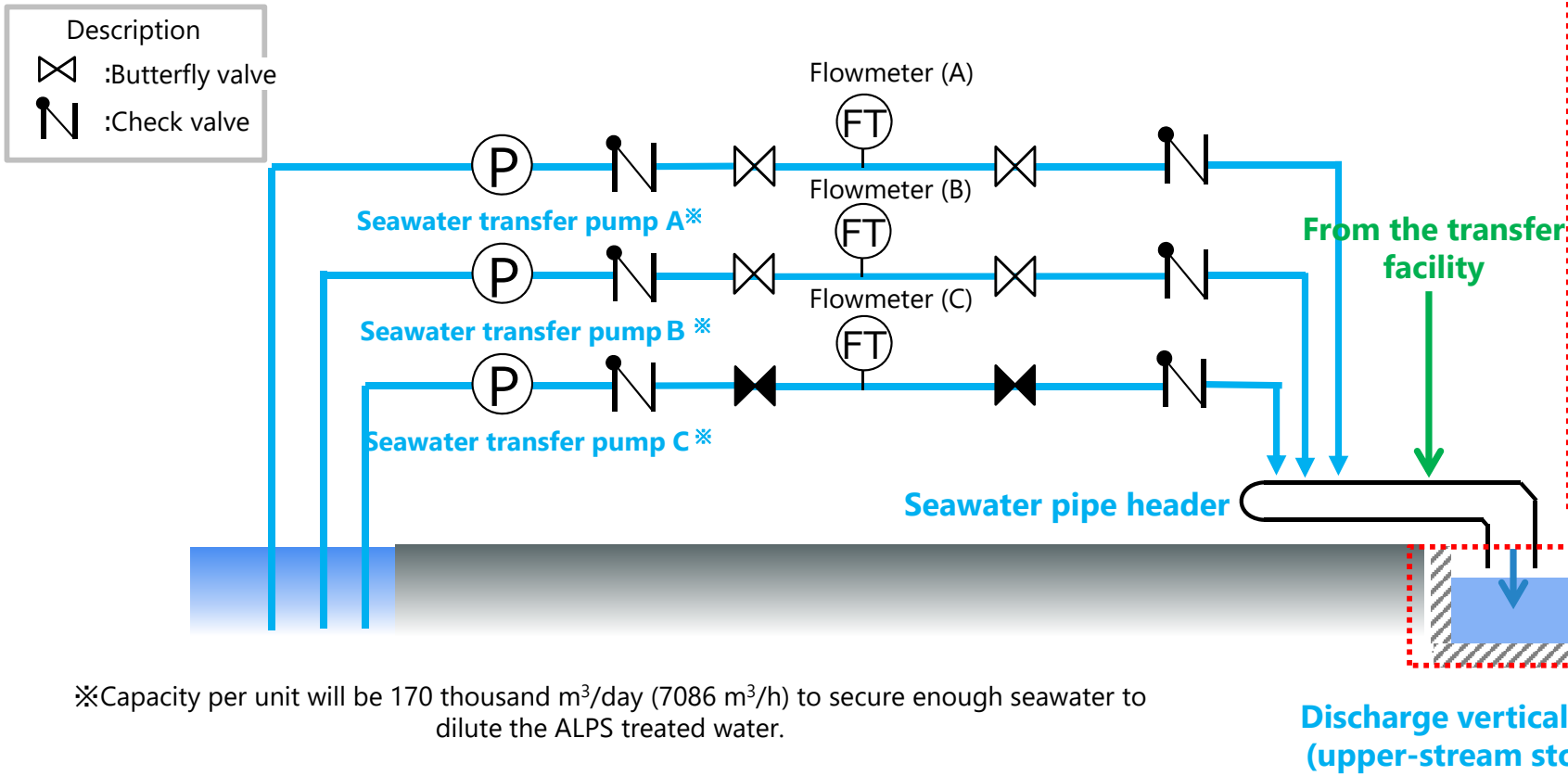
2-4. ALPS Treated Water Dilution and Discharge Facility (Dilution Facility)

Underlined parts: Major areas of updated

Updated

TEPCO

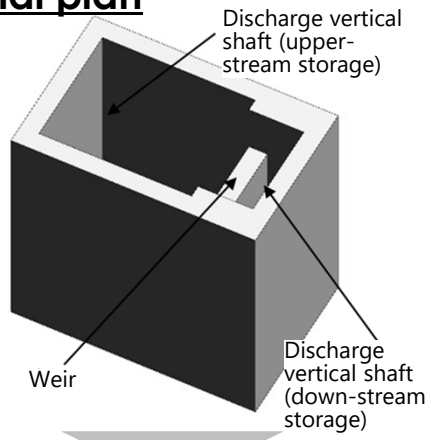
- Dilution facility
  - The dilution facility is comprised of the seawater transfer pump, seawater pipe (including seawater pipe header), and discharge vertical shaft (upper-stream storage). It will dilute ALPS treated water using sweater and then transfer the diluted water to the discharge vertical shaft (upper-stream storage), and to the discharge facility.
  - The seawater transfer pump will have a capacity that allows ALPS treated water transferred using the transfer facility to be diluted by more than 100 times.
  - <u>The construction of the discharge vertical shaft (upper-stream storage) was changed to a wide and shallow structure to secure safety in construction and maintainability.</u>



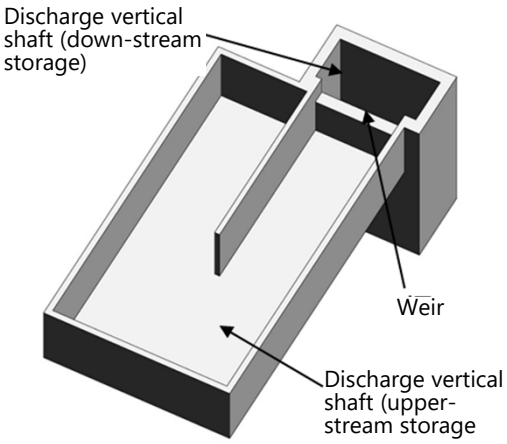
※Capacity per unit will be 170 thousand m^3/day (7086 m^3/h) to secure enough seawater to dilute the ALPS treated water.

