Document 1-1 for the 7th Review Meeting on the Implementation Plan Regarding the Handling of ALPS Treated Water

Installation of New ALPS treated Water Dilution/ Discharge Facilities and the Related Facility

February 1, 2022

TEPCO

Tokyo Electric Power Company Holdings, Inc.

The Japanese version shall prevail.

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Responses to major issues* concerning the content of the application for the facilities for discharge of ALPS treated water into the sea

*: Document 1-2 for (The 3rd) Review Meeting on the Implementation Plan Regarding the Handling of ALPS Treated Water

(2-1 Major issues to be reviewed based on the Nuclear Reactor Regulation Act)

(1) Discharge Facilities of ALPS Treated Water into the Sea

(6) Validity assessment of the facility design in the event of failure

- Explanations shall be given regarding facilities, systems, and procedures necessary to cope with the postulated unintentional discharge of ALPS treated water into the sea due to trouble during discharge, such as equipment failures (hereinafter referred to as “abnormal event”), and discharge amount after those measures are taken shall be evaluated.
- When performing the above-mentioned evaluation, the most severe abnormal event shall be selected in terms of the amount of ALPS treated water discharged and, when analyzing, a single equipment failure that will lead to the most severe consequence shall be assumed.

(4) Detection of abnormalities and methods for deactivating the discharge of ALPS treated water into the sea

- As for the interlock mechanism, the role expected, the logic circuit, and the concept of various set points shall be explained in an organized manner.

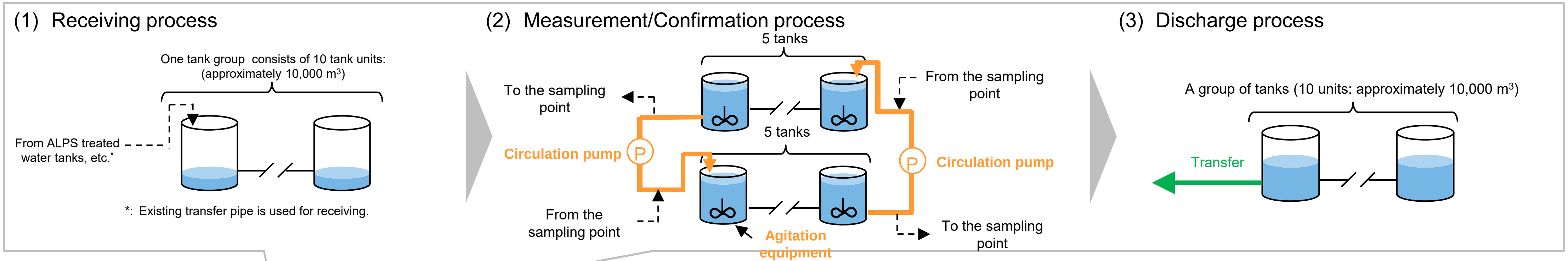
(5) Structure and strength of equipment, protection against natural phenomena such as earthquakes and tsunamis, prevention of misoperation, reliability, etc.

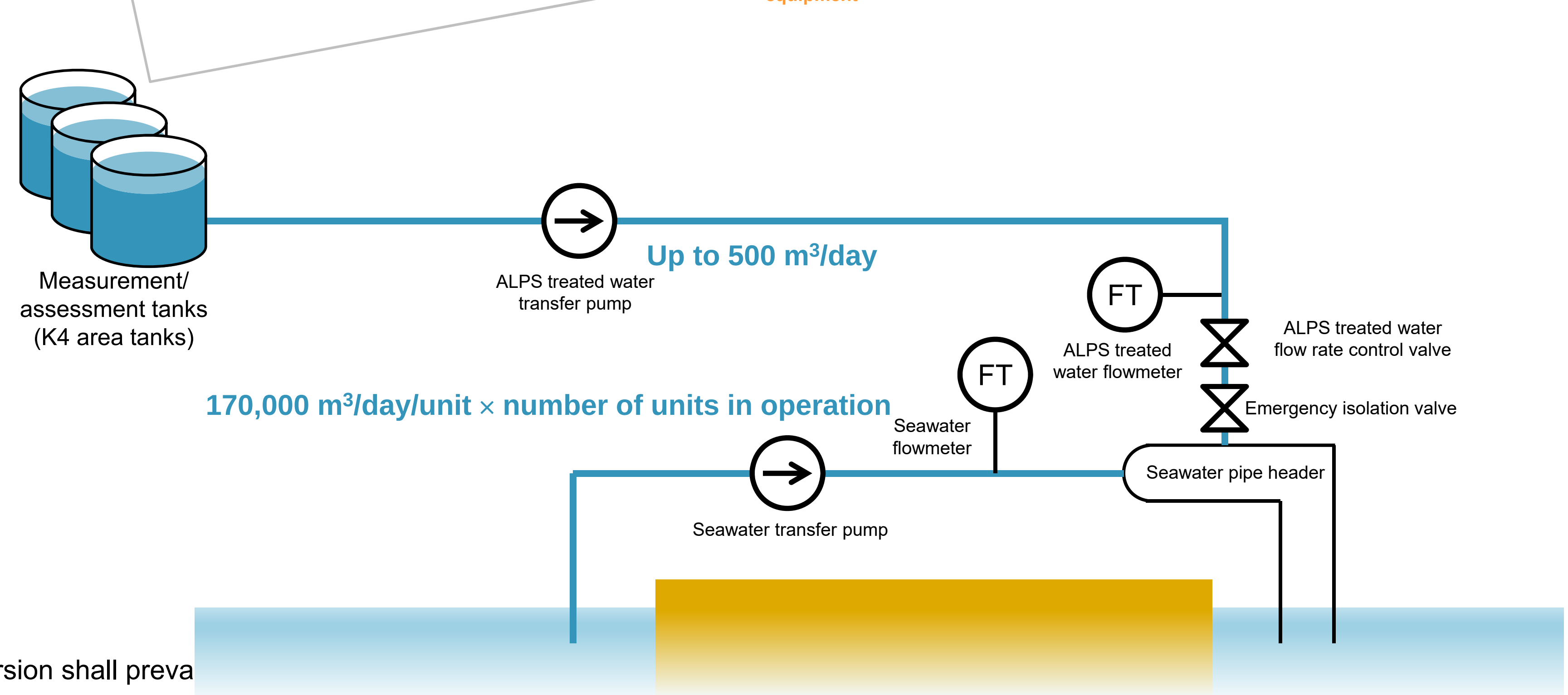
1. Overview of validity assessment methods for the facility design in the event of failure*

2-1 (1) (6) Validity assessment of the facility design in the event of failure
1.1 Overview

- We examine what equipment single failure may cause “Unintentional discharge of ALPS treated water into the sea” in the operation of ALPS Treated Water Dilution/Discharge Facilities.

  *: Note that in the receiving process, only the ALPS treated water transfer pipe must be used. Regarding the immediate ALPS treatment results, the sum of the ratios to regulatory concentrations limits of radionuclides other than tritium must be less than 1. In addition, the transfer to the Measurement/Confirmation tanks requires the value that the sum of the ratios to regulatory concentrations limits of radionuclides other than tritium is less than 1.





1.2 Extraction of specific abnormal events

- Setting the top event when ALPS treated water discharges into the sea failing to meet the terms and conditions in the plan, defines as the incident “unintentional discharge of ALPS treated water into the sea”. And every incident unsatisfied each of the conditions specified in the plan is defined as the specific content of the top event.

No.	Scheduled content		Notes
1	Water to be discharged	ALPS treated water	The sum of the ratios to regulatory concentration limits of radionuclides other than tritium is less than 1.
2	Discharging methods	The drainage concentration for tritium, which is difficult to remove, must be less than 1,500 Bq/L.	the tritium concentration of ALPS treated water checked in advance and the seawater flow rate determine the flow rate of ALPS treated water.
		When discharging, the ALPS treated water must be diluted to a large extent (100 times or more) with seawater.	Based on the maximum flow rate each of ALPS treated water and the sea water transfer pump is of 500 m^3/day and 170,000 m^3/day per unit, respectively. Operating only a single seawater transfer pump enable the water to dilute 340 times.
3	Discharge routes	Transfer using the Transfer facility and discharge into the sea through the Transfer facility.	

Top event

Unintentional discharge of ALPS treated water into the sea

Abnormal events
[Definition (1)] **Discharge radioactive materials other than tritium caused by incomplete checks**
[Definition (2)] **Discharge with incomplete checks on tritium concentrations, or with at above 1,500 Bq/L (dilution with seawater performed)**
[Definition (3)] **Leakage from the facilities (failing to dilute with seawater)**

2. Details on design and operation for the ALPS Treated Water Dilution/Discharge Facilities

2-1 (1) (6) Validity assessment of the facility design in the event of failure
2.1 Design concept of the ALPS Treated Water Dilution/Discharge Facilities(1/2)

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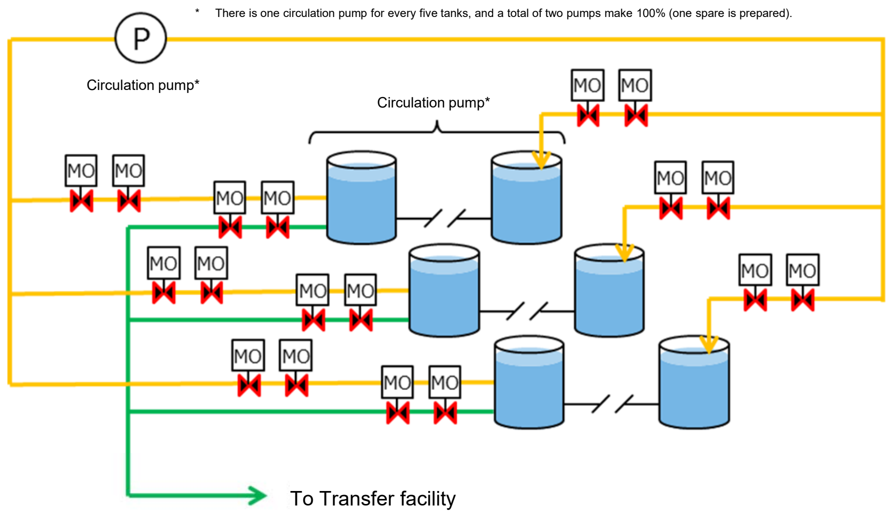
- In each design process for ALPS treated water dilution/discharge facilities, the following viewpoints are taken into account:

Design details	Viewpoints for consideration
System design	• Design provides a sufficient margin for the required function.
	• Active components (pumps and valves) are set dual-redundant from the viewpoint of facility reliability.
	• Valves for discharging and deactivating ALPS treated water are set dual-redundant in series.
	• The arithmetic unit of the monitoring and control system is made dual-redundant.
	• The power source is designed to receive power through onsite high-voltage buses of two different systems.
	• Equipment that operates in a safe condition (fail-safe) in the event of a partial equipment failure is selected.
	• Condition monitoring of the entire system is performed, and if any abnormalities are detected, the discharge of ALPS treated water will be stopped.
	• Interlock is provided to prevent equipment operation due to misoperation (foolproof).
	• In the event of an abnormality, dilution will continue by operating seawater transfer pumps as much as possible.
Equipment design	• Design is provided with a sufficient margin for the strength and durability of the equipment.
	• Design is provided to cope with natural conditions (e.g., equipment layout considering tsunami).
	• Weirs are constructed around pumps and pipes with flanges of relatively high leakage potential (detection is performed by leakage detectors and patrols).

2-1 (1) (6) Validity assessment of the facility design in the event of failure
2.1 Design concept of the ALPS Treated Water Dilution/Discharge Facilities(2/2)

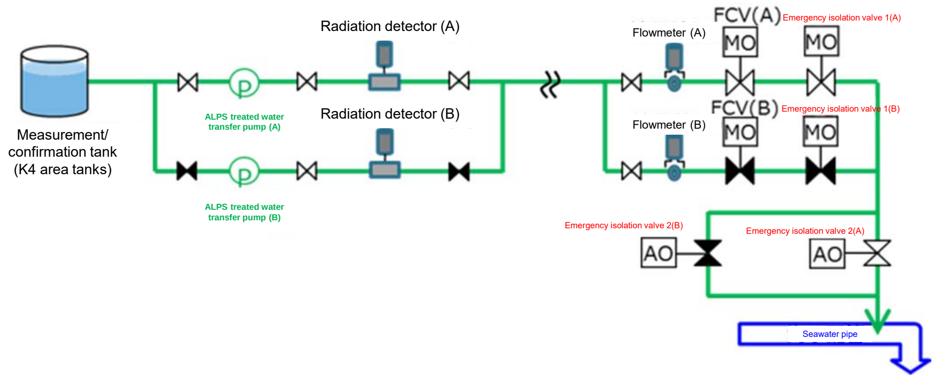
- The concept of ensuring the reliability of each facility in the ALPS Treated Water Dilution/Discharge Facilities is as follows:

Measurement/Confirmation facility



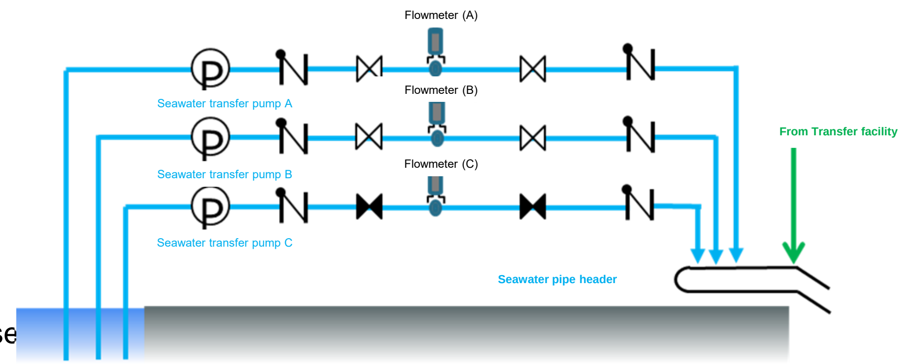
- Measurement/Confirmation tanks consist of three groups.
- To prevent leakage from the tank groups and water mixing between the tank groups, the valves serving as the boundary are placed dual-redundant in series.
- Spares are prepared for the circulation pumps and agitation equipment.

Transfer facility



- Emergency isolation valves for deactivating the discharge of ALPS treated water into the sea are made dual-redundant in series. (Fail-close for both AO and MO valves)
- For important pumps, valves, and instrumentation equipment, two systems are installed from the viewpoint of inspection and maintainability.

Transfer facility



- For pumps, valves, and instrumentation equipment, one backup system is arranged for the two operating systems from the viewpoint of inspection and maintainability.
- Spares are prepared for seawater transfer pumps and flowmeter orifices.

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2-1 (1) (6) Validity assessment of the facility design in the event of failure
2.2 Design of Measurement/Confirmation facility

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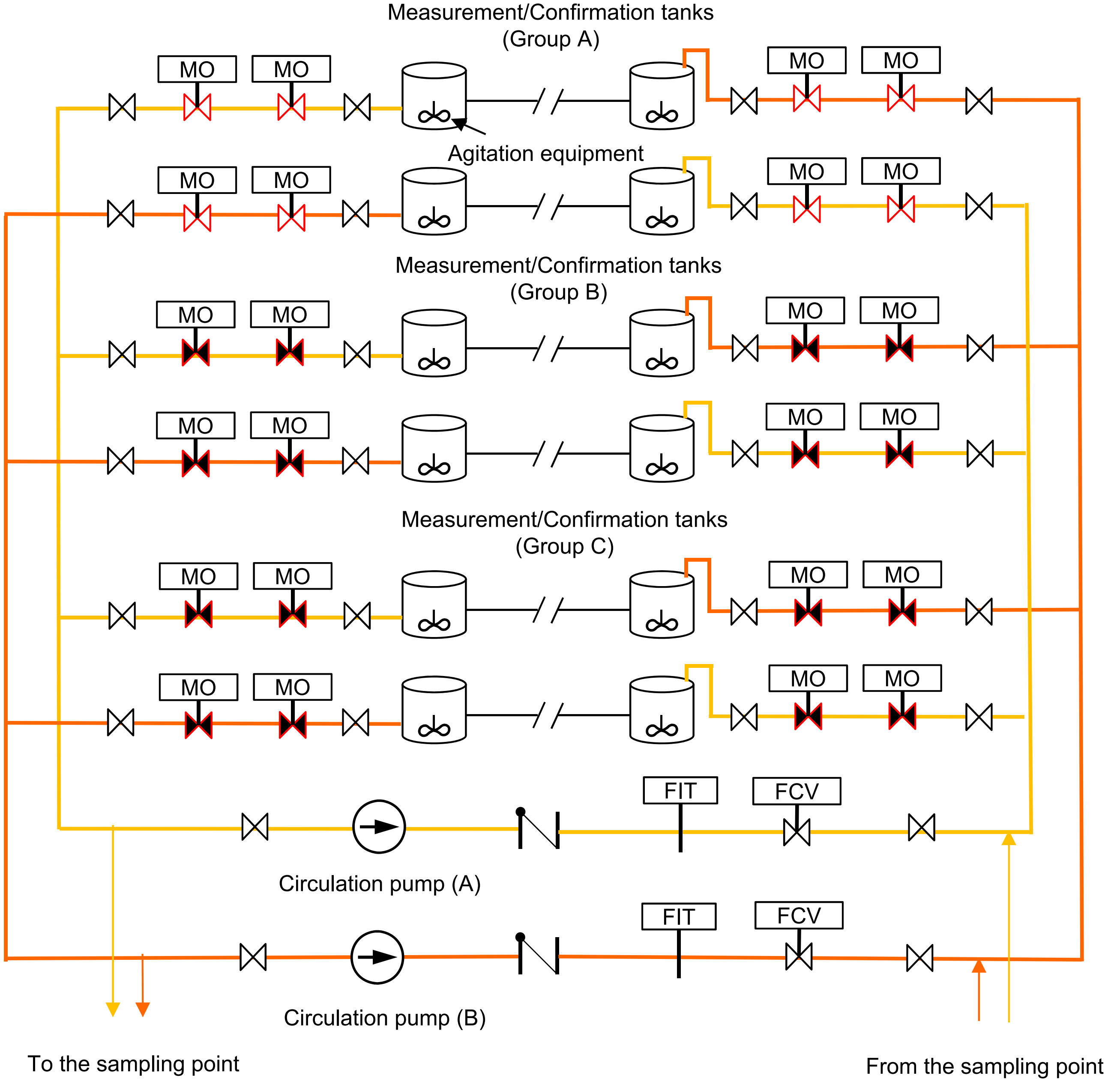
- The detailed system configuration of the Measurement/Confirmation Facility is as follows.



