Document 1-1, the