Image

Initial plan



After the structure was finalized



3-1. Objective and facility overview of related facilities (Discharge Facility)

Remain the original (partly erased)

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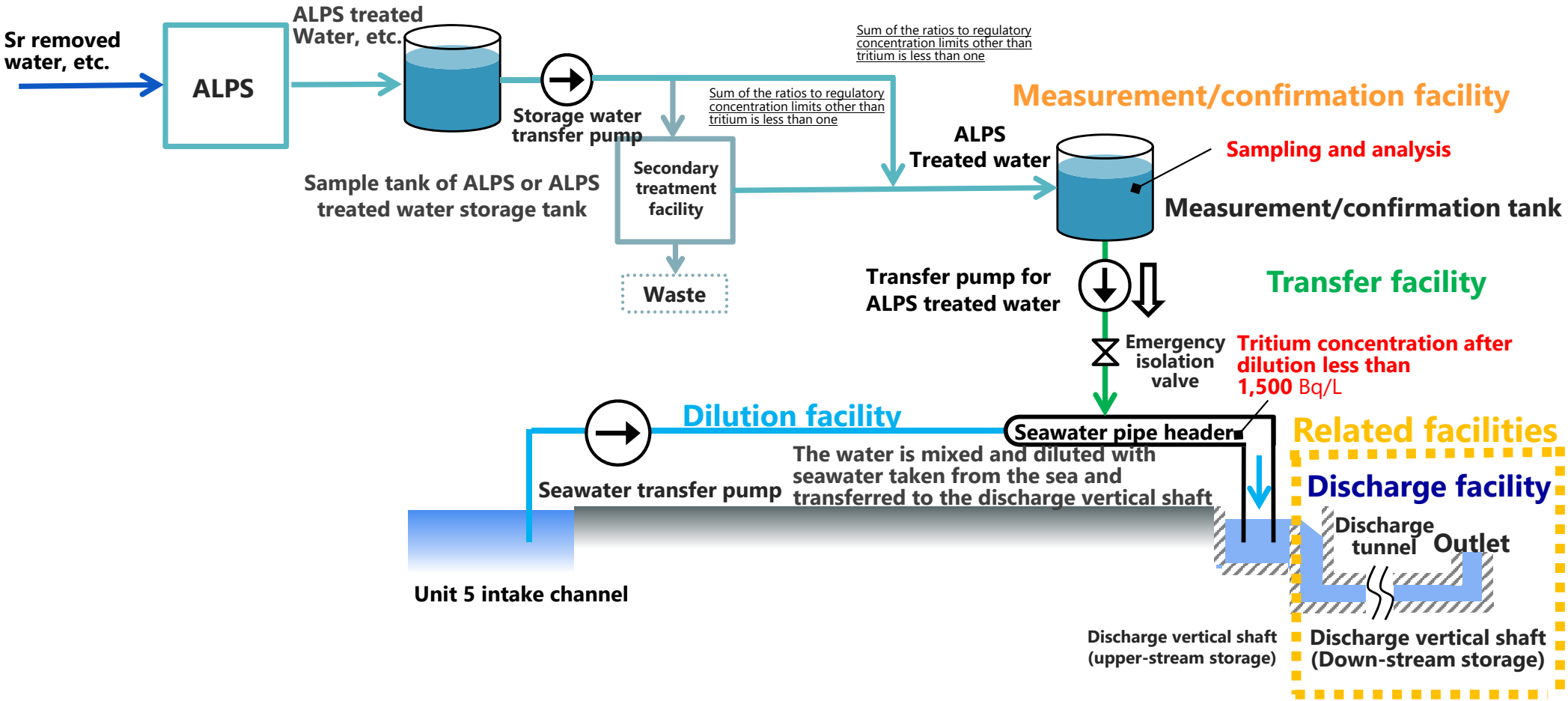
Objective

To discharge the water that is released from the ALPS treated water dilution/discharge facility (water diluted by seawater and has been confirmed to be the sum of ratios to regulatory concentration limits, including tritium, is less than 1) into the sea at a location 1km from the Fukushima Daiichi Nuclear Power Station.