<Abbreviations>
MO: Motor-operated
FCV: Flow rate control valve
FIT: Flow indicator

*: The motor-operated facilities should be capable of receiving power even when switching between Systems A and B.

The Japanese version shall prevail.

2.3 Operating procedures of Measurement/Confirmation facility

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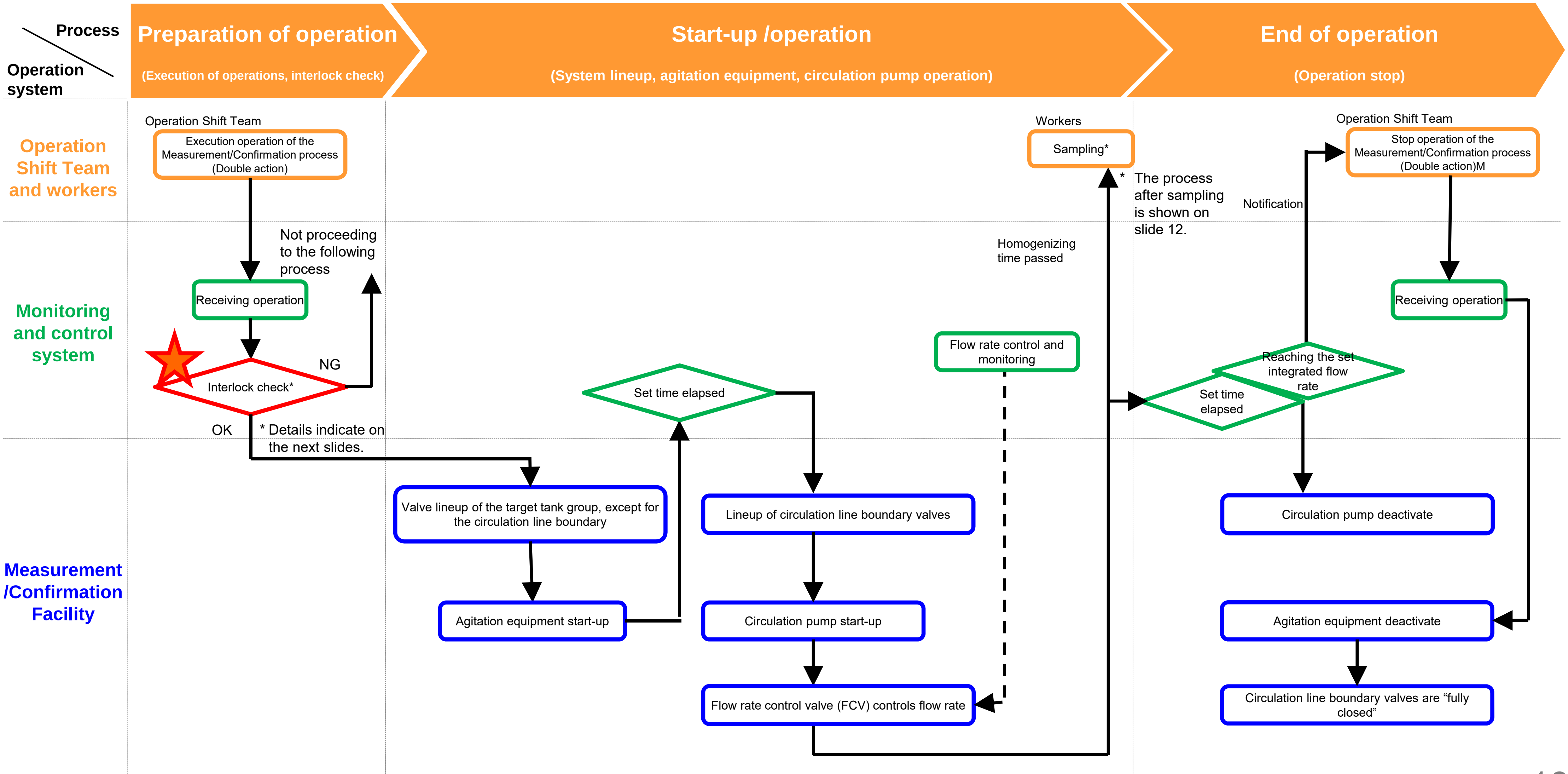
- The operating procedures of the Measurement/Confirmation Facility are as follows.
  - In the Measurement/Confirmation process, once operator selects a tank group and starts operating the process automatically operated thereafter.
  - To avoid mixing water between the tank groups or accidental discharge, a monitoring and control equipment has an interlock system: to ensure that no selected tank groups is in the status of Measurement/Confirmation process, the boundary valves are fully closed.



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2-1 (1) (6) Validity assessment of the facility design in the event of failure
2.4 Prevention of misoperation in the Measurement/Confirmation process

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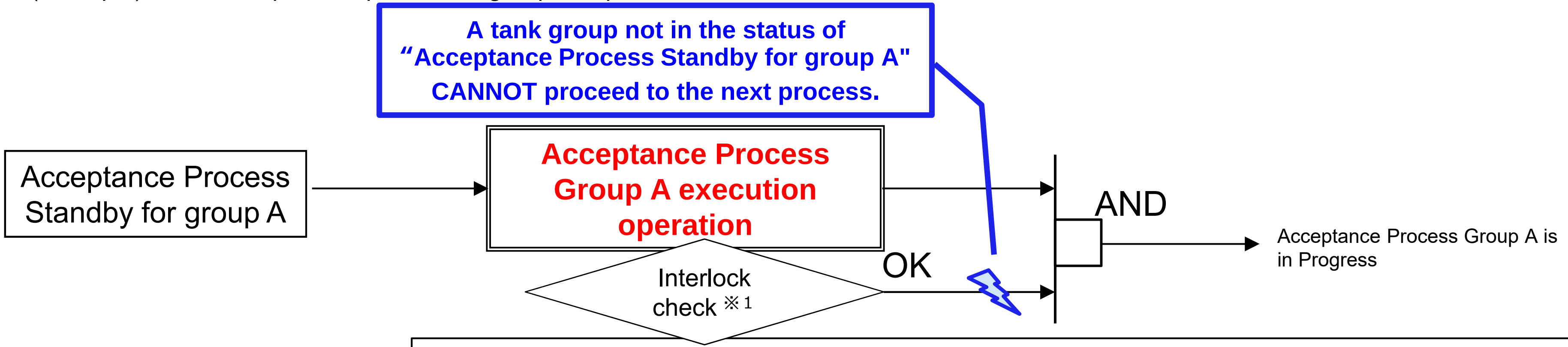
Execution operation of the Measurement/Confirmation process

(Example) When acceptance operation of group A is performed



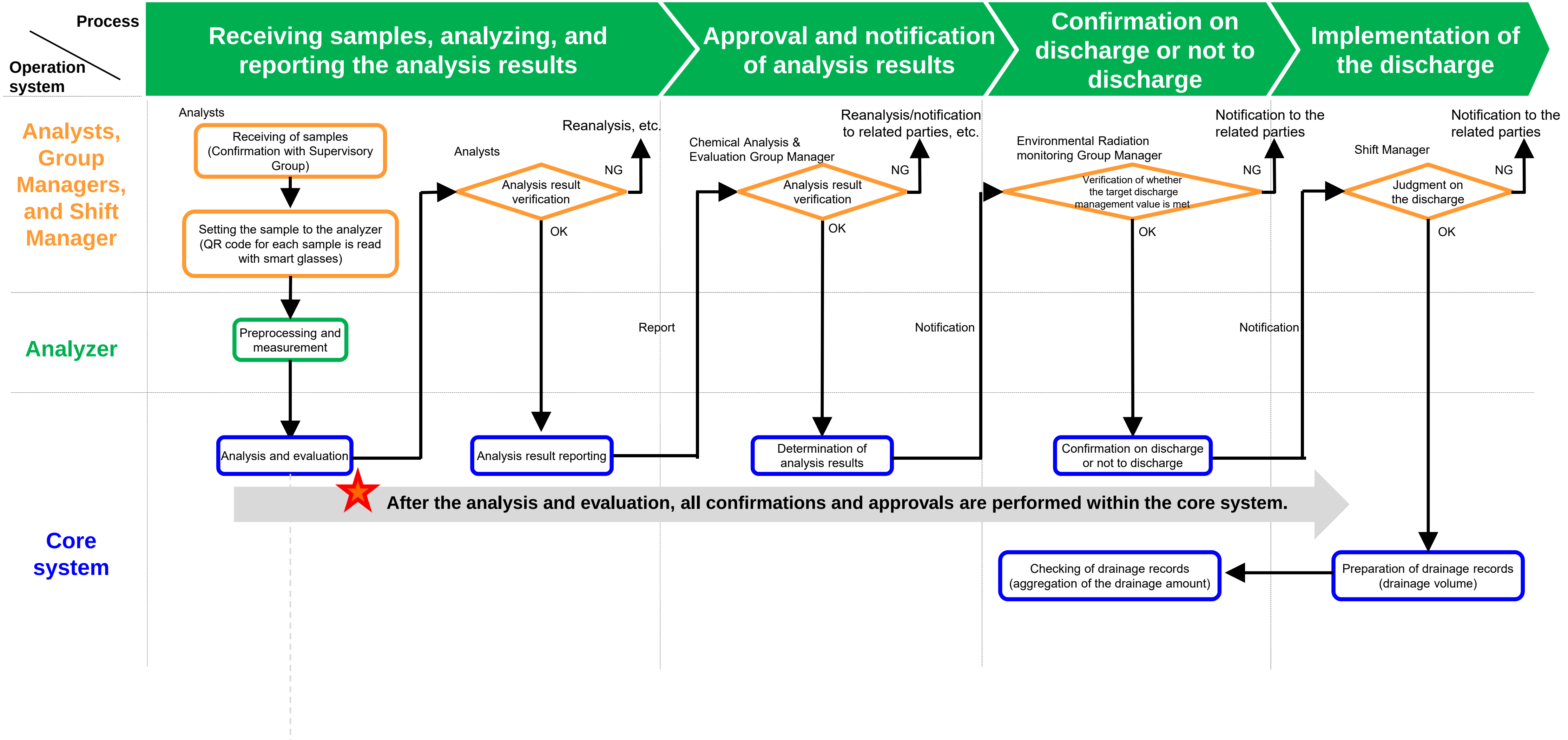
※1 Interlock check

- ✓ Group A must be in the status of "Standby for group A acceptance process" (below "high water level") ⇒ Check the status of the target tank group.
- ✓ Confirm that group B and C are not in the receiving process ⇒ Check the status of other tank groups
- ✓ Confirm that the receiving switch valves of groups B and C are fully closed ⇒ Check the valve status (Physical inflow prevention to other tank groups)

(Example) When the status of the tank group is not in the "acceptance process standby" (that means it is in the "measurement /confirmation process" or "release process"), even if an operator mistakenly performs on a incorrect [Group B acceptance process execution operation], the process cannot proceed to the "acceptance process".

2.5 Operating procedures for analysis

- The post-sampling operating procedures in the Measurement/Confirmation Facility are as follows:
  - After measurement by the analyzer, confirmation/approval works inside the core system (there is no manual calculation or transcription).
  - All actions performed in the core system are recorded.



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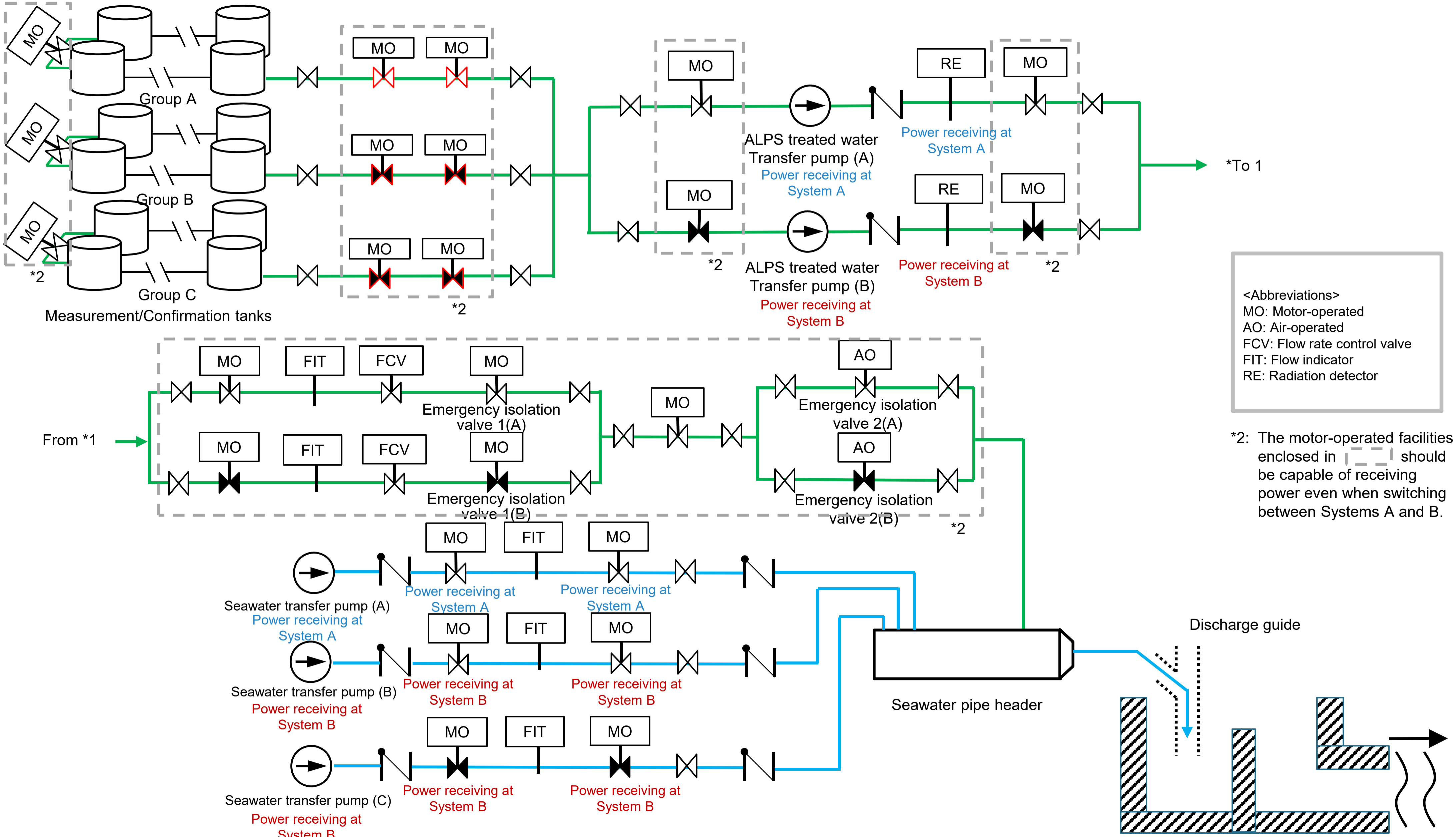
- The system schematics of the Transfer facility/Dilution facility are as follows:



<Abbreviations>
MO: Motor-operated
AO: Air-operated
FCV: Flow rate control valve
FIT: Flow indicator
RE: Radiation detector

*2: The motor-operated facilities enclosed in [dashed box] should be capable of receiving power even when switching between Systems A and B.

2-1 (1) (6) Validity assessment of the facility design in the event of failure
2.7 Operating procedures of Transfer facility/ Dilution facility

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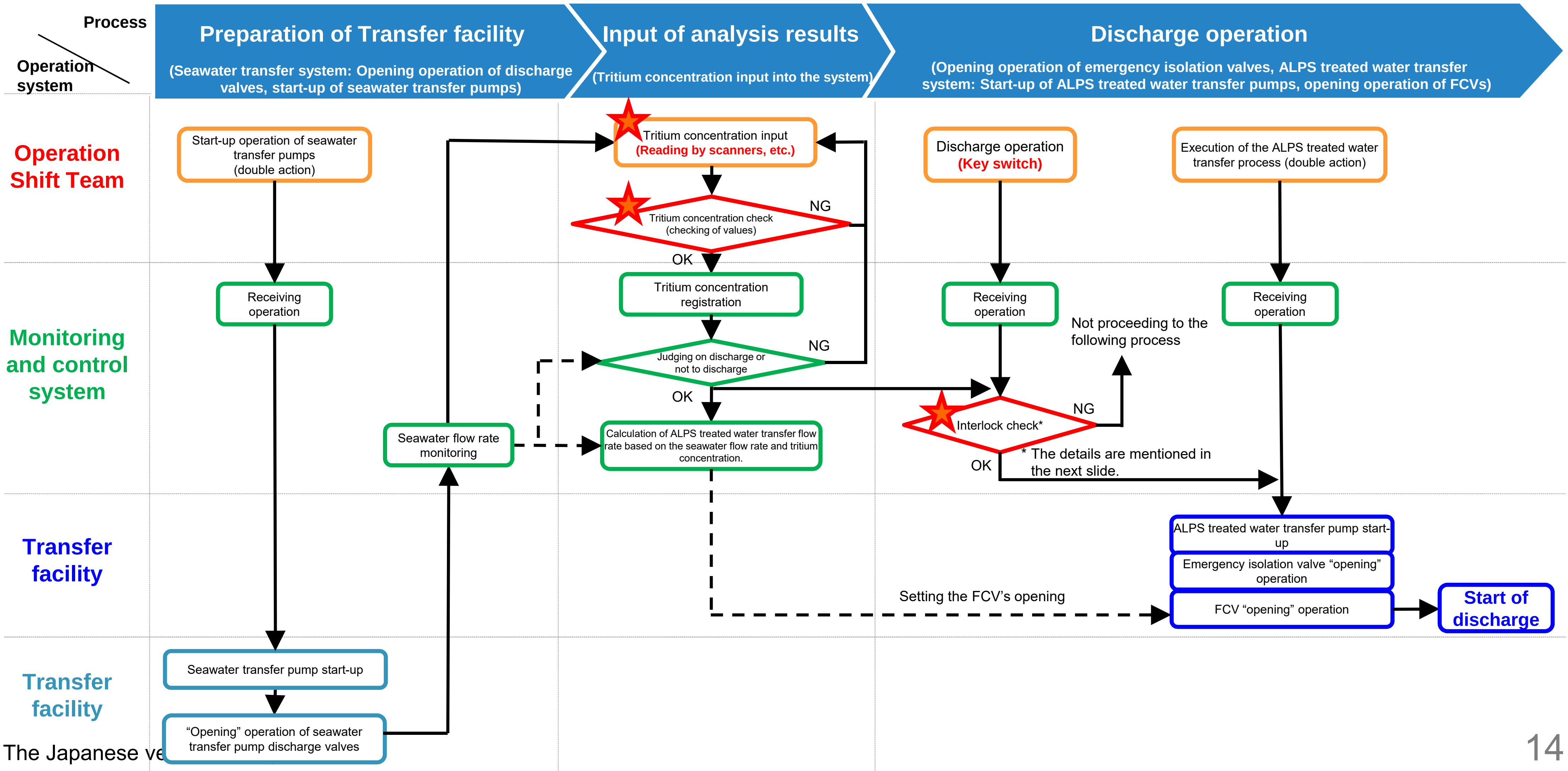
- The operating procedures for discharging ALPS treated water are as follows.
  - To prevent human error, registering the tritium concentrations should be mechanically imported to the monitoring and control system, such as by scanners (several people will check if imported values are correct).
  - To prevent accidental discharge, the monitoring and control system is provided with an interlock to check that selected tank groups have completed the Measurement/Confirmation process and that the boundary valves of other tank groups are fully closed.



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2.8 Prevention of misoperation in the discharge process

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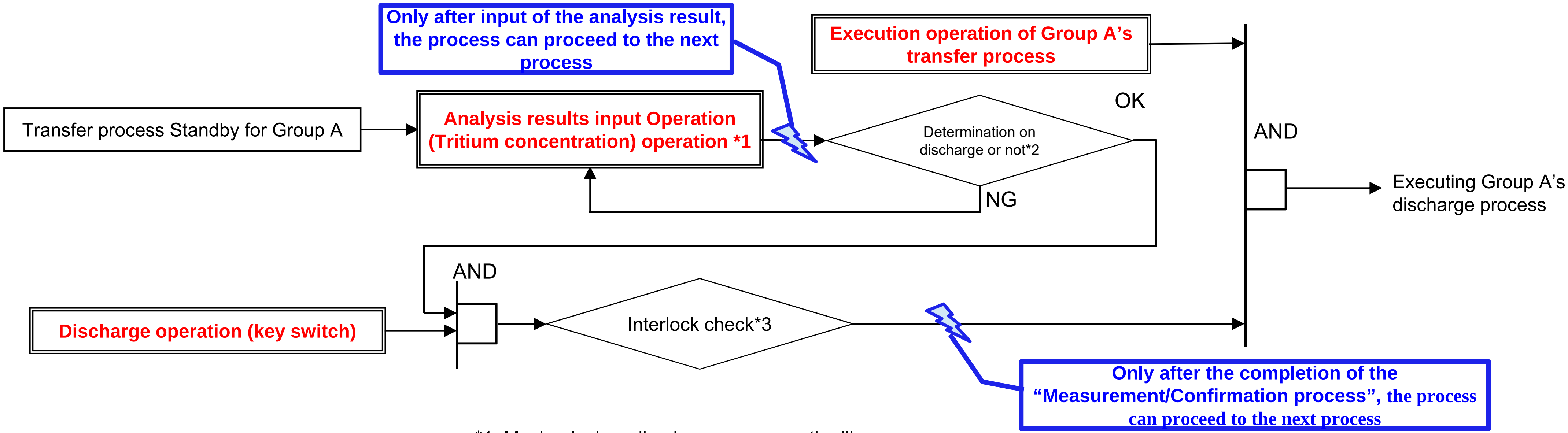
Discharge operation

(Example) When operating discharge from Group A



*1: Mechanical reading by a scanner or the like

<u>*2: Judging on discharge or not to discharge</u>

✓ Check that the water can be diluted to the specified concentration against the volume of seawater for dilution (the number of seawater pumps in operation).

<u>*3: Interlock check</u>

✓ Group A should be in preparation for the transfer process.
(The "Measurement/Confirmation process" in the previous process has been completed) -> Confirm that no process was skipped

✓ The discharge switching valves of Groups B and C should be "fully closed" -> It prevents the discharge of water from the tank groups that are not subject to discharge

✓ Seawater transfer pumps should be operating -> It prevents the discharge of ALPS treated water without being diluted

✓ The key switch should be in the "discharge permitted" -> It prevents misoperation resulting from changing operation procedures

(Example 1) Even if the **[Execution operation of Group A' s transfer process]** is performed with an incomplete analysis of the ALPS treated water by human error, it cannot proceed to the following process unless the analysis result is input.

(Example 2) Even if the **[Execution operation of Group B's transfer process]** is performed by human error, it cannot proceed to the "discharge process" unless the "Measurement/Confirmation process" of the previous process has been completed.

The Japanese version shall prevail.

2.9 Design of the emergency isolation valve and its expected rolls

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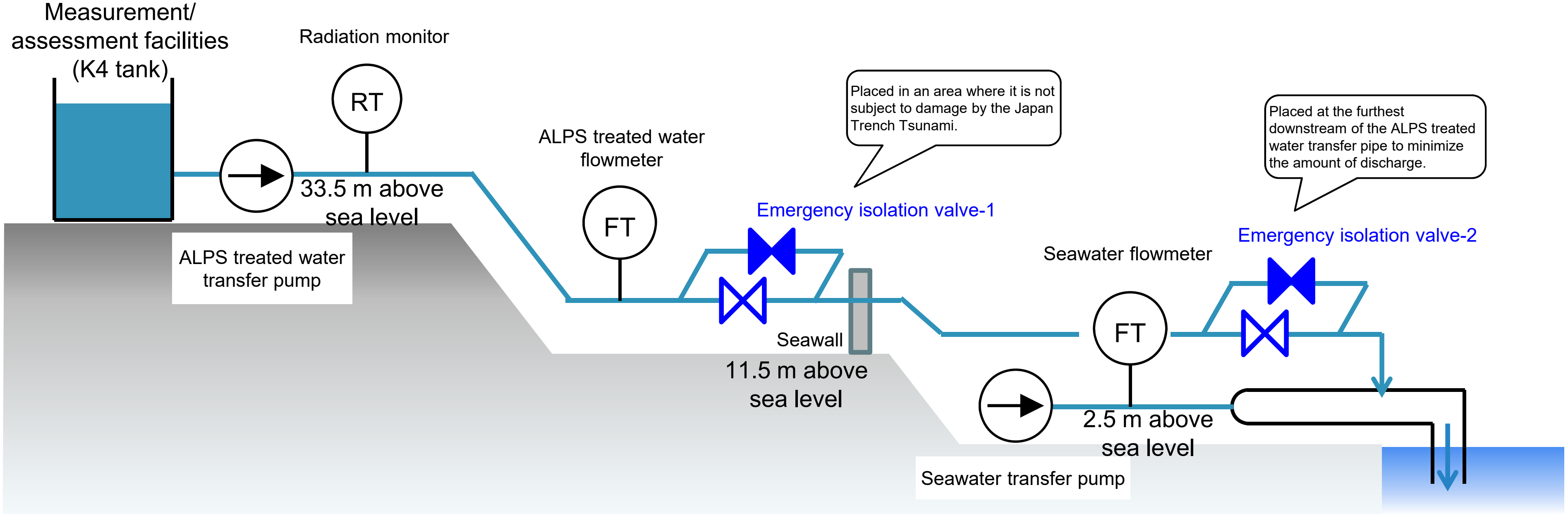
- The emergency isolation valves provided in the ALPS treated water transfer line have a function to stop the discharge of the ALPS treated water into the sea by closing without manual operation in the event of detecting an abnormality that deviates from normal operation.
- The emergency isolation valves are made dual-redundant in series. Their installation position, working methods, and design concept are as follows:

Design	Emergency isolation valve-1	Emergency isolation valve-2
Location of installation	Location not subject to damage by tsunami	Placed at the furthest downstream of ALPS treated water transfer pipe to minimize the amount of discharge during valve operation.
Operating system	Motor-operated (it takes 10 seconds from opening to closing)	AO (it takes 2 seconds from opening to closing)
Concept of design	Two systems are installed and, in the event of failure and maintenance, the system can be switched by opening and closing the front and rear valves to keep the facility availability.	(Same as on the left)



2.10 Operating conditions of the emergency isolation valve

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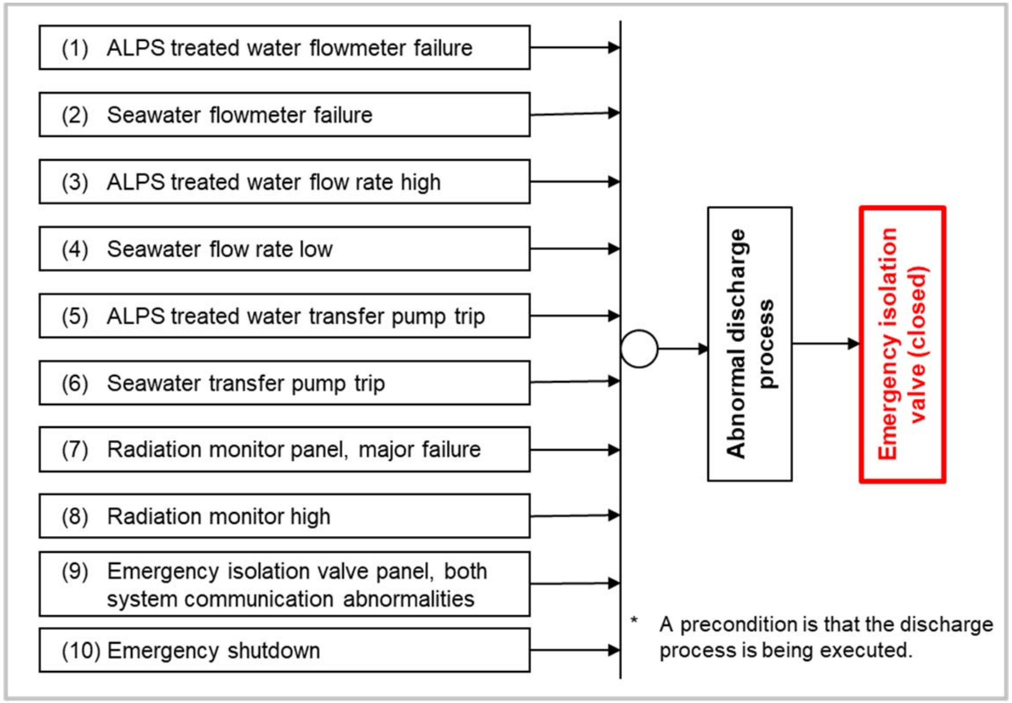
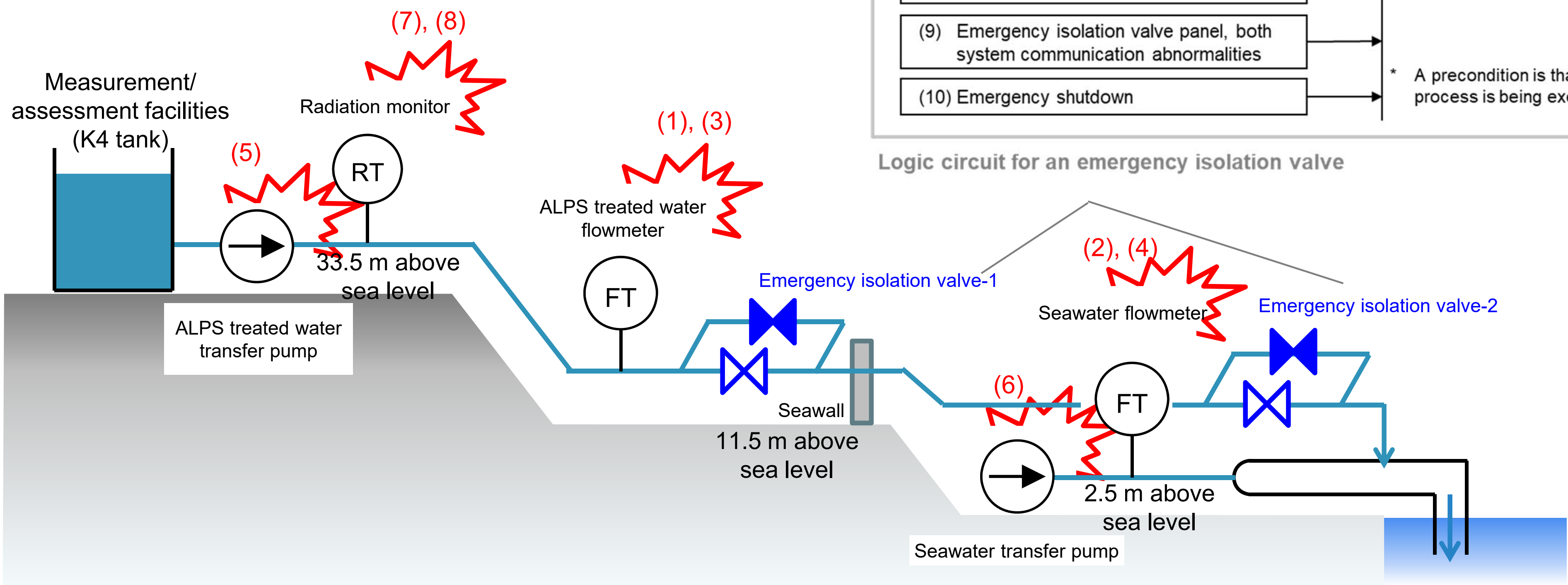
- The operating conditions under which the emergency isolation valve is “closed ” are as shown in the figure below, which is designed to prevent “unintentional discharge of ALPS treated water into the sea.”
- The logic is that when various kinds of abnormalities are detected, the sound seawater transfer system will continue the operation and dilution as much as possible.



Logic circuit for an emergency isolation valve



2-1 (1) (6) Validity assessment of the facility design in the event of failure
[Supplement} Detailed operating conditions of the emergency isolation valve

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Element	Signal	Objective
ALPS treated water flowmeter failure	Transfer line (A) (B) flowmeter overscale	The flow rate cannot be monitored due to instrument failure.
	Transfer line (A) (B) flowmeter downscale	The flow rate cannot be monitored due to instrument failure or cable disconnection.
Seawater flowmeter failure	Seawater transfer pump (A) (B) (C) flowmeter overscale	The flow rate cannot be monitored due to instrument failure.
	Seawater transfer pump (A) (B) (C) flowmeter downscale	The flow rate cannot be monitored due to instrument failure or cable disconnection.
ALPS treated water flow rate high	Transfer line (A) (B) flow rate signal	To maintain the diluted tritium concentration at less than 1,500 Bq/L due to the rising transfer line flow rate
Seawater flow rate low	Seawater transfer pump (A) (B) (C) flow rate signal	To prevent an increase in diluted tritium concentration due to insufficient seawater supply for dilution Due to possible abnormalities in the seawater transfer system
ALPS treated water transfer pump trip	Circuit breaker trip signal	Due to possible abnormalities in the transfer process
Seawater transfer pump trip	M/C trip signal	To prevent an increase in the diluted tritium concentration due to the suspension of seawater supply for dilutionDue to possible abnormalities in the seawater transfer system
Radiation monitor panel, major failure	Radiation monitor (A) (B) lower limit	Due to the radiation monitor not being capable of monitoring
	Radiation monitor (A) (B) circuit breaker trip	
Radiation monitor high	Radiation monitor (A) (B) high	Due to the detection of abnormalities by radiation monitors
Emergency isolation valve panel, both system communication abnormalities	Abnormal communication signal at both systems	In the emergency isolation valve panel, when both systems are in an abnormal condition, the abnormality signal cannot be received, disabling the automatic closing of the emergency isolation valve.
Emergency shutdown	Emergency shutdown signal	To shut down immediately when an operator detects an abnormality

3. Extraction of abnormal events and validity of countermeasures

3.1 Extraction of initiating events and causes leading to abnormal events

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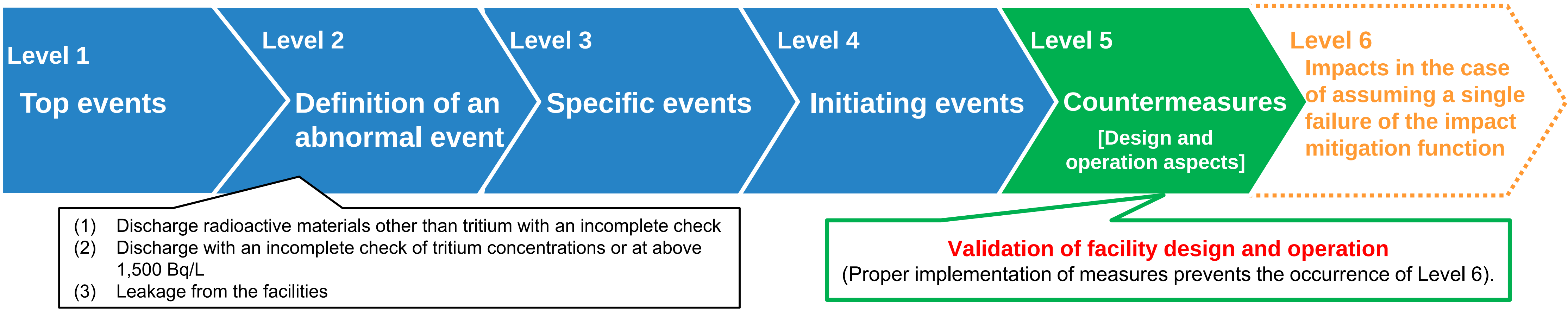
- Using Master Logic Diagram (MLD)*, an abbreviated fault tree, analysis was carried out on whether an abnormal event would occur or not at the ALPS treated water dilution/discharge facilities.
- In developing the MLD, systematically analyzed under the MLD concept with our members engaged in machinery, electricity, and instrumentation related to the facility design, and supervised by the members involved in safety and risk assessment.
- As a result of the analysis, we have confirmed a need for redundancy for the ALPS treated water flow meter.

*MLD is a top-down analysis method to identify initiating events from top events, revealing the initiating events and causes that would result in abnormal events.

	Description
Level 1	The top event, “Unintentional discharge of ALPS treated water into the sea,” is set.
Level 2	Three abnormal events defined as top events are set (see (1) - (3) below).
Level 3	As for the abnormal events defined in Level 2, specific events that may lead to abnormal events are identified with reference to facility specifications, P&ID, IBD, equipment layout drawings, and operating procedures, focusing on the functions expected in each process.
Level 4	Equipment single failure, misoperation, or single misoperation by the operator anticipated with this facility in service, leading up to Level 3, and disturbances expected to occur with similar frequency to those mentioned above are extracted.
Level 5	Related to the Level 4 initiating events, the validity of the facility design and operation measures are checked.