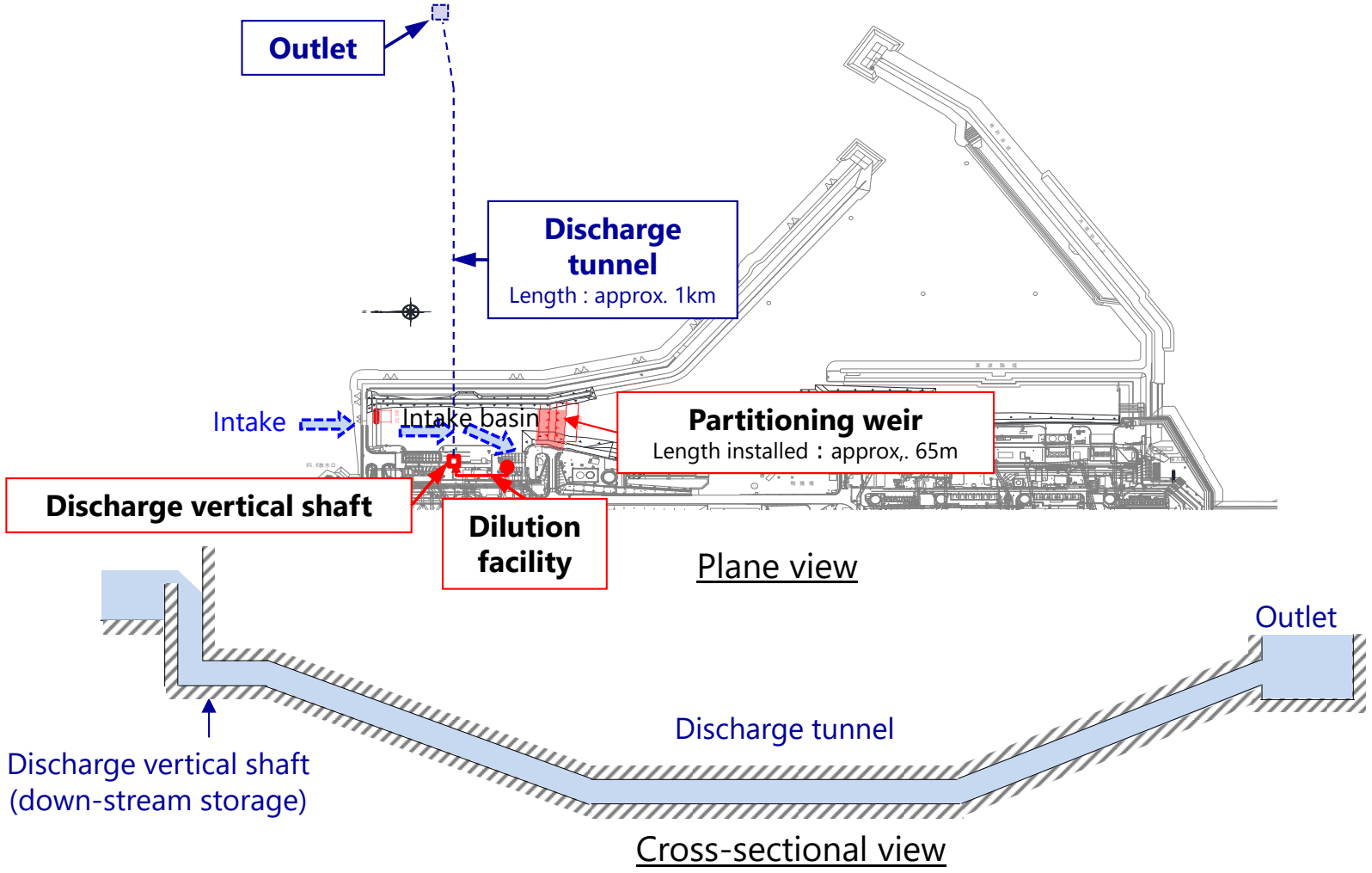
Facility overview

The discharge facility will be comprised of the discharge shaft (down-stream storage), discharge tunnel and discharge outlet to achieve the objective above.



3-2. Overview of related facilities (Discharge Facility)

- Discharge facility
  - The discharge facility is designed so that the water that has spilled over the weir in the discharge vertical shaft will be transferred to the outlet 1 km away due to the differential head between the discharge vertical shaft (down-stream storage) and sea surface. The design will take into account friction loss and rising water levels in the discharge facility.



3-3. Overview of related facilities (Discharge Facility)

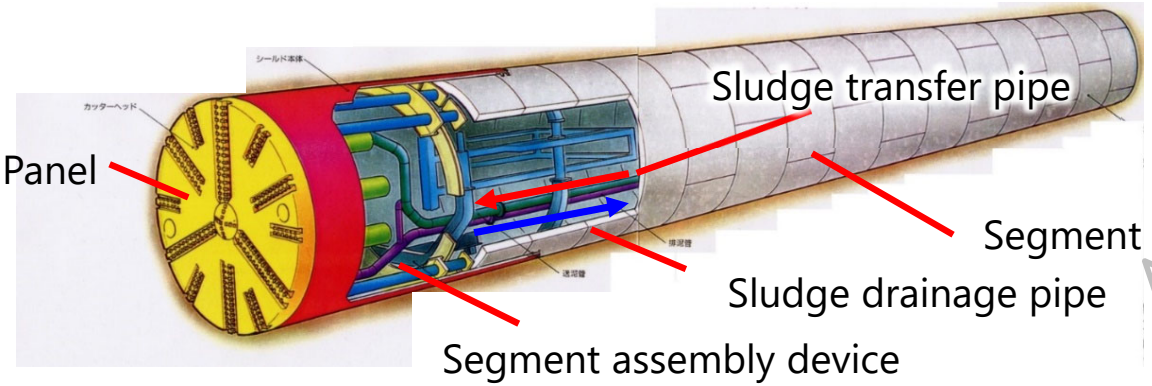
TEPCO

Overview of structural design

- Because it goes through the rock base layer, the structure will be highly resistant against any earthquakes and the risk of water leakage will be low.
- The shield method will be used in construction. It will be made waterproof through the use of two layers of sealing material in the reinforced concrete segment.
- The tunnel structure (segment) is designed considering the effects of typhoons (high waves) and storm surges (sea level rise).

Overview of discharge tunneling (shield method)

- There are many examples of discharge tunnels built using the shield method. Therefore the probability of any problems occurring is deemed low as long as construction work in conducted appropriately.
- The slurry shield tunneling method* will be used for this project.



Overview of shield machine

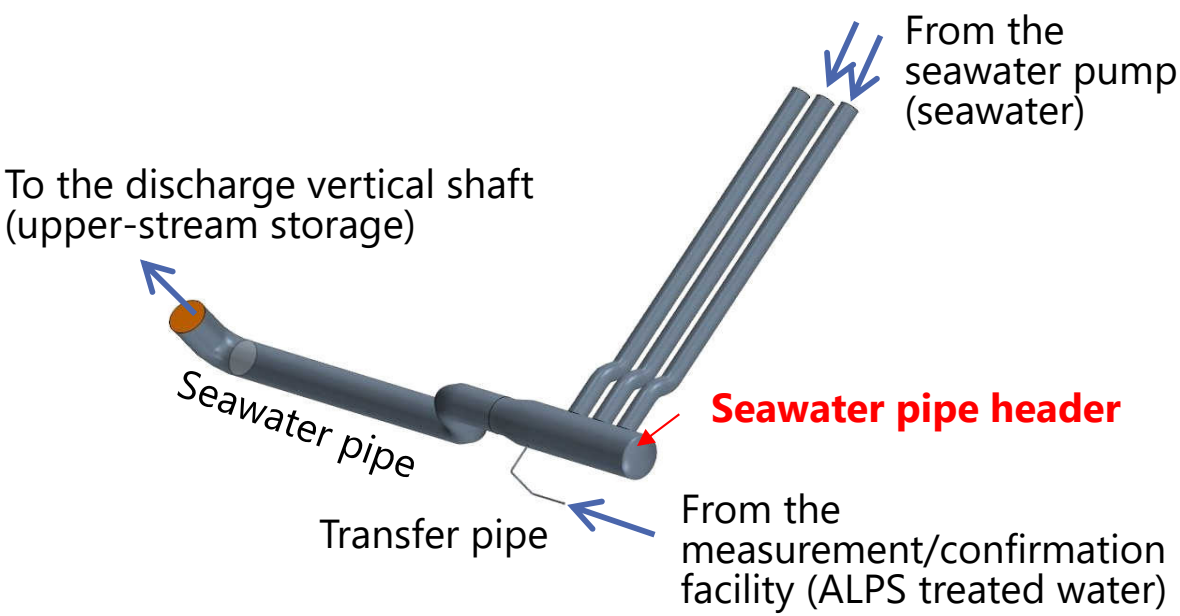
Segment

※In this shield tunneling method, pressure is applied to the slurry to counter the hydraulic pressure in the soil to stabilize the cutterhead (the tip excavating). The slurry will be mixed and circulated with the excavated dirt in order to enable transport of the excavated dirt as a fluid.