Evaluation method using master logic diagram (MLD)

2-1 (1) (6) Validity assessment of the facility design in the event of failure
3.2 Results of analysis using MLD

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- The evaluation results by the MLD are as follows.

-> It has not been confirmed that the abnormal event (1) "Discharge of radioactive materials other than tritium with an incomplete check" would occur. An impact assessment was conducted based on abnormal events (2) and (3).

Level 1	Level 2	Level 3	Level 4			Level 5	Level 6
Top events	Definition of an abnormal event (OR condition)	Specific events (OR condition)	Initiating events			Countermeasures (AND condition)	Impact
			Timing of occurrence	Abnormality category	Description		
Unintentional discharge of ALPS treated water into the sea	(1) Discharge of radioactive materials other than tritium with an incomplete check	Inadequate sampling	Measurement /Confirmation process	HE	When selecting a tank group for water sampling, wrong ones are selected (double action input failure)	• Set up interlock check • Check the status of valve opening/closing during water sampling	(Prevention)
				Facility (static)	Water from tank groups other than the target tank group is mixed into the water sampling point	• Make tank inlet valves and outlet valves dual-redundant, respectively • Check the status of valve opening/closing during water sampling • Perform time-based maintenance for the circulation line switching valves at appropriate times	(Prevention)
				HE	Wrong sample for analysis	• Workers and analysts to check by matching the analysis instructions with sample bottles	(Prevention)
		Inadequate analysis	Measurement /Confirmation process	HE	Incorrect analysis procedure	• Check by matching the internal analysis results with the third-party analysis results	(Prevention)
				HE	Analytical results of different samples are notified to the Discharge and Environmental Radiation Monitoring Group Manager	• Notify data in the core system without transcription • Analysts to check trends of results	(Prevention)

2-1 (1) (6) Validity assessment of the facility design in the event of failure
3.2 Results of analysis using MLD

Level 1	Level 2	Level 3	Level 4			Level 5	Level 6
Top events	Definition of an abnormal event (OR condition)	Specific events (OR condition)	Initiating events: Timing of occurrence	Initiating events: Abnormality category	Initiating events: Description	Countermeasures (AND condition)	Impact
Unintentional discharge of ALPS treated water into the sea	(1) Discharge of radioactive materials other than tritium with an incomplete check	Inadequate analysis [Continued]	Measurement /Confirmation process	HE	Abnormal values in the analysis results are overlooked	• Analyst to detect abnormal values from recent trends • Chemical Analysis & Evaluation Group Manager to detect abnormal values from past analysis results, etc.	(Prevention)
				HE	The analysis results of different samples are notified to the Shift Manager.	• Notify data in the core system without transcription • Analysts to check trends of results	(Prevention)
		Inadequately homogenized sample	Measurement /Confirmation process	Facility (dynamic)	Insufficient agitation and circulation due to shutdown (failure) of Agitation equipment and circulation pump	• Circulation operation deactivate due to Agitation equipment shutdown • Regularly check the operation status with the monitoring and control system	(Prevention)
				Facility (dynamic)	Lack of circulation due to declining circulation pump flow rate	• An interlock to shut down the circulation pump is activated with the circulation pump's low flow rate signal. • Regularly check the flow rate with the monitoring and control system	(Prevention)
	(2) Discharge with an incomplete check of tritium concentrations or at above 1,500 Bq/L	Inadequate sampling	Measurement /Confirmation process	HE	When selecting a tank group for water sampling, wrong ones are selected (double action input failure)	(Same as countermeasures against an abnormal event (1))	(Prevention)
				Facility (static)	Water from tank groups other than the target tank group is mixed into the water sampling point	(Same as countermeasures against an abnormal event (1))	(Prevention)
				HE	Wrong sample for analysis	(Same as countermeasures against an abnormal event (1))	(Prevention)

2-1 (1) (6) Validity assessment of the facility design in the event of failure
3.2 Results of analysis using MLD

Level 1	Level 2	Level 3	Level 4			Level 5	Level 6
Top events	Definition of an abnormal event (OR condition)	Specific events (OR condition)	Initiating events			Countermeasures (AND condition)	Impact
			Timing of occurrence	Abnormality category	Description		
Unintentional discharge of ALPS treated water into the sea	(2) Discharge with an incomplete check of tritium concentrations or at above 1,500 Bq/L	Inadequate analysis	Measurement /Confirmation process	HE	Incorrect analysis procedure	(Same as countermeasures against an abnormal event (1))	(Prevention)
				HE	Analytical results of different samples are reported to the Discharge and Environmental Radiation monitoring Group Manager	(Same as countermeasures against an abnormal event (1))	(Prevention)
				HE	Abnormal values in the analysis results are overlooked	(Same as countermeasures against an abnormal event (1))	(Prevention)
				HE	Analytical results of different samples are reported to the Shift Manager	(Same as countermeasures against an abnormal event (1))	(Prevention)
		Defect in dilution	Measurement /Confirmation process	HE	When the tritium concentration is registered to the monitoring and control system, a value lower than the actual value is input incorrectly (-> The opening of the FCV becomes larger)	• Mechanically input tritium concentrations to the monitoring and control system using a scanner, etc. • Several people check the values mechanically imported to the monitoring and control system	(Prevention)
			Discharge process	Facility (static)	Loss of off-site power supply	• In the event of loss of power, the emergency isolation valve-1 (MO) will be automatically closed • In the event of loss of power, the emergency isolation valve-2 (AO) will be automatically closed • It can be closed by installing a hand-operated valve in the tank inlet/outlet	**(1) Discharge assuming a single failure of the emergency isolation valve**

The Japanese version shall prevail.

Countermeasures --> **Blue**: Design, **Green**: Operation

2-1 (1) (6) Validity assessment of the facility design in the event of failure
3.2 Results of analysis using MLD

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Level 1	Level 2	Level 3	Level 4			Level 5	Level 6
Top events	Definition of an abnormal event (OR condition)	Specific events (OR condition)	Initiating events			Countermeasures (AND condition)	Impact
			Timing of occurrence	Abnormality category	Description		
Unintentional discharge of ALPS treated water into the sea	(2) Discharge with an incomplete check of tritium concentrations or at above 1,500 Bq/L	Defect in dilution [Continued]	Discharge process	Facility (dynamic)	When two seawater transfer pumps are in operation, one unit fails	• In the event of seawater transfer pump failure, the emergency isolation valve-1 (MO) will be automatically closed • In the event of seawater transfer pump failure, the emergency isolation valve-2 (AO) will be automatically closed • It can be closed by a hand-operated valve in the tank inlet/outlet • *Make arithmetic units dual-redundant*	**(1) Discharge assuming a single failure of the emergency isolation valve**
			Discharge process	Facility (dynamic)	When three seawater transfer pumps are in operation, one unit fails	(Same as the above)	**(1) Discharge assuming a single failure of the emergency isolation valve**
			Discharge process	Facility (static)	An abnormality occurs in the indication value of the seawater flowmeter, but an interlock fails to activate	• Perform time-based maintenance for the seawater flowmeter at appropriate times • Set off an alarm if an instrument fails • Monitor the deviation of flow rate indication values of two or three seawater transfer pumps, and when the deviation exceeding the instrument error is observed, set off an alarm	**(Prevention)**
			Discharge process	Facility (static)	An abnormality occurs in the indication value of the ALPS treated water flow meter (-> Leading to an inadequate opening of the FCV), but an interlock fails to activate	• Perform time-based maintenance for the ALPS treated water flow meters at appropriate times • **[Addition] Make ALPS treated water flow meters dual-redundant** • Set off an alarm if an instrument fails • Set the upper limit flow rate according to the set dilution ratio, and generate an alarm when the upper limit is reached	**(Prevention)**

The Japanese version shall prevail.

Countermeasures --> **Blue**: Design, **Green**: Operation

2-1 (1) (6) Validity assessment of the facility design in the event of failure
3.2 Results of analysis using MLD

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Level 1	Level 2	Level 3	Level 4			Level 5	Level 6
Top events	Definition of an abnormal event (OR condition)	Specific events (OR condition)	Initiating events			Countermeasures (AND condition)	Impact
			Timing of occurrence	Abnormality category	Description		
ALPS Unintentional discharge of ALPS treated water into the sea	(2) Discharge with an incomplete check of tritium concentrations or at above 1,500 Bq/L	Defect in dilution [Continued]	Discharge process	Facility (static)	FCV failure (mechanical failure such as valving element failure)	• An interlock is to be established to activate the emergency isolation valve if the indication value of the ALPS treated water flow rate does not approach the calculated value of the monitoring and control system. • **[Addition] Make ALPS treated water flow meters dual-redundant** • It can be closed by installing emergency isolation valve -1 (MO). • It can be closed by installing emergency isolation valve -2 (AO) • It can be closed by a hand-operated valve in the tank inlet/outlet • Make arithmetic units dual-redundant	(Prevention)
			Discharge process	Facility (static)	Leakage occurs at the downstream flange of the seawater flowmeter	• Use of seawater transfer pumps with sufficient capacity to meet the required functions • Implementation of periodic patrol inspection	(Prevention)

The Japanese version shall prevail.

Countermeasures --> **Blue**: Design, **Green**: Operation

2-1 (1) (6) Validity assessment of the facility design in the event of failure
3.2 Results of analysis using MLD

Level 1	Level 2	Level 3	Level 4			Level 5	Level 6
Top events	Definition of an abnormal event (OR condition)	Specific events (OR condition)	Initiating events: Timing of occurrence	Abnormality category	Description	Countermeasures (AND condition)	Impact
ALPS Unintentional discharge of ALPS treated water into the sea	(3) Leakage from the facilities	Leakage	Constantly (including during inspection)	Facility (static)	[Reference] Complete destruction of three tank groups*	• In the event of an earthquake (seismic intensity 5 lower or higher), the system will be shut down	Assess the impact resulting from the loss of functions
			Constantly (including during inspection)	Facility (static)	[Reference] Transfer pipe rupture*		
			Constantly (including during inspection)	Facility (static)	Leakage from the flange of the circulating pipe	• Implementation of periodic patrol inspection • The connection between the PE tubes should be a fusion structure. • Installation of foundation weirs around tanks with flanges • Installation of weirs and leakage detectors around circulation pumps with flanges	(Prevention)
			Constantly (including during inspection)	Facility (static)	Leakage from the transfer pipe flange between the tank outlet and the MO isolation valve	• Implementation of periodic patrol inspection • The connection between the PE tubes should be a fusion structure. • Installation of foundation weirs around tanks with flanges • Installation of weirs and leakage detectors around transfer pumps/MO valves with flanges	(Prevention)
			Constantly (including during inspection)	Facility (static)	Leakage from the transfer pipe flange between the MO isolation valve and the AO isolation valve	• Implementation of periodic patrol inspection • The connection between the PE tubes should be a fusion structure. • Installation of weirs and leakage detectors around MO/AO valves with flanges	(Prevention)

*: Assuming the occurrence of an earthquake exceeding the seismic category (C class) of this facility.

The Japanese version shall prevail.

Countermeasures --> **Blue**: Design, **Green**: Operation

3.2 Results of analysis using MLD

TEPCO

Level 1	Level 2	Level 3	Level 4			Level 5	Level 6
Top events	Definition of an abnormal event (OR condition)	Specific events (OR condition)	Initiating events			Countermeasures (AND condition)	Impact
			Timing of occurrence	Abnormality category	Description		
ALPS Unintentional discharge of ALPS treated water into the sea	(3) Leakage from the facilities	Leakage [Continued]	Constantly (including during inspection)	Facility (static)	Leakage from the transfer pipe flange between the seawater pipe header and the AO isolation valve	• Implementation of periodic patrol inspection • The connection between the PE tubes should be a fusion structure. • Installation of weirs and leakage detectors around AO valves with flanges	(Prevention)

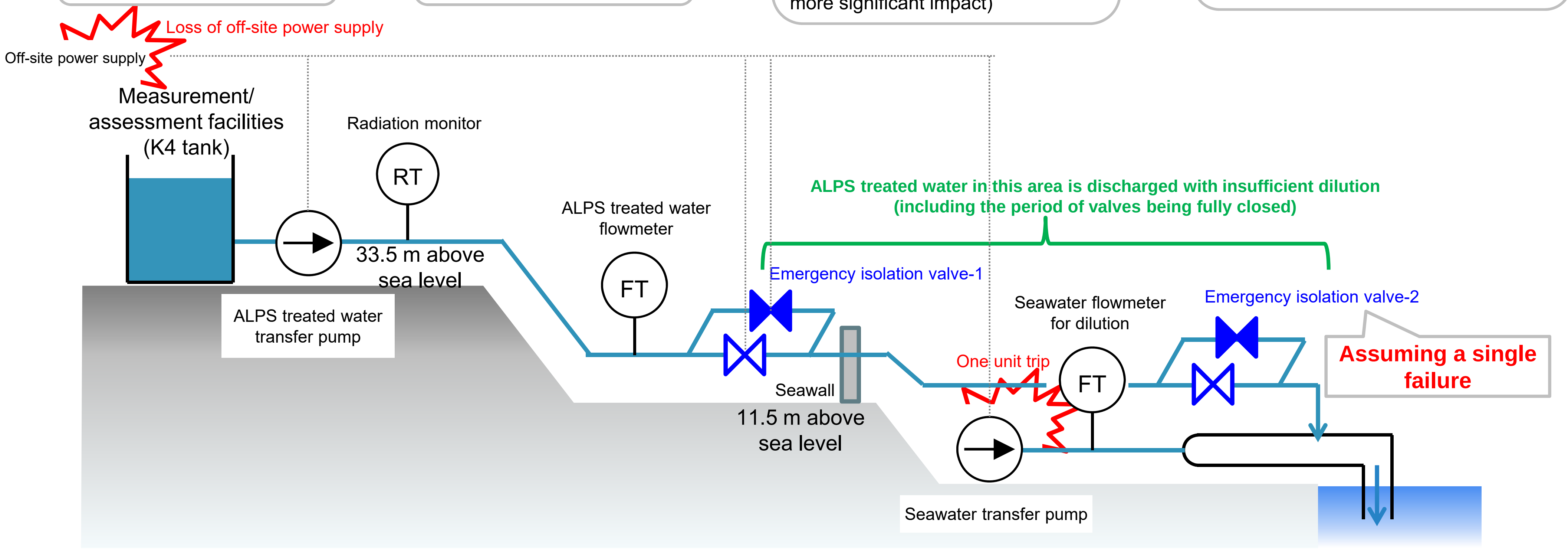
The Japanese version shall prevail.

Countermeasures --> **Blue**: Design, **Green**: Operation

2-1 (1) (6) Validity assessment of the facility design in the event of failure
3.3 Assessment of abnormal events (single failure of emergency isolation valve)

- Based on the MLD results, the following was extracted as an abnormal event (2) “Discharge with an incomplete check of tritium concentrations or at 1,500 Bq/L or above”.

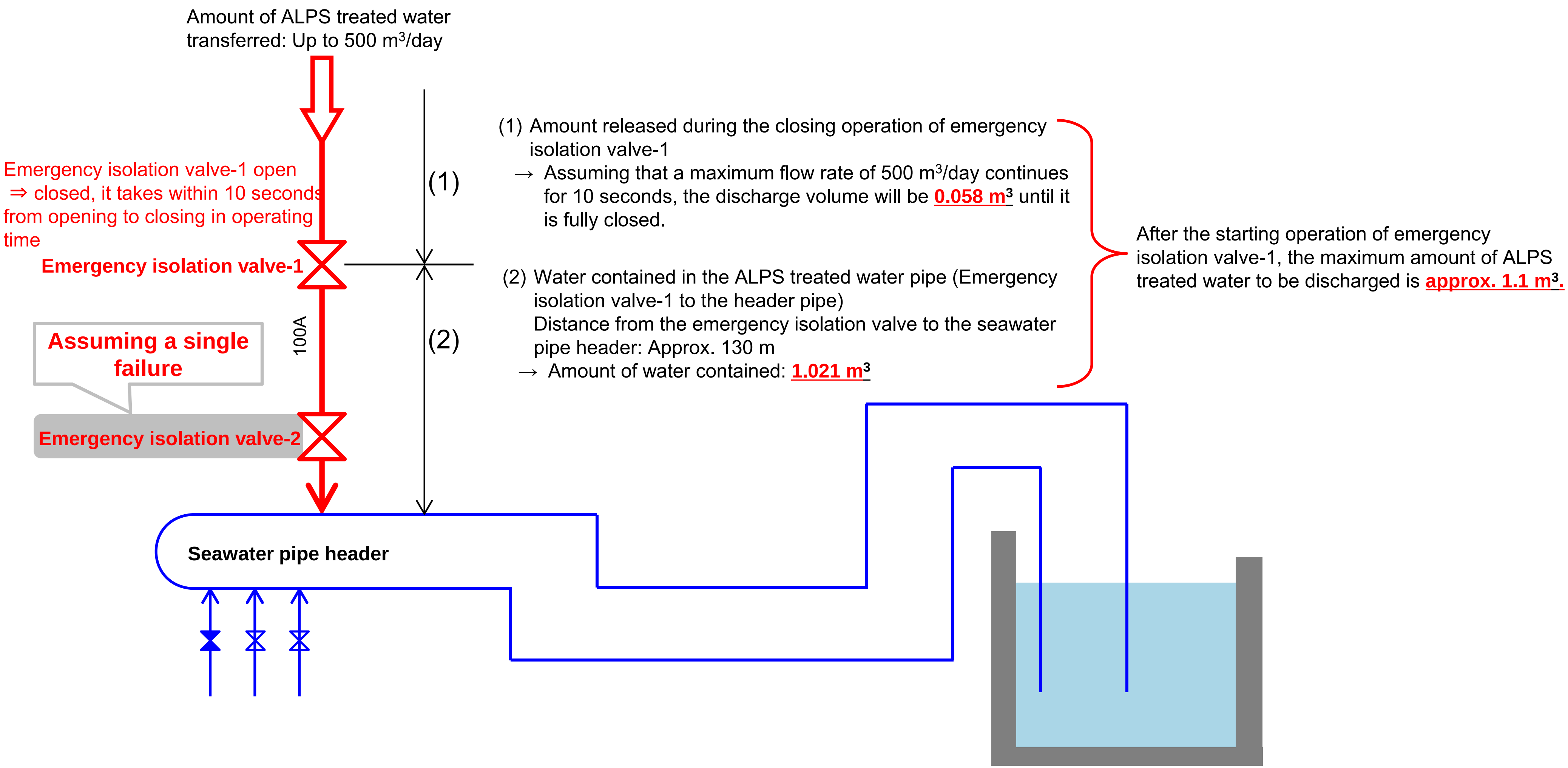
Initiating events	Impact	Single failure of the impact mitigation function, etc.	Evaluation results
Loss of off-site power supply	All pump trip	An emergency isolation valve is usually operated; however, in this case, a single failure of the applicable equipment is assumed. (assuming a failure of the emergency isolation valve-2 with a more significant impact)	Until emergency isolation valve-1 is fully closed, the ALPS treated water is discharged with insufficient dilution. **Discharge amount: Approx. 1.1 m^3**
Seawater transfer pump When two or three units are in operation, one unit trips	Reduction in the volume of the dilution with seawater		



- It has been confirmed that this discharge amount (approx. 1.1 m^3) is sufficiently small compared with the currently planned discharge amount of ALPS treated water (up to 500 m^3/day).
- Based on this, it has been confirmed that the design and operation of the ALPS Treated Water Dilution/Discharge Facilitiesare sufficient for ensuring safety.