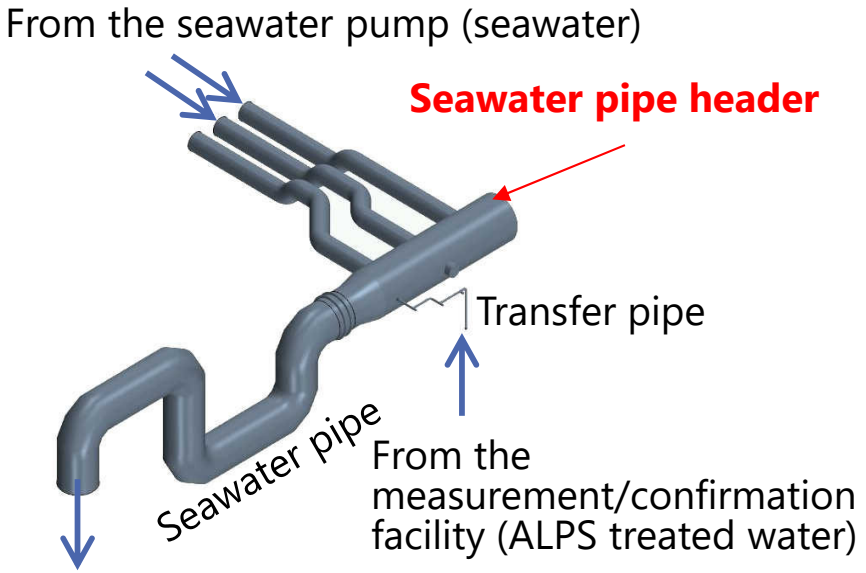
Newly added

4-1. Major Changes and additions

- As the structural design of the discharge vertical shaft (upper-stream storage) was finalized, the shape of the seawater pipe was also altered. The mixing and dilution assessment using the analysis code was updated accordingly. As before the design changed, it was confirmed that water could be diluted by 100 times in the seawater pipes.



Seawater pipe header model (before)



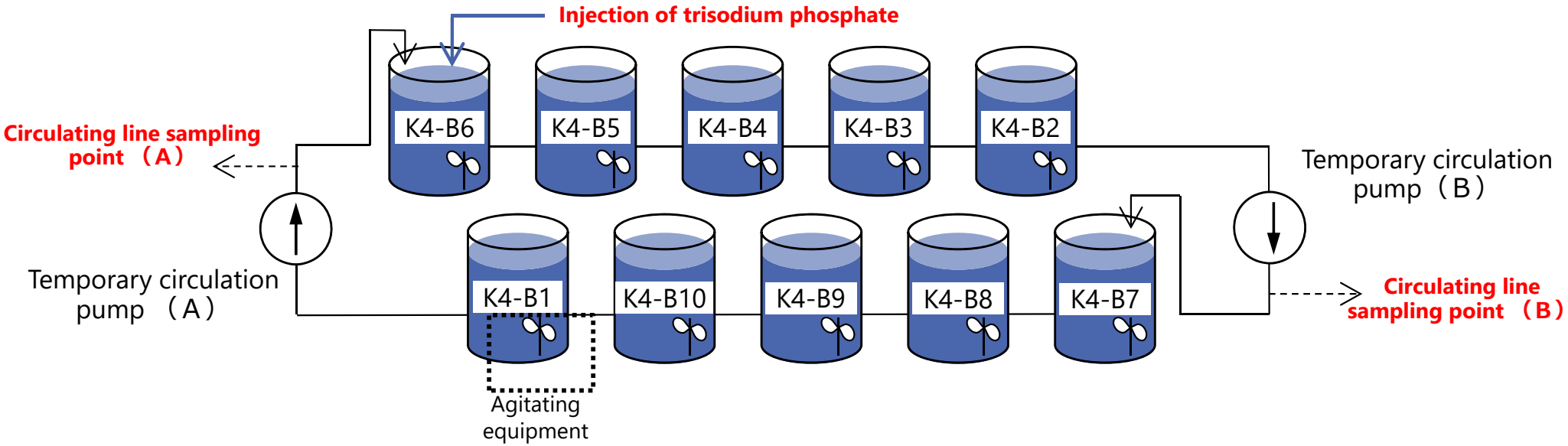
Seawater pipe header model (after)

- Seawater intake method / discharge method of ALPS treated water after dilution
  - A partition weir will be installed to separate the Unit 5 and 6 open conduit from the station harbor on the side of the Units 1-4 open conduit intake, and parts of the north breakwater permeation prevention works on the north side will be modified (partly removed) to create a partition for taking seawater for dilution from outside of the station harbor on the north side of the Units 5 and 6 discharge outlet. This will reduce the amount of seawater with relatively high radioactive materials concentration flowing in from the side of the Units 1-4 open conduit intake channel (See diagram in slide 8).

Newly added

4-2. Major Changes and additions

- To ensure the radioactive concentration of ALPS treated water before discharge into the sea can be made homogenized, a agitating demonstration test for one tank with trisodium phosphate as the reagent was conducted in November 2021. While A circulation agitating demonstration test connecting 10 tanks (see diagram below) was conducted in February 2022. These tests confirmed that the concentrations can be made homogenized with this equipment configuration for 10 tanks.
- The application was amended to include that based on these results, the actual equipment configuration will be set up similarly to the demonstration test and the circulation and agitating time will be set appropriately (enough for the full tank amount to circulate the 10 tanks twice at the start of operation).

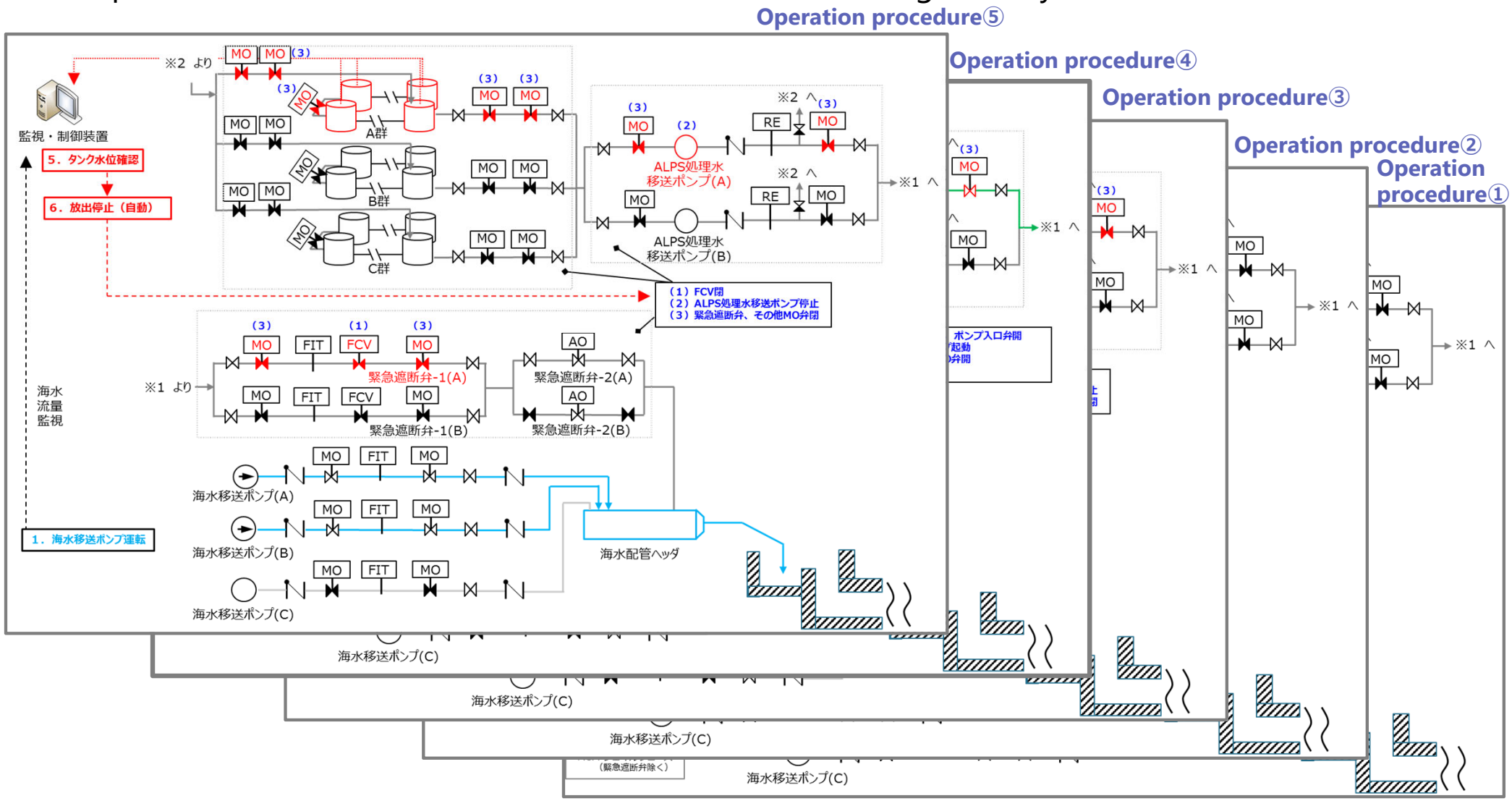


Agitating demonstration test: conducted in November 2021
Circulation and agitating demonstration test: conducted in February 2022

Newly added

4-3. Major Changes and additions

- Operation management for ALPS treated water dilution and discharge facility
  - Added the operation procedures for the measuring and confirmation step and the discharge step in the ALPS treated water dilution and discharge facility , and the appropriateness of design and operation of the ALPS treated water dilution and discharge facility.



Operation procedures for the discharge step

4-4. Major Changes and additions

Newly added

TEPCO

- ALPS treated water analysis methods, structure
  - Clarified the resources necessary for analysis (analysis devices, personnel, etc.) and the structures necessary to perform the analysis, analysis methods and matters to be implemented to secure objectivity and capability.

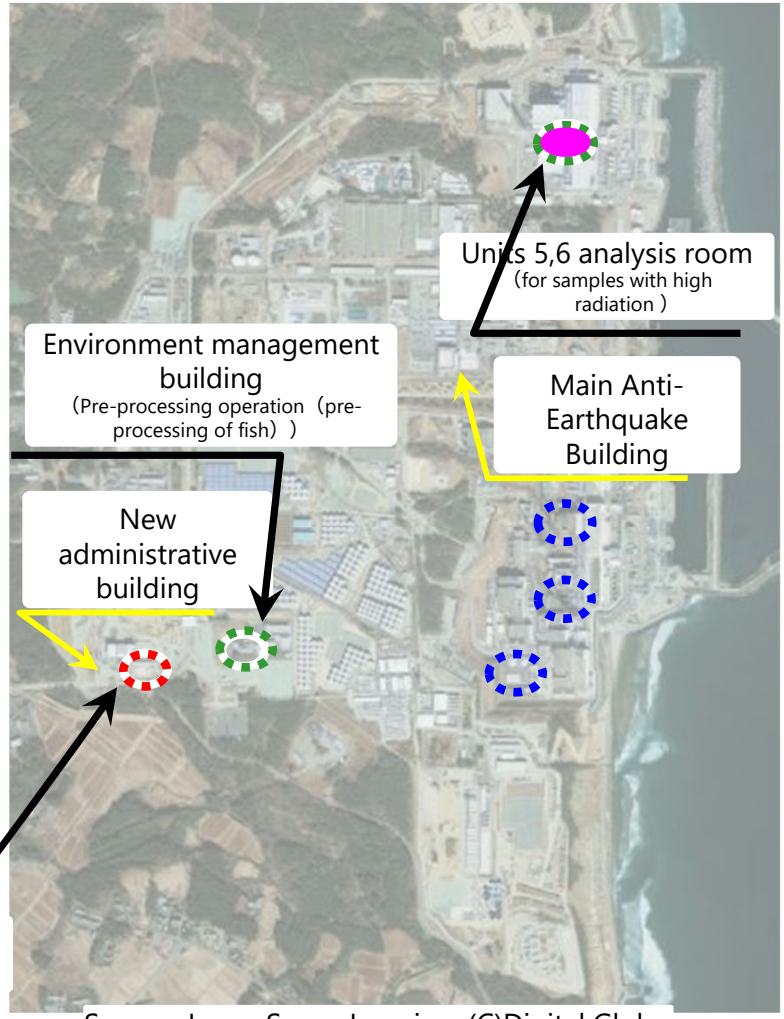
- In operation from before 3.11
- Inoperable due to 3.11
- Built after 3.11
- Modified/expanded after 3.11

Chemical analysis building

For low radiation samples

Analysis room＋ measurement room：1,000 m^2
Lab bench: 15, draft: 35

• Started operation in 2013



Source: Japan Space Imaging, (C)Digital Globe

Expanding the chemical analysis function

【Pre-processing area】

Target	Particle measured	Scale of expansion (Maximum number of samples per year)	Pre-processing facility (planned number of equipment)	
Seawater	H-3	156	Draft chamber	4
			Rotary evaporator	5
			Electrolytic enrichment device	4
	I-129	8	Lab bench	2
	C-14	20	Draft chamber	7
	Gamma nuclide (including Sn-126)	12	Draft chamber	4
			Lab bench	2
	Alpha nuclide	12	Lab bench	1
	Sr-90	12	Draft chamber	4
Seabed soil	Sn-126	20		
Fish	C-14	1	Draft chamber	6
	Sn-126	1	Lab bench	3
Seaweed	C-14	2	Freeze-dry machine	6
	Sn-126	2	Electrolytic enrichment device	6
			H-3 attenuation container	2