[Note] Assessing the discharge amount at the time of a single failure of emergency isolation valve-2

TEPCO



Responses to major issues* concerning the content of the application for the facilities for discharge of ALPS treated water into the sea

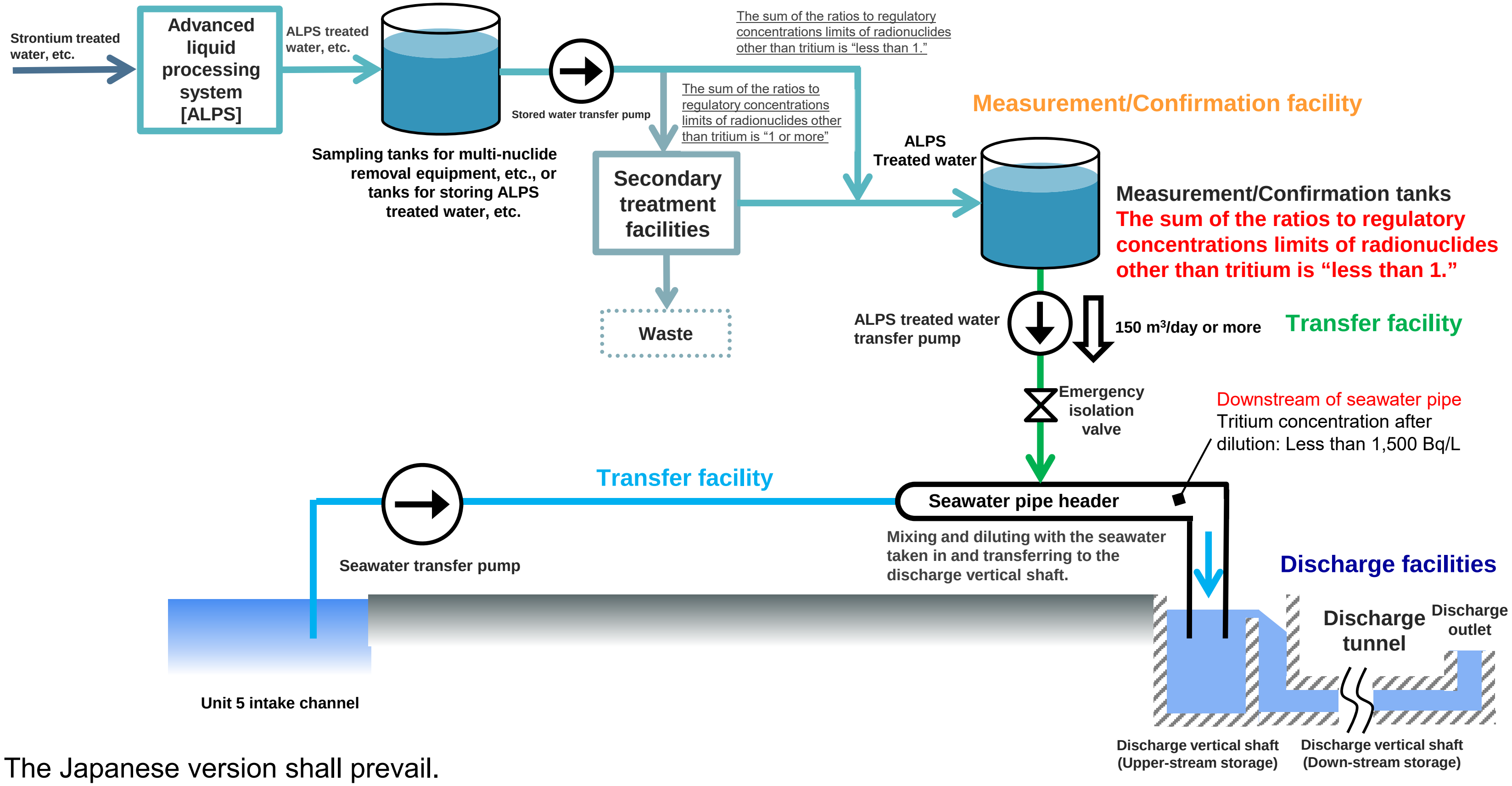
*: Document 1-2 for (The 3rd) Review Meeting on the Implementation Plan Regarding the Handling of ALPS Treated Water

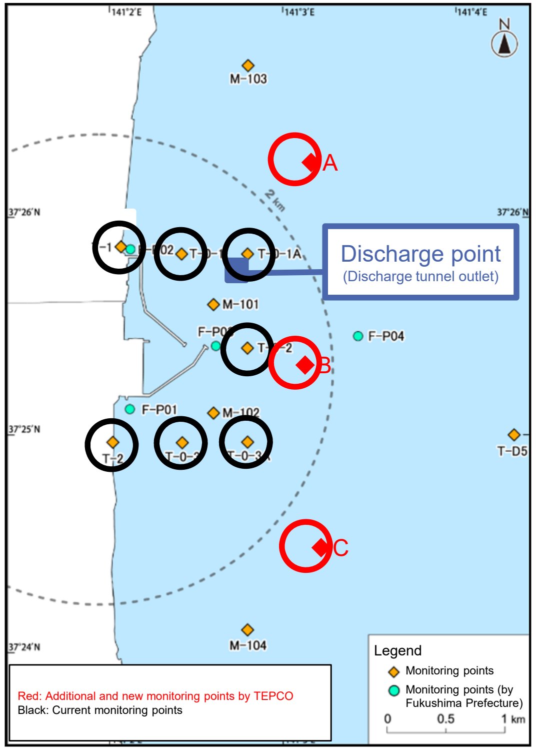
(2-2 Major items to be confirmed regarding activities in line with government policy)

(2) Response based on the results of sea area monitoring

- Explanations shall be provided for judgment criteria and response procedures when abnormal values are detected in the sea area monitoring, and the discharge will be stopped.

- Monitoring policy
  - Concept: ALPS treated water is the purified/treated water in a multi-nuclide removal facility (ALPS); thus, monitoring tritium, which is unable to eliminate, finds abnormality, if any.
  - Details of implementation: The impact of discharging the ALPS treated water is verified through monitoring *, and when any abnormal values are detected, the discharge will be stopped. *: Three new monitoring points are added to the existing seven points (bottom right)
  - Setting abnormal values: The fluctuation range is defined based on the monitoring data, and the abnormal values will be set separately.





Monitoring frequency: once a week

Figure: Sea area monitoring point

The Japanese version shall prevail.

2. Response procedures

- Response procedures in the event of detecting any abnormal values
  1. If any abnormal value is detected, immediately stop the discharge.
  2. Check the analysis results at downstream of the seawater pipe performed daily during discharge period and the flowmeter records. Then determine if any abnormalities occurs in discharge.
  3. In the event that any abnormality is detected in discharge, investigate the operation and management aspects, such as facility abnormality including the discharge vertical shaft and seawater pipe, as well as dilution operation log, and resume discharge after taking necessary measures.
  4. If the abnormality was caused by something other than discharge, investigate the factor of the increase of the value of tritium concentration, identify the cause, and resume the discharge by ensuring that the discharge is possible.
  5. After the resumption of discharge, perform seawater sampling at 10 points for 3 days to check any abnormalities in the sea area monitoring.

The following slides are for reference.

- Monitoring value assessment

When the monitoring value falls under any of the following, it is judged that it has significantly increased.

• Cases where the normal fluctuation range deviates (10 times or more of the annual set point*)

In cases where the value exceeds the highest value in past monitoring results, it should not be treated as a significant increase if it does not deviate from the normal fluctuation range.

- Investigation of the factors of the rise

When judged that the monitoring value has increased significantly, perform the following and identify the cause of the increase.

(1) Check the trend in the monitoring value

Check the concentration fluctuations, whether it has increased in the past or not, and the cause (at the applicable sampling point and the surrounding area)

(2) Check the source of contamination

Check any new contaminated water leakage

- Leakage from contaminated water treatment facilities
- Leakage from containers in the temporary storage area
- Leakage from other facilities

(3) Check the environment around monitoring points

Check the surrounding of the applicable water sampling points

- Check if any on-site work may affect the water sampling points
- Weather conditions (precipitation, wind direction/velocity, tide level, etc.)

(4) Perform resampling of samples and additional sampling

In light of the date and time of the following sampling, examine the necessity, scope, and schedule of the sampling

- Perform resampling to see if the rise continues
- To investigate whether there were factors in the rise or the validity, perform additional sampling at a point other than the water sampling point of concern.

*: Annual set value: Since the Accident in March 2011, the activity concentration has clearly decreased due to decontamination, implementation of measures to prevent the spread of contamination, decay of nuclides, etc., and the value was set as the highest value of data transition over the last 1 year (Jan. 1 to Dec. 31).

[Reference] Examples of measures to be taken when seawater concentration rises

September 25, 2021: Response to an increase in Cs-137 concentration in seawater at the north side of the Unit 5/6 discharge port

<Regular monitoring on September 25 morning>

- When the properties of the sample were checked, it was more turbid (colored) than usual due to sand contamination.
- The analytical results of Cs-137 [7.9 Bq/L] were acceptable because there were no deficiencies in the sampling and analysis procedures (the highest value in the past was 4.5 Bq/L on March 17, 2014).

<Resampling on September 25 evening >

- Although it does not fall under the category of a significant increase, resampling was performed during the day just in case.
- No turbidity (coloring) was observed when the properties of the sample were checked.
- The analytical results of Cs-137 [<0.65 Bq/L were acceptable because there were no deficiencies in the sampling and analysis procedures.
- The Cs-137 concentration was confirmed to be equivalent to that of the previous day, September 24 [< 0.59 Bq/L].

<Check of concentration changes and the surrounding situation>

- From September 19 to 25, no rise in seawater concentrations was observed at other seawater sampling points, except for locations affected by rising drainage channels due to rainfall.

Inside the port:	Port outlet < 0.45 - 0.77 Bq/L (September 25 < 0.46 Bq/L)
Outside the port:	Detected value at the north side of the discharge port of Unit 5/6: 0.48 Bq/L on September 22 and 7.9 Bq/L on September 25 Near the south discharge port < 0.47 - < 0.77 Bq/L (September 25 < 0.73 Bq/L)
Precipitation observed:	September 18: 19.0 mm/day, September 23: 2.5 mm/day, and September 25: 4.5 mm/day

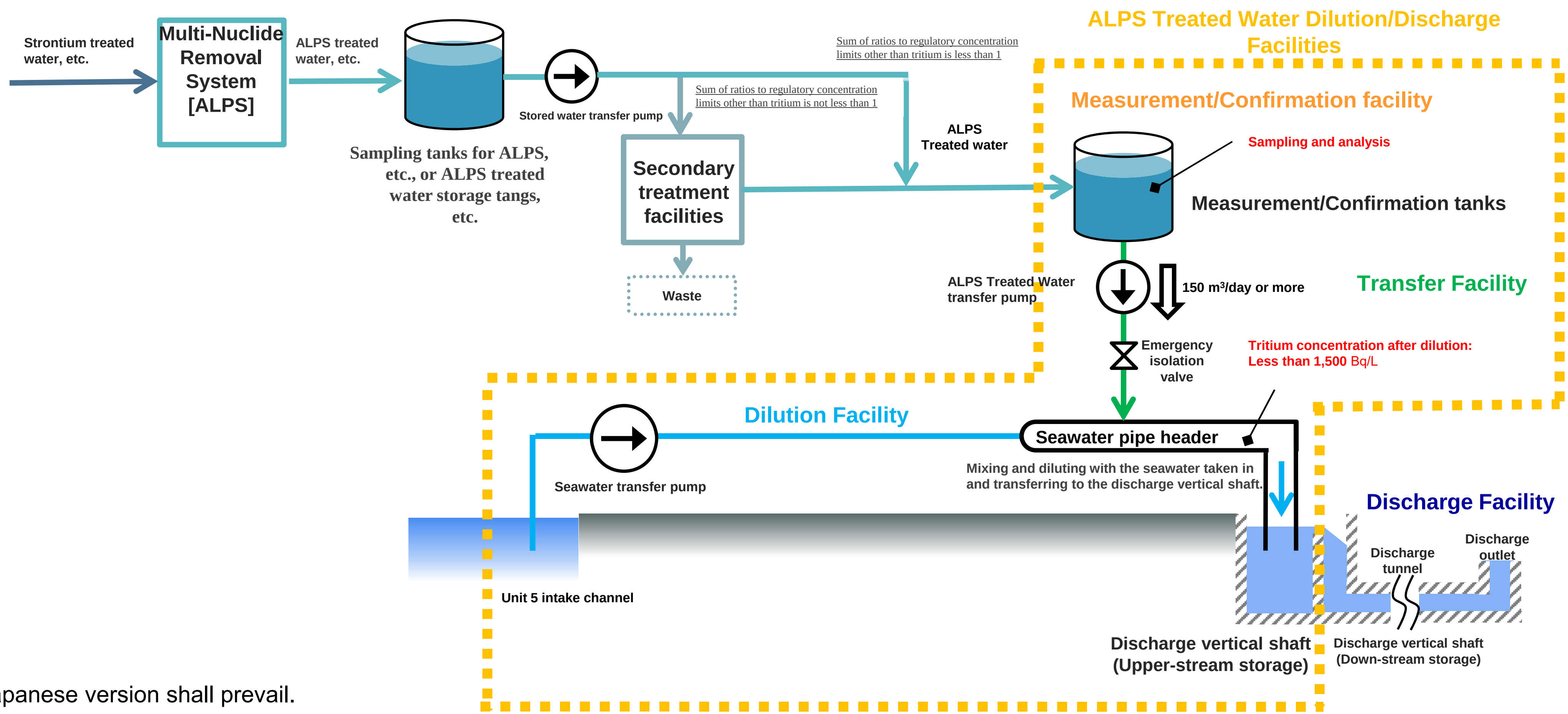
[Reference] Overview of the ALPS Treated Water Dilution/Discharge Facilities

Objective

The facilities ensure that the water treated by Multi-Nuclide Removal System (ALPS) until the radionuclide concentration becomes sufficiently low is the ALPS Treated Water (that is the water in which sum of the ratios to regulatory concentration limits other than tritium is less than 1), and dilute the treated water with seawater, then discharge it into the sea.

Facilities Overview

The Measurement/Confirmation Facility homogenizes the concentration of radionuclides all tanks of the tank group in the status of measurement/ confirmation, and then collects and analyzes samples to ensure that the water is ALPS treated water. Thereafter, the Transfer Facility sends the ALPS Treated Water to the seawater pipe header, and then the Dilution Facility dilutes the water with seawater taken in by the seawater transfer pump at the unit 5 intake channel until tritium concentration in it becomes less than 1,500 Bq/L, and discharge the water to the Discharge Facility.



[Reference] Overview of the ALPS Treated Water Dilution/Discharge Facilities (Measurement/Confirmation facility)

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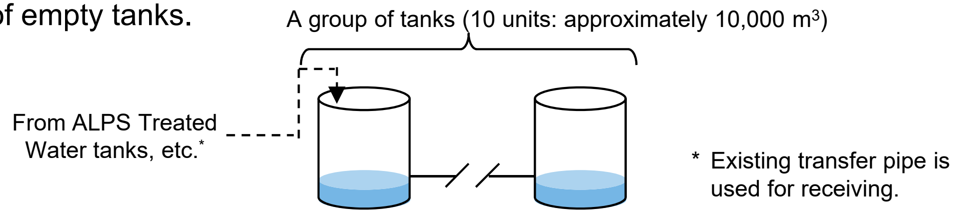
Measurement/Confirmation facility

- K4 area tanks (approx. 30 000 m^3 in total) are reused for the Measurement/Confirmation tanks, and each group from A to C consists of 10 tanks (approximately 1,000 m^3 per unit).
- Each tank group takes the following steps (1) to (3) in rotation, and in the (2) Measurement/Confirmation process, water is circulated and stirred to become homogenized, and then sampled for analysis.

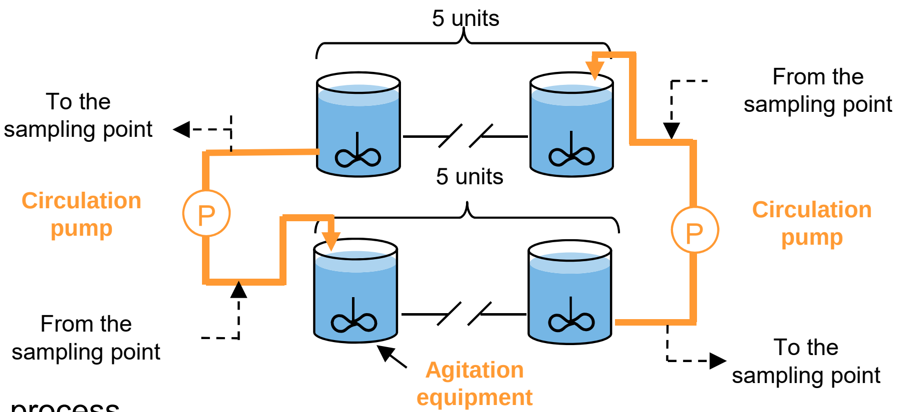
(1) Receiving process

ALPS Treated Water from ALPS Treated Water storage tanks, etc., is transferred into a group of empty tanks.