【Measurement area 】

LSC: 11 to 14

Particle subject to measurement	Measurement device (planned number of	
H-3	LSC*1	3
C-14	He-MS*2	2
Gamma nuclide (including Sn-126)	Ge (LEPS*)	2

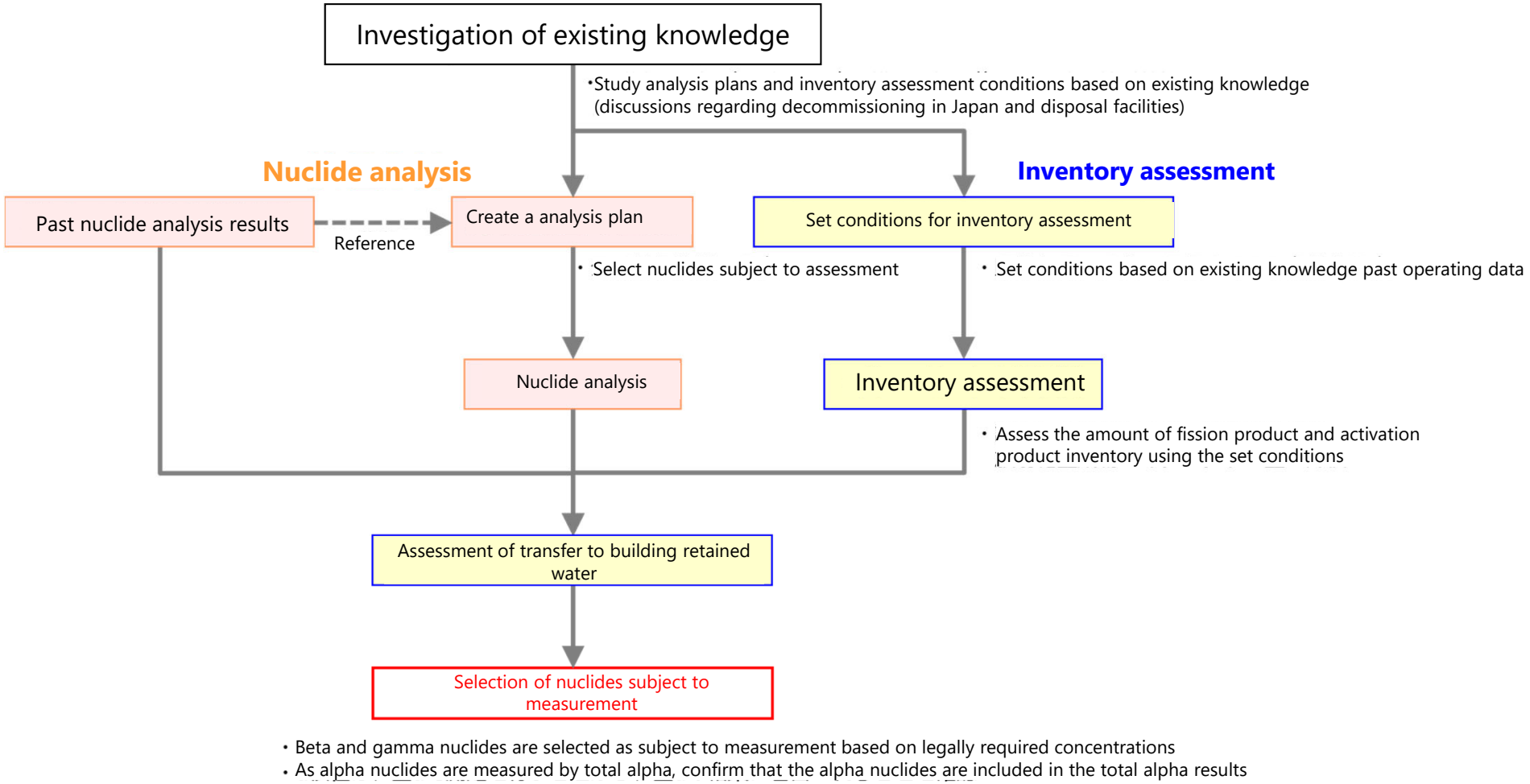
*1 LSC: Low back liquid scintillation counting device
*2 He-MS: Noble gas mass spectrometer (for H-3 analysis)
*3 LEPS: Low energy photon spectrometers (LEPS)

Analysis facilities for ALPS treated water discharge

Newly added

4-5. Major Changes and additions

- Selection policy for nuclides that could impact dose assessment in ALPS treated water
  - Added an explanation of the policy for selecting nuclides subject to measurement and assessment with rigorous verification to ensure that the ALPS treated water meets the discharge criteria after it has been diluted before discharge (sum of the ratios to regulatory concentration limit, excluding tritium, in the ALPS treated water is less than 1) based on the knowledge in Japan on decommissioning and disposal facilities.

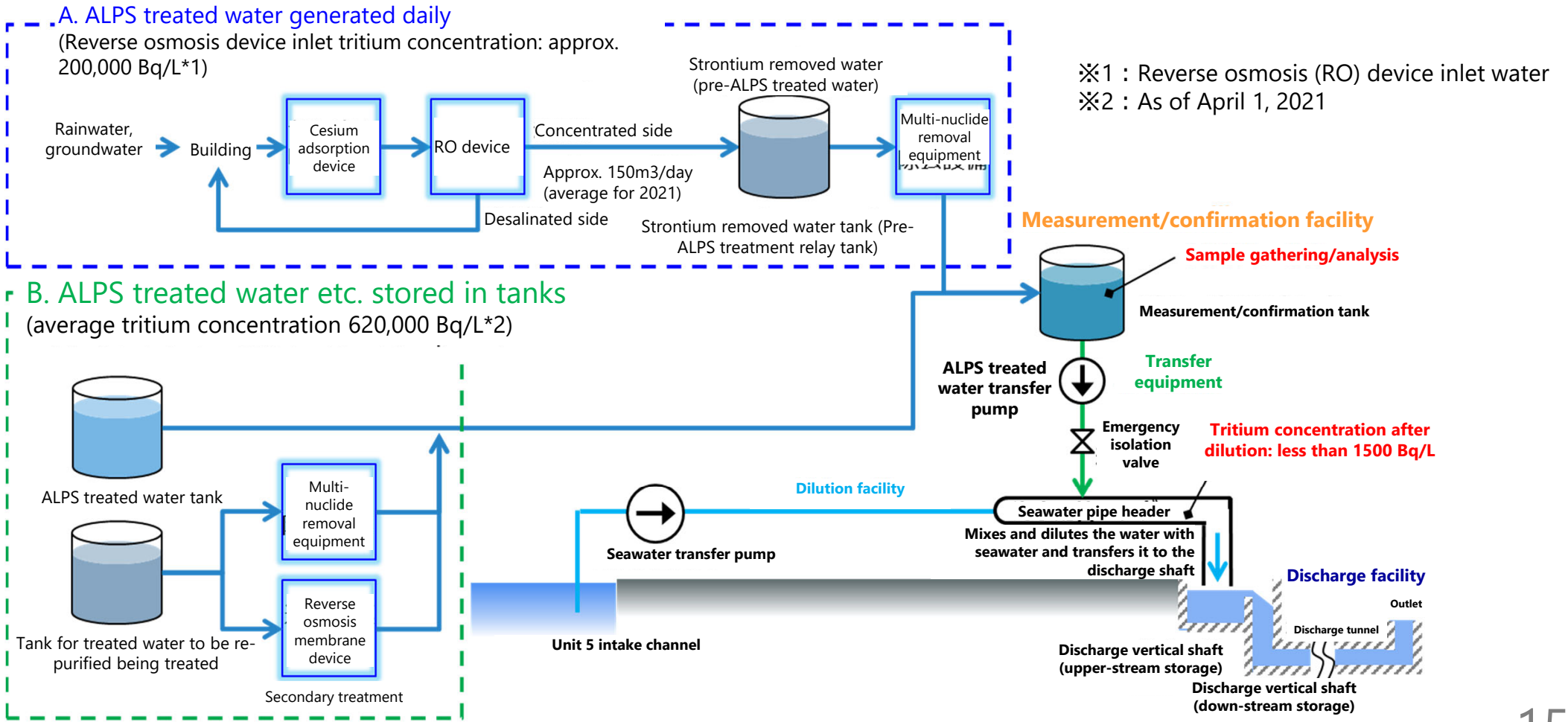


Flowchart of the discussion process for selecting nuclides subject to measurement and assessment

Newly added

4-6. Major Changes and additions

- Management of the annual amount of tritium discharged
  - ALPS treated water to be discharged is comprised of A. ALPS treated water generated daily, B. ALPS treated water, etc. stored in tanks. The basic policy is to discharge ALPS treated water starting with the water with the lower tritium concentration. The application was amended to include the tritium water management policy whereby ALPS treated water is discharged (A below) and then ALPS treated water is discharged at amounts that do not exceed 22 trillion Bq/year (B below).



4-7. Major Changes and additions

Underlined parts: Major areas of updated

Updated

TEPCO

- Overview

  Management methods to reduce the amount of radionuclide using ALPS in treated water from the contaminated water treatment facility and treatment facility outlet water, and to dilute ALPS treated water (water where the sum of the ratios to regulatory concentration limits, excluding tritium, is less than 1) with seawater and discharge it, and assessment of the dose at the station site boundary impacted by the discharge of ALPS treated water are explained here.

- Management method

  Samples are taken from the measurement/confirmation facility before discharge, and tritium and other radionuclide are analyzed to confirm that the water meets ALPS treated water criteria. The water is then diluted with seawater in the dilution facility to reduce the tritium concentration, and then discharged.

  - It is confirmed in measurements that the tritium concentration is less than 1,000,000 Bq/L and the sum of the ratios to regulatory concentration limits, excluding tritium, is less than 1 for ALPS treated water.
  - The ALPS treated water flow rate and the diluting seawater flow rate will be set so that the tritium concentration in the discharge vertical shaft (upper-stream storage) is less than 1500Bq/L and the seawater dilutes the ALPS treated water by more than 100 times.
  - The amount of tritium discharged according to the implementation plan will be less than 22 trillion Bq per year.

- Dose assessment

  The effective dose evaluation value at the site boundary due to the discharge of ALPS treated water is 0.035 mSv/year. As such, there will be no change to the effective dose evaluation value due to the discharge of radioactive liquid waste (0.22mSv/year).

  - Contributions of tritium to the dose are conservatively evaluated to be 0.025 (1500/60,000) as a ratio against the regulatory concentration of 60,000 Bq/L, since it will be diluted by seawater until the dose is less than 1500 Bq/L.
  - Contributions of radioactive nuclides other than tritium are conservatively evaluated to be 0.01 (1/100) as the ratios to regulatory concentration limits, since it will be diluted by more than 100 times with seawater after it is confirmed that the ratios to regulatory concentration limits in the measurement/confirmation facility is less than 1.

5. Site plan for the ALPS treated water dilution/discharge facility and related facilities

Underlined parts: Major areas of updated

Remain the original (partly updated)

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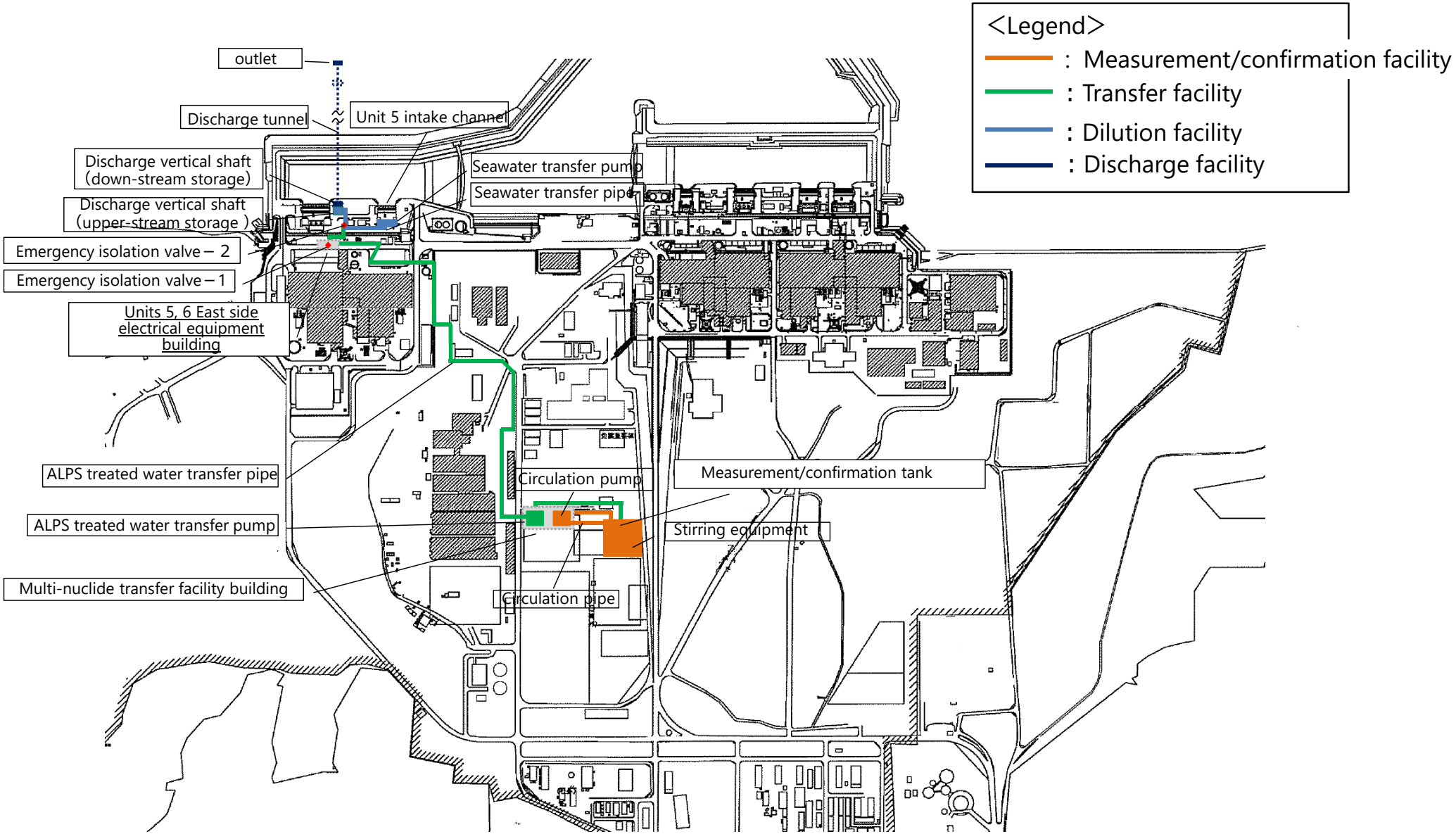
- The ALPS treated water dilution/discharge facility and related facilities will be located as follows.