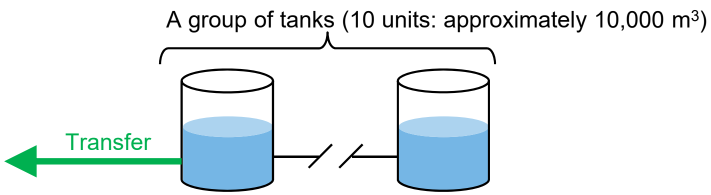
(2) Measurement/Confirmation process

After the quality of water in the tank group is homogenized by the agitation equipment and circulation pumps, the water is sampled to check if it meets the discharge standard.

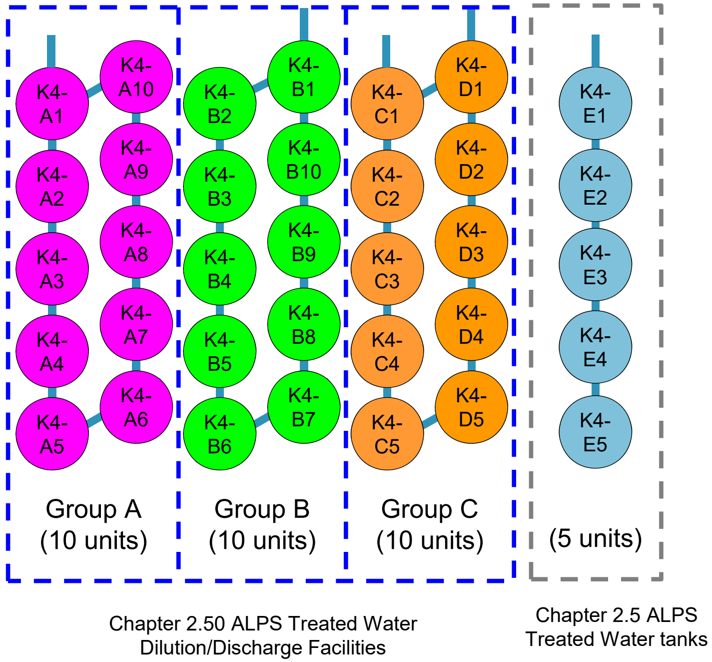


(3) Discharge process

After confirming that the ALPS Treated Water satisfies the discharge standard, the water is transferred to the Dilution Facility by the Transfer Facility.



K4 area tank groups: (35 units)



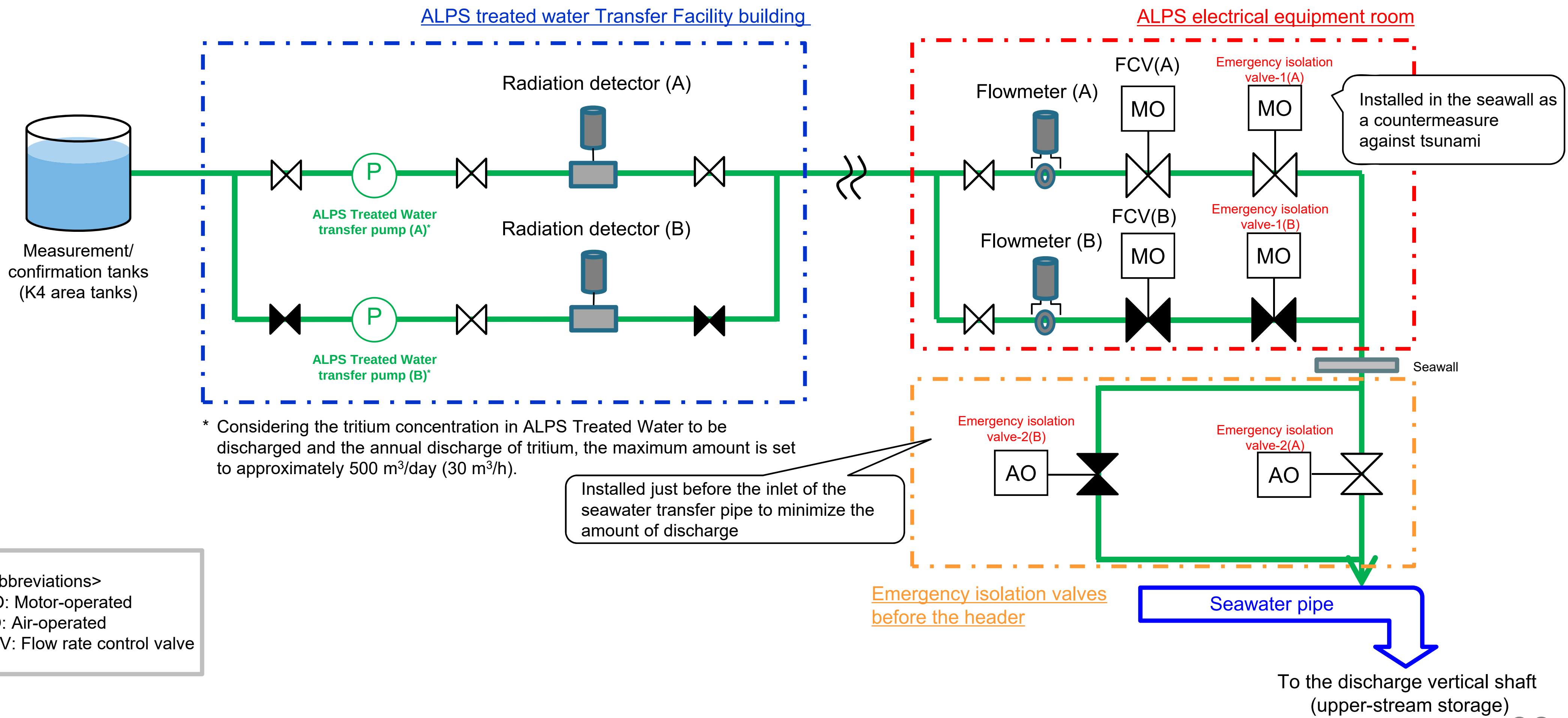
	Group A	Group B	Group C
1st cycle	Receiving	-	-
2nd cycle	Measurement/ confirmation	Receiving	-
3rd cycle	Discharge	Measurement/ confirmation	Receiving
4th cycle	Receiving	Discharge	Measurement/ confirmation
...	Measurement/ confirmation	Receiving	Discharge

TEPCO

[Reference] Overview of the ALPS Treated Water Dilution/Discharge Facilities (Transfer Facility)

Transfer Facility

- The Transfer Facility consists of ALPS Treated Water transfer pumps and transfer pipes.
- Two ALPS Treated Water transfer pumps are prepared, a unit in operation and the other backup unit, to transfer ALPS Treated Water from Measurement/Confirmation tanks to the Dilution Facility.
- Emergency isolation valves are provided both before the seawater piping header and in the seawall as a countermeasure against tsunami so that the transfer can be stopped immediately when an abnormality occurs.

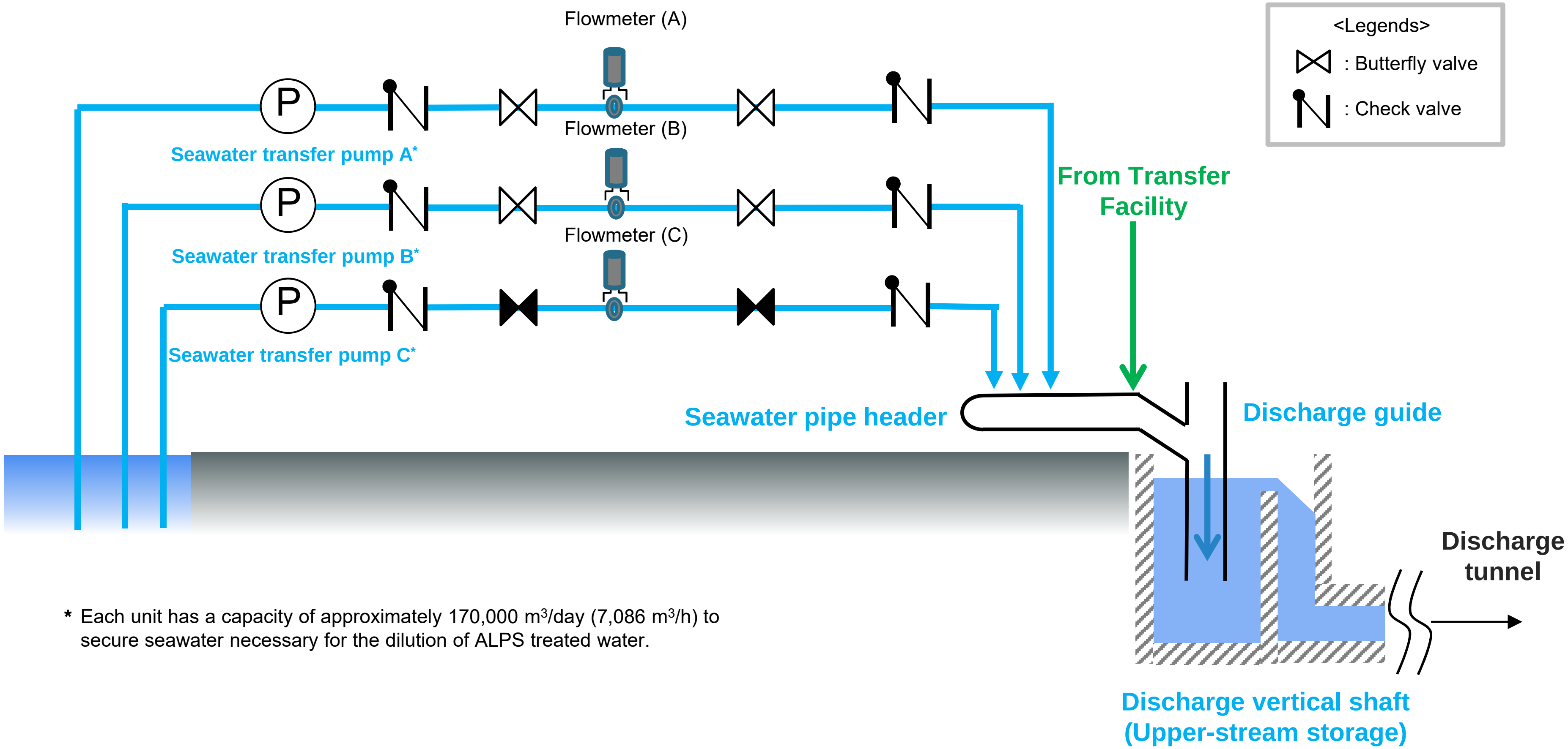


* Considering the tritium concentration in ALPS Treated Water to be discharged and the annual discharge of tritium, the maximum amount is set to approximately 500 m^3/day (30 m^3/h).

<Abbreviations>
MO: Motor-operated
AO: Air-operated
FCV: Flow rate control valve

[Reference] Overview of the ALPS Treated Water Dilution/Discharge Facilities (Dilution Facility)

- Dilution Facility
  - Consisting of seawater transfer pumps, seawater pipe (including a header pipes), a discharge guide, and a discharge vertical shaft (upper-stream storage), the Dilution Facility diluted ALPS Treated Water with seawater, transfers it to the discharge vertical shaft (upper-stream storage), and discharge it to the Discharge Facility.
  - The seawater transfer pumps have a capacity that can dilute ALPS Treated Water transferred by the Transfer Facility 100 times or more.



* Each unit has a capacity of approximately 170,000 m^3/day (7,086 m^3/h) to secure seawater necessary for the dilution of ALPS treated water.

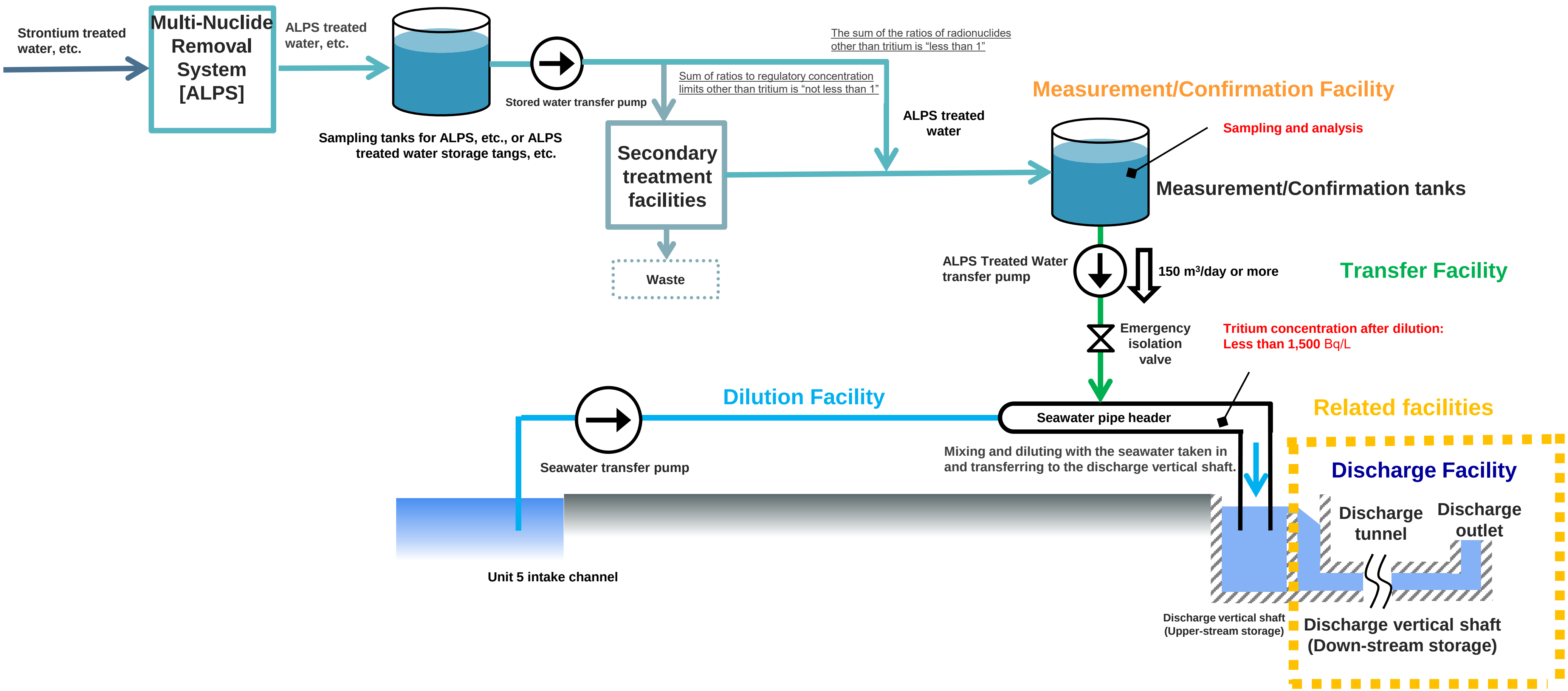
[Reference] Overview of the Related Facility (Discharge Facility)

Objective

Drainage water is discharged from the ALPS Treated Water Dilution/Discharge Facilities (water diluted with seawater so that the sum of which ratios to regulatory concentration limit including all nuclides together with tritium is less than 1) into the sea from a location approximately 1 km away from the coast.

Outline of the facilities

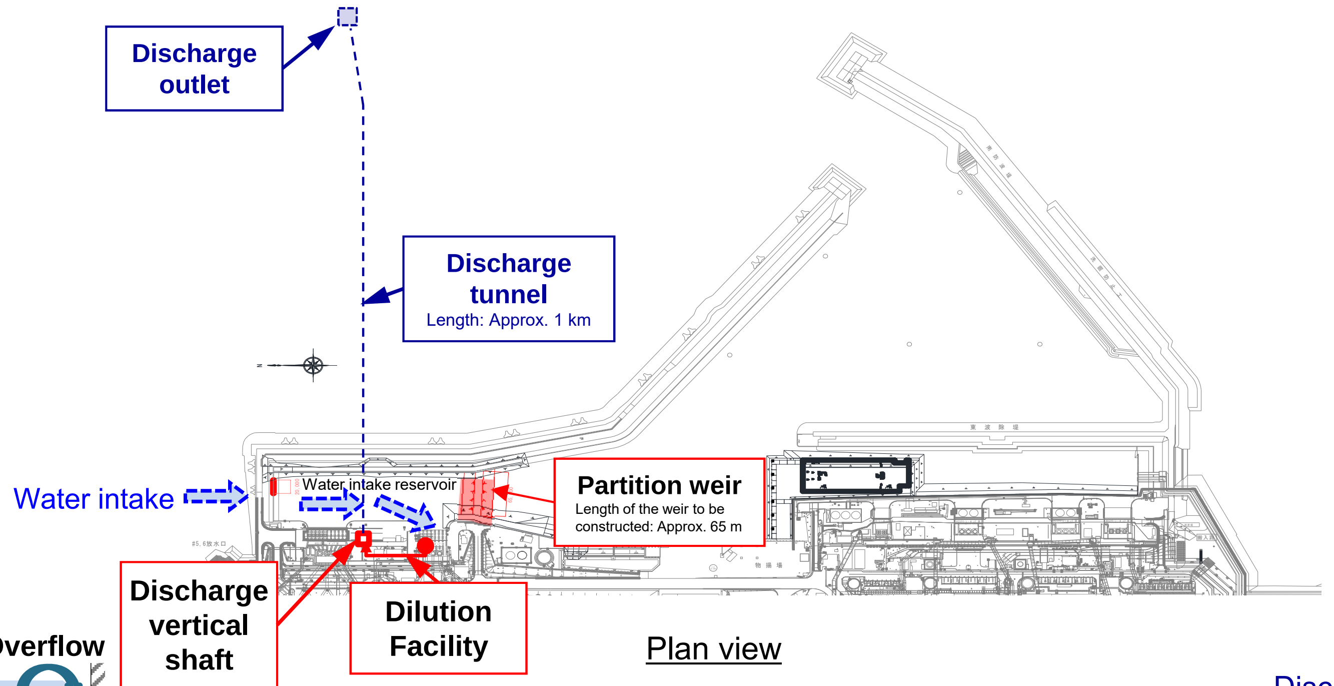
The Discharge Facility consist of a discharge vertical shaft (down-stream storage), a discharge tunnel, and a discharge outlet to achieve the above objective.

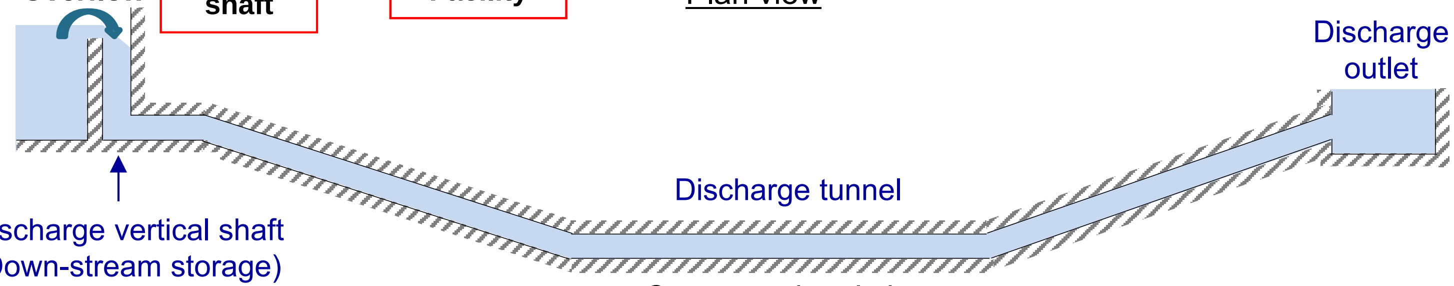


[Reference] Overview of the Related Facility (Discharge Facility) (1/2)

Discharge Facility

- Discharge Facility has a design so that they can transfer water flowing out over the partition wall in the discharge vertical shaft to the outlet, which is approximately 1 km away from the shore, by using the water head difference between water in the discharge vertical shaft (down-stream storage) and the sea surface. In addition, the design concept includes friction losses in the Discharge Facility and elevation of water surface.





Excerpt from the document 1-1 for the 3rd Review Meeting on the Implementation Plan Regarding the Handling of ALPS Treated Water

TEPCO

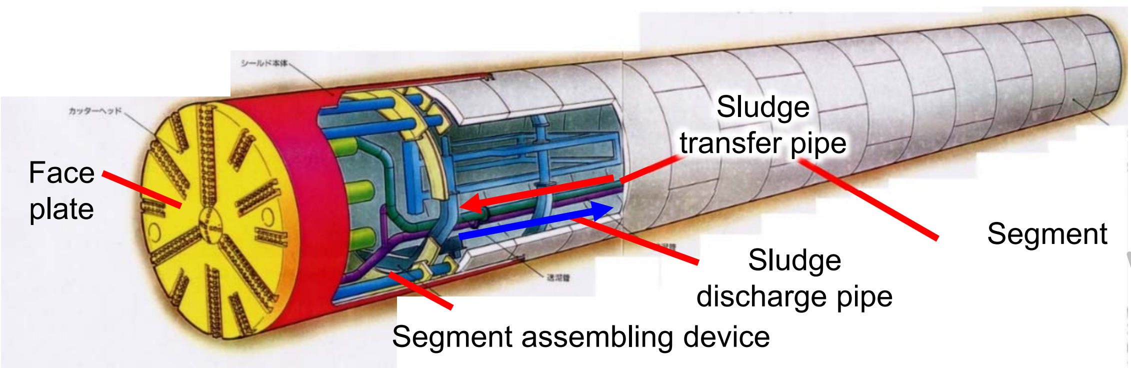
[Reference] Overview of related facilities (Discharge Facility) (2/2)

Overview of the structural design

- Water flows through the bedrock layer to minimize the leakage risk and to ensure a highly earthquake-resistant structure.
- A shield method is adopted and double-layer seals are installed in the reinforced concrete segment to ensure water cut-off performance.
- The tunnel body (segment) is designed considering the impacts of typhoons (high waves) and storm surges (sea level rise).

Construction of tunnel (shield method)

- As there are many discharge tunnels constructed by the shield method, this secure construction will minimize the possibility of trouble.



*Slurry shield method was adopted this time.

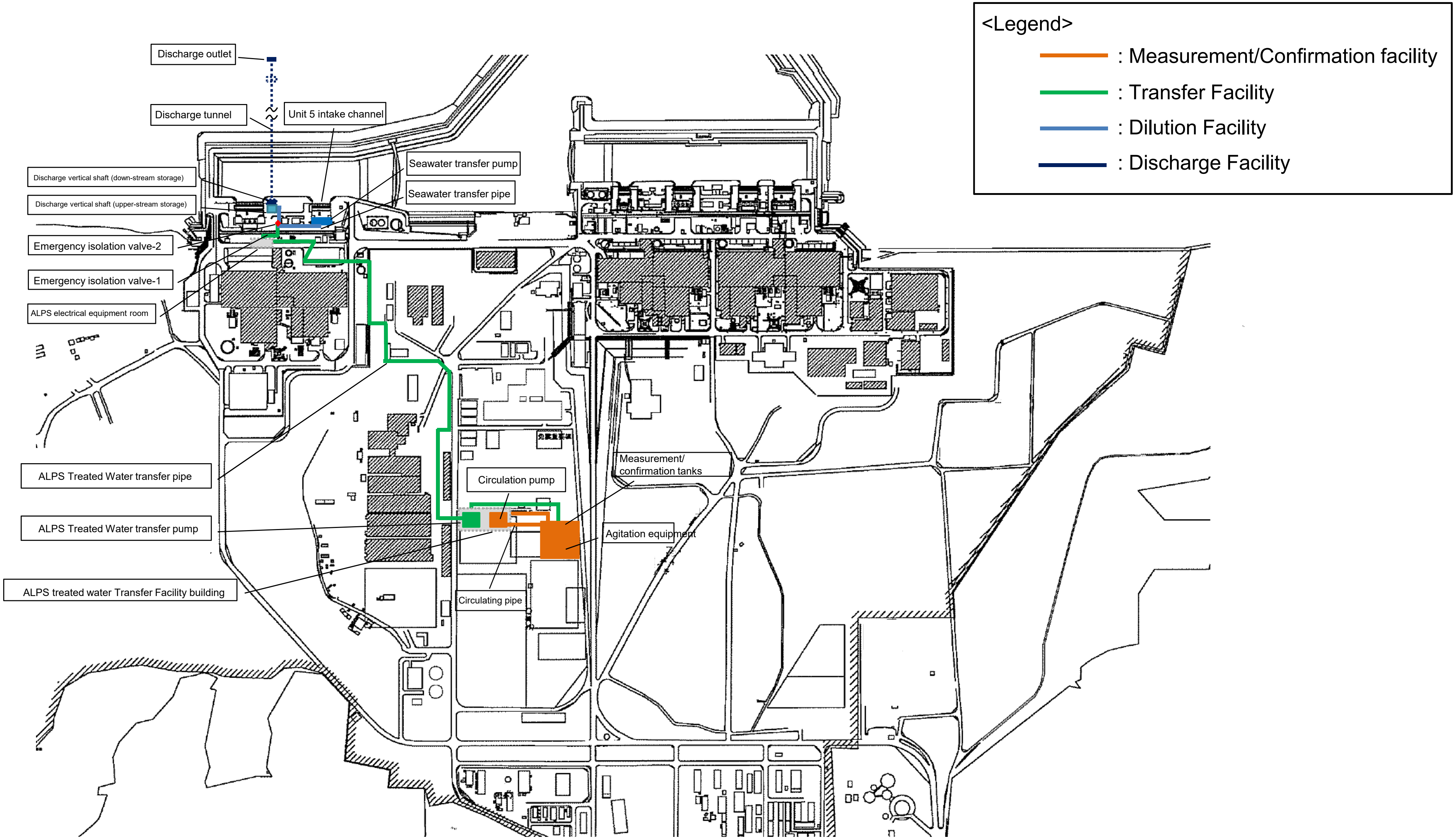
Schematic diagram of a shield machine

Segment

The Japanese version shall prevail.

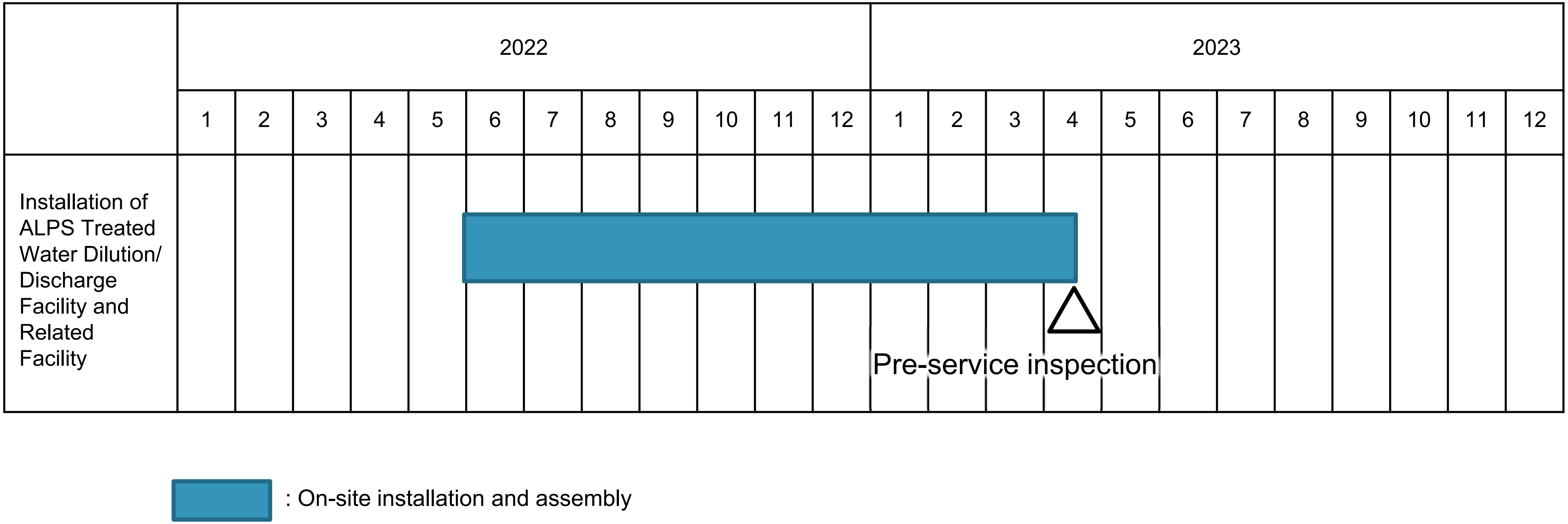
[Reference] Layout plan of ALPS Treated Water Dilution/Discharge Facilities and related facilities

- The layout of ALPS Treated Water Dilution/Discharge Facilities and related facilities is as follows. (Implementation Plan: II-2-50-Attachment 1-2)



[Reference] Installation schedule for ALPS Treated Water Dilution/Discharge Facilities and related facilities

- Once the approval is granted after review by the Nuclear Regulatory Authority, the on-site installation and assembly of the facilities will commence, with completion scheduled for around mid-April 2023.
(Implementation Plan: II-2-50-Attachment 6-1)



The Japanese version shall prevail.

Excerpt from the document 1-1 for the 3rd Review Meeting on the Implementation Plan Regarding the Handling of ALPS Treated Water

[Reference] Facility overview for ensuring safety

Source: This map was created by Tokyo Electric Power Company Holdings, Inc. based on a map published by the Geographical Survey Institute (Electronic Map Web)
https://maps.gsi.go.jp/#13/37.422730/141.044970/&base=std&ls=std&disp=1&vs=c1j0h0k0l0u0t0z0r0s0m0f1

Measurement/Confirmation facility (K4 tank groups)

Consists of 3 groups, each of which is responsible for receiving, measurement/confirmation, and discharge. In the Measurement/Confirmation process, water is circulated and agitated to become homogenized, and then sampled for analysis. (Approx. 10,000 m³ × 3 groups)

Secondary treatment facility (new reverse osmosis membrane equipment)

Secondarily treats treated water to be purified in which the sum of ratios to regulatory concentration limits other than tritium is "1 to 10".

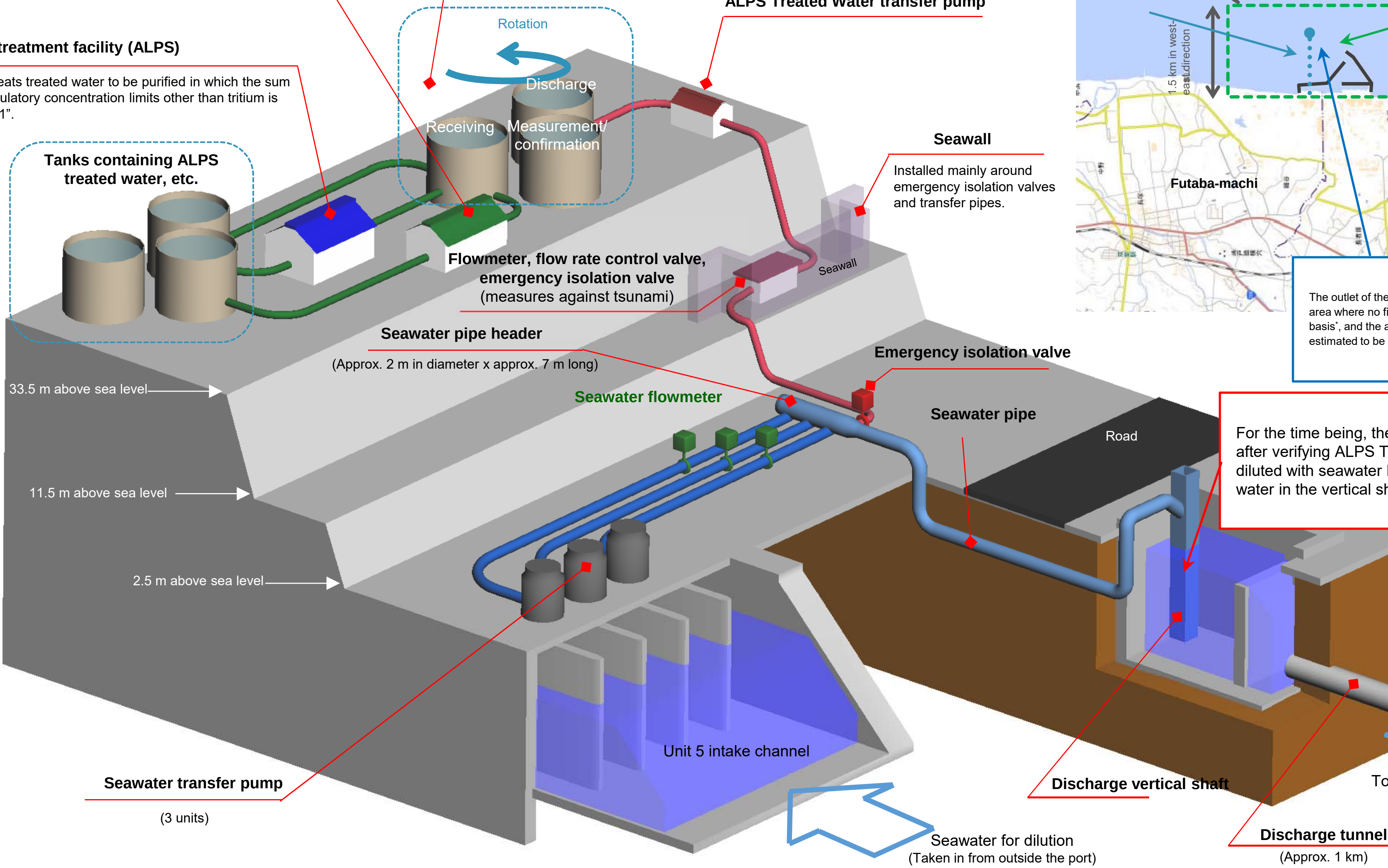
Secondary treatment facility (ALPS)

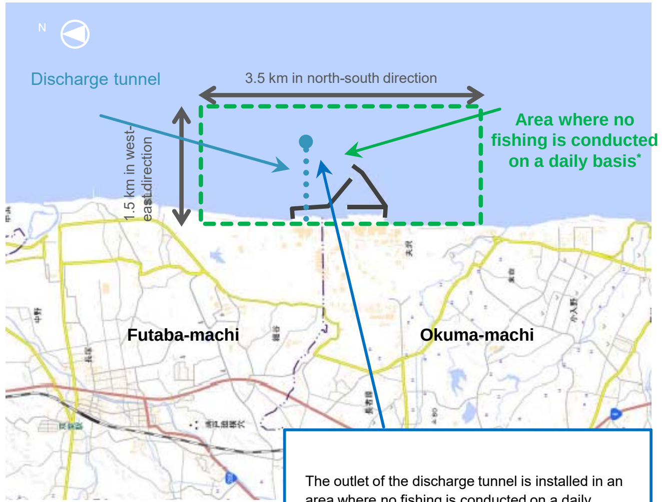
Secondarily treats treated water to be purified in which the sum of ratios to regulatory concentration limits other than tritium is "not less than 1".

ALPS Treated Water transfer pump

Seawall

Installed mainly around emergency isolation valves and transfer pipes.





The outlet of the discharge tunnel is installed in an area where no fishing is conducted on a daily basis*, and the amount of water in the area is estimated to be about 60 billion liters.

For the time being, the discharge will be started after verifying ALPS Treated Water is mixed and diluted with seawater by directly checking the water in the vertical shaft.

The Japanese version shall prevail.

*Area where common fishery rights are not set.