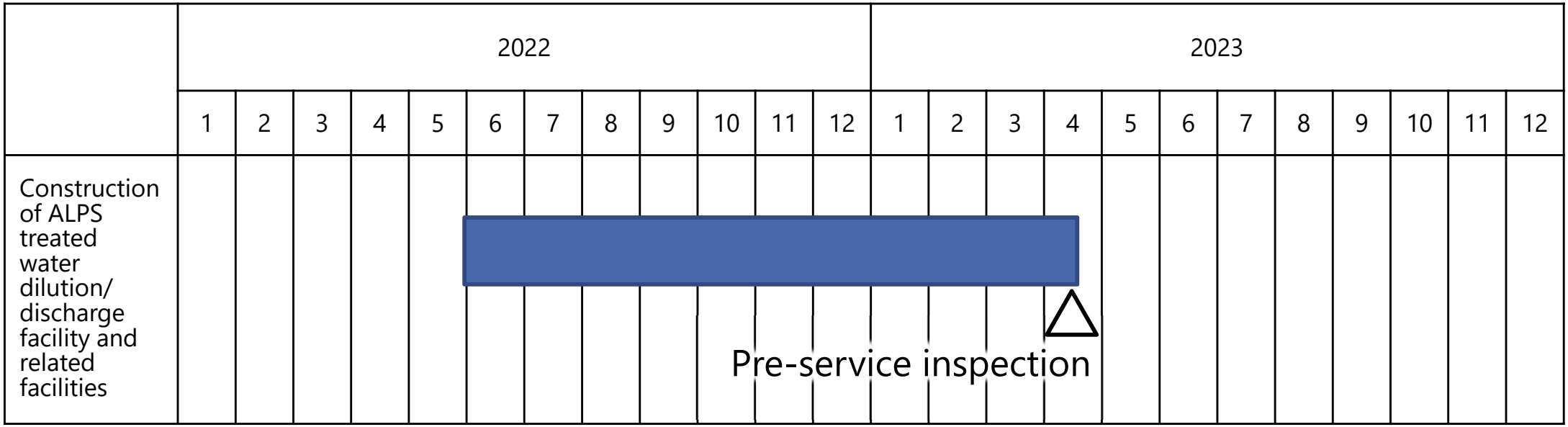


6. Construction schedule for the ALPS treated water dilution/discharge facility and related facilities

Remain the original

TEPCO

- Subject to the approval of the Nuclear Regulation Authority (NRA), construction and assembly on the field will begin, and facilities are scheduled to be completed around mid-April 2023.



: Construction and assembly on the field

Updated

TEPCO

【Reference】Overview of facilities for securing safety

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)

ALPS treated water transfer pump

Seawall

Installed around emergency isolation valves and transfer pipes

ALPS treated water, etc. tanks

Rotation

Discharge

Receiving

Measurement/ confirmation

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

Seawater flow meter

Seawater pipe

EL 33.5m

EL 11.5m

EL 2.5m

Discharge vertical shaft (Down-stream storage)

Road

Utilize the vertical shaft for the time being, and initiate discharge after confirming directly that seawater and ALPS treated water has mixed and diluted.

*Area where common fishery rights are not set

Unit 5 intake

Seawater transfer pump
3 units

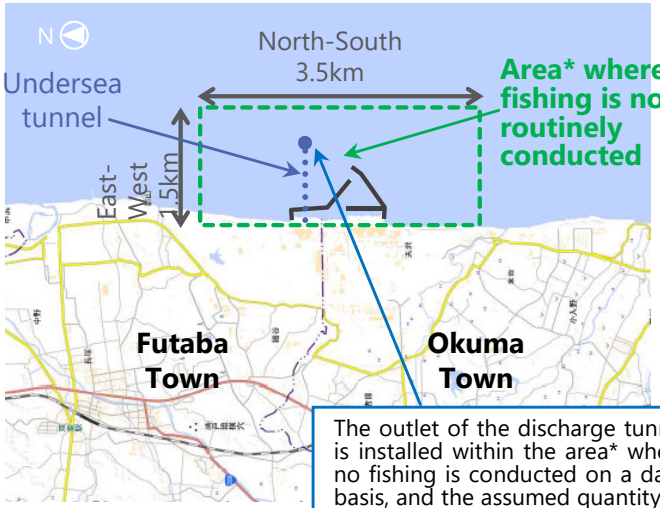
Discharge vertical shaft (upper-stream storage)

Discharge to sea

Discharge tunnel
(approx. 1km)

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



The outlet of the discharge tunnel is installed within the area* where no fishing is conducted on a daily basis, and the assumed quantity of water within the subject area is approx. 60 billion(6.0E+10) liters.