[Reference] Required function of the ALPS treated water dilution/discharge facilities

TEPCO

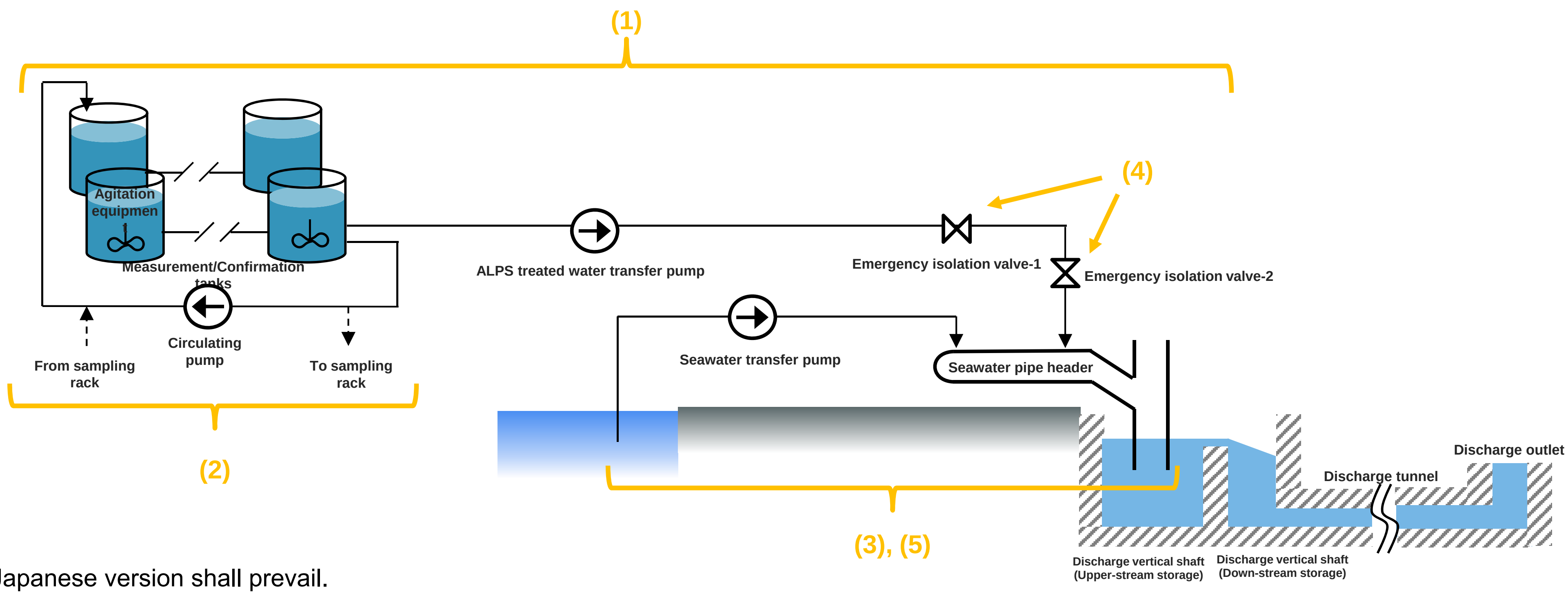
(1) The discharge capacity into the sea must be larger than the amount of contaminated water generated (increase due to inflow of groundwater and rainwater).

(2) To ensure that the undiluted water before discharge is ALPS treated water, the facilities must be able to homogenize the concentration of radioactive documents in a tank and a tank group and collect samples.

(3) The facilities must dilute ALPS treated water with seawater and discharge it into the sea.

(4) The facilities must be equipped with functions to immediately stop the discharge of ALPS treated water into the sea in the event of an abnormality.

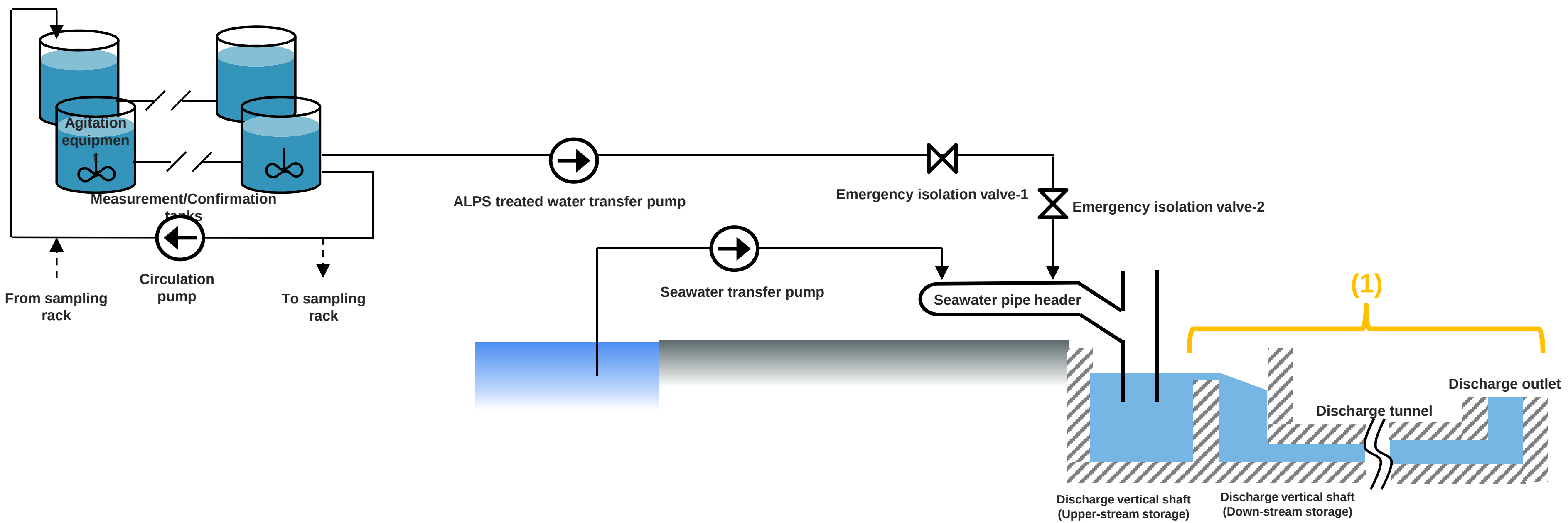
(5) The facilities must be capable of diluting ALPS treated water 100 times or more with seawater so that the tritium concentration in the diluted water becomes sufficiently below the regulatory concentration limit (60,000 Bq/L).
(Implementation Plan: II-2-50-1)



The Japanese version shall prevail.

[Reference] Required functions of the discharge facilities (1/2)

(1) The facilities must be able to discharge the water from the ALPS Treated Water Dilution/Discharge Facilities(wate seawater so that the sum of the ratios to regulatory concentrations limits of all radionuclides including tritium is les sea from a location approx. 1 km away from the coast.
(Implementation Plan: II-2-50-7)



[Reference] Required functions of the discharge facilities (2/2)

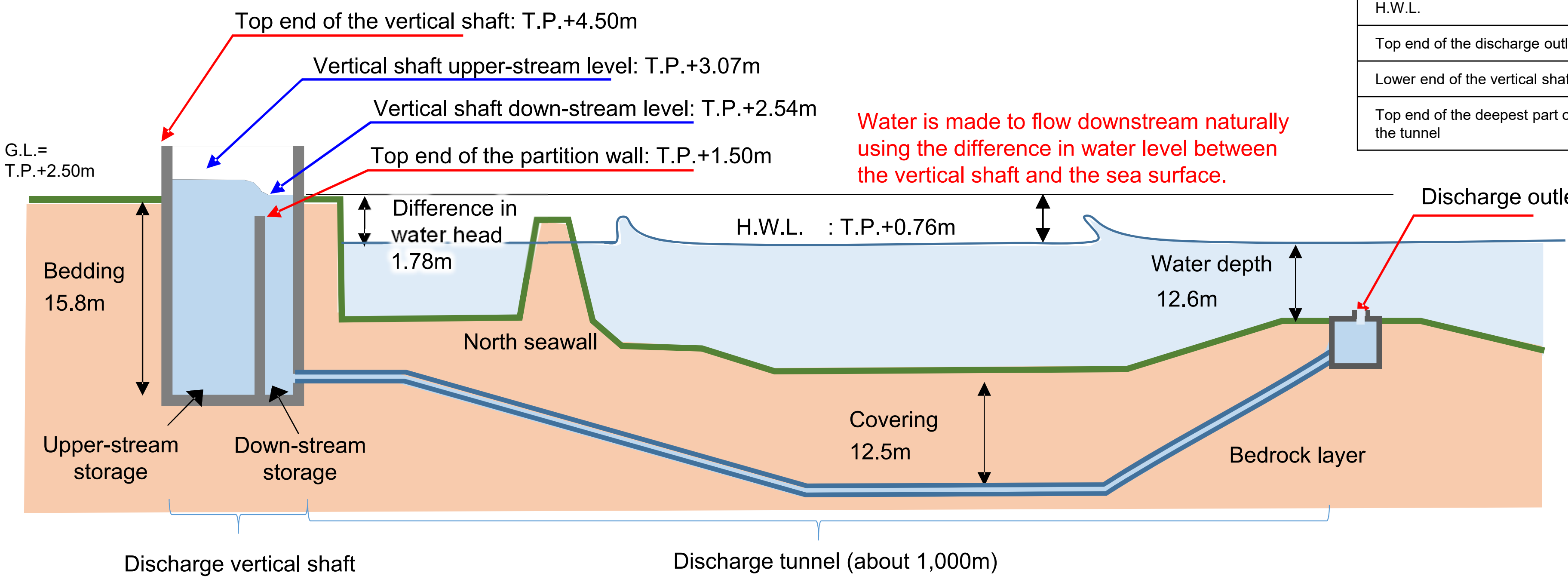
TEPCO

Concept of hydraulic design

- Pressure is released to the atmosphere from the discharge vertical shaft in order to reduce pressure in pipes.
- The structure of the discharge vertical shaft is linked to the tide level in the open ocean through the water discharge tunnel and outlet. It was confirmed that even when three seawater transfer pumps are in operation (510,000 m^3/day = 6 m^3/s), water can flow downstream naturally using the water head difference between the discharge vertical shaft (down-stream storage) and the sea surface (about 1.8 m: total loss from the shaft to the outlet).
- Consideration is given to the rise in water level due to a surge in the event of an emergency shutdown.

List of water levels and elevation

Top end of the vertical shaft	T.P.+4.50m
Vertical shaft upper-stream level	T.P.+3.07m
Vertical shaft down-stream level	T.P.+2.54m
G.L.	T.P.+2.50m
Top end of the partition wall	T.P.+1.50m
H.W.L.	T.P.+0.76m
Top end of the discharge outlet	T.P.-11.9m
Lower end of the vertical shaft	T.P.-15.1m
Top end of the deepest part of the tunnel	T.P.-24.3m



Conceptual diagram of discharge facilities

The Japanese version shall prevail.

[Reference] Basic specifications of equipment and facilities (ALPS treated water dilution/discharge facilities)

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Circulation pump

Number of units	2 units
Capacity	160 m^3/h per unit

ALPS treated water transfer pump

Number of units	2 units
Capacity	30 m^3/h per unit

Seawater transfer pump

Number of units	3 units
Capacity	7,086 m^3/h per unit

Discharge guide

Number of units	1 unit
Main dimensions	Length 2,100 mm x Width 2,100 mm x Height 7,096 mm (upper-stream) Length 2,140 mm x Width 2,140 mm x Height 11,144 mm (down-stream)
Material	SUS316L

Discharge vertical shaft (upper-stream storage)

Number of units	1 unit
Structure	Reinforced concrete

[Reference] Basic Pipe Specifications (ALPS Treated Water Dilution/Discharge Facilities)

Name	Specifications	
From the outlet of the Measurement/Confirmation tanks to the inlet of the circulation pumps (Steel pipe)	Nominal diameter / Thickness Material Maximum operating pressure Maximum operating temperature	200A/Sch.20S SUS316LTP 0.49MPa 40ºC
(Polyethylene pipe)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 200A Polyethylene 0.49MPa 40ºC
(Pressure hose)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 200A Synthetic rubber 0.49MPa 40ºC
(Expansion joint)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 200A Synthetic rubber 0.49MPa 40ºC
From the outlet of the circulation pumps to the inlet of the measurement/ confirmation tanks (Steel pipe)	Nominal diameter / Thickness Material Maximum operating pressure Maximum operating temperature	125A/Sch.20S 150A/Sch.20S 200A/Sch.20S SUS316LTP 0.98MPa 40ºC
(Polyethylene pipe)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 150A Polyethylene 0.98MPa 40ºC
(Expansion joint)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 125A Synthetic rubber 0.98MPa 40ºC

Name	Specifications	
Between Measurement/Confirmation tanks s (Steel pipe)	Nominal diameter / Thickness Material Maximum operating pressure Maximum operating temperature	200A/Sch.20S SUS316LTP 0.49MPa 40ºC
(Polyethylene pipe)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 200A Polyethylene 0.49MPa 40ºC
(Pressure hose)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 200A Synthetic rubber 0.49MPa 40ºC
From the outlet of the Measurement/Confirmation tanks to the inlet of the ALPS treated water transfer pump (Steel pipe)	Nominal diameter / Thickness Material Maximum operating pressure Maximum operating temperature	100A/Sch.20S 150A/Sch.20S SUS316LTP 0.49MPa 40ºC
(Polyethylene pipe)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 100A Equivalent to 150A Polyethylene 0.49MPa 40ºC
(Expansion joint)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 100A Synthetic rubber 0.49MPa 40ºC

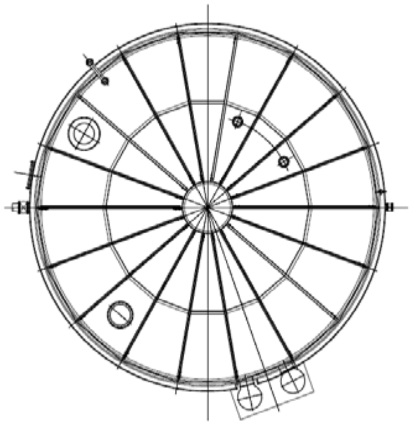
[Reference] Basic Pipe Specifications (ALPS Treated Water Dilution/Discharge Facilities)

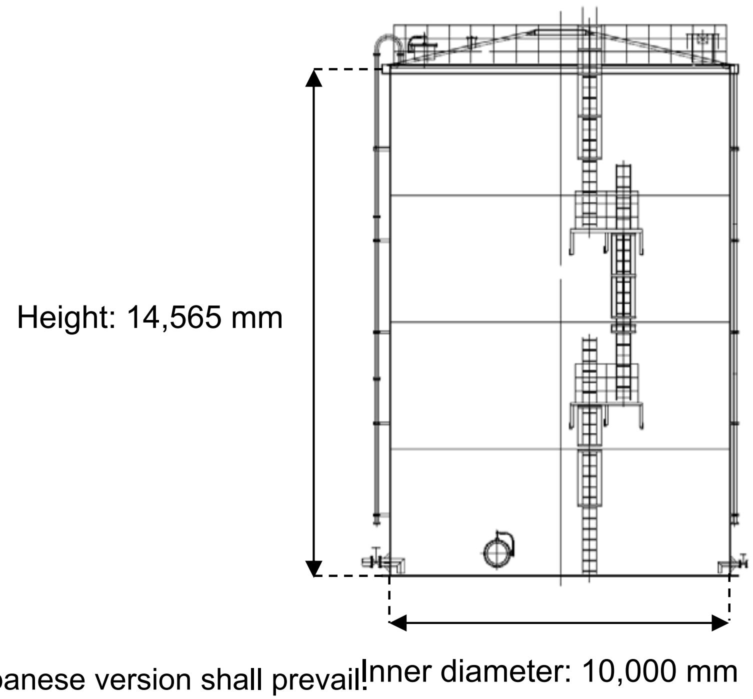
Name	Specifications	
From the outlet of the ALPS treated water transfer pump to the inlet connection of the seawater pipe header (Steel pipe)	Nominal diameter / Thickness Material Maximum operating pressure Maximum operating temperature	100A/Sch.40 STPG370 0.98MPa 40ºC
(Steel pipe)	Nominal diameter / Thickness Material Maximum operating pressure Maximum operating temperature	65A/Sch.20S 100A/Sch.20S 150A/Sch.20S SUS316LTP 0.98MPa 40ºC
(Polyethylene pipe)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 100A Polyethylene 0.98MPa 40ºC
(Expansion joint)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 65A Equivalent to 100A Synthetic rubber 0.98MPa 40ºC

Name	Specifications	
From the outlet of the seawater transfer pumps to the inlet connection of the seawater pipe header (Steel pipe)	Nominal diameter / Thickness Material Maximum operating pressure Maximum operating temperature	800A/12.7mm 900A/12.7mm STPY400 0.60MPa 40ºC
(Steel pipe)	Nominal diameter / Thickness Material Maximum operating pressure Maximum operating temperature	900A/Sch.20S SUS329J4LTP 0.60MPa 40ºC
(Expansion joint)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 800A Equivalent to 900A Synthetic rubber 0.60MPa 40ºC
Seawater pipe header (Steel pipe)	Nominal diameter / Thickness Material Maximum operating pressure Maximum operating temperature	1800A/13mm 2200A/16mm SM400B 0.60MPa 40ºC
From the outlet of the seawater pipe header to the discharge guide (Steel pipe)	Nominal diameter / Thickness Material Maximum operating pressure Maximum operating temperature	1800A/13mm SM400B 0.60MPa 40ºC
(Expansion joint)	Nominal diameter Material Maximum operating pressure Maximum operating temperature	Equivalent to 1800A Synthetic rubber 0.60MPa 40ºC

[Reference] Basic Specifications of Measurement/Confirmation tanks s

- Measurement/Confirmation tanks (using K4 tanks)





Tank capacity		m^3	1,000
Main dimensions	Inner diameter	mm	10,000
	Thickness of shell plate	mm	15
	Thickness of bottom plate	mm	25
	Height	mm	14,565
Thickness of pipe stand	100A	mm	8.6
	200A	mm	12.7
	600A	mm	16.0
Material	Shell plate/Bottom plate	-	SS400
	Pipe stand	-	STPT410,SS400

- Design temperature 50 °C

[Reference] Specifications of facilities related to Measurement/Confirmation tanks s

■ Tank weir* (Foundation weirs are installed to prevent leakage from spreading) (Implementation Plan: II-2-5- Attachment 12-25)

The capacity in the foundation weirs must be equal to the sum of the capacity of 1 tank per 20 tanks (When the number of tanks is 20 units or more, the capacity of 1 tank per 20 tanks, and even when the number is less than 20, the capacity to retain water equal to the capacity of 1 tank can be secured) and the volume of water that can be retained in the allowance guaranteed in view of operations at the time of heavy rain (about 20 cm high of the weirs).

*For tank weirs, those in the K4 area will be used.

Place of installation	Number of installed tanks	Assumed leakage		Capacity inside the foundation weirs around tanks (m^3)	(Planned value)			
		Number of units	Capacity (m^3)		Area in the foundation weirs around tanks (m^2)	Area exclusively used for the tanks (m^2)	Area that can retain water (m^2)	Height of foundation weirs around tanks (m)
K4	35	1.75	1,750	2,190 or more	5,145	2,944	2,201	0.995 or more

■ Pipes attached to the Measurement/Confirmation tanks s

	Nominal diameter	Material	Maximum operating pressure	Maximum operating temperature
Connecting pipe (Pressure hose)	Equivalent to 200A	EPDM synthetic rubber	1.0MPa	50ºC
Inlet pipe (Steel pipe)	100A	STPT410	1.0MPa	50ºC

■ Measurement/Confirmation tanks water gauge

Detection method	TEPCO's management precision
Microwave type	± 1%

■ Valves attached to Measurement/Confirmation tanks s

	Nominal diameter	Material	Maximum operating pressure	Maximum operating temperature
Connecting valve	Equivalent to 200A	FCD450-10	1.0MPa	50ºC

■ Agitation equipment

Number of units
30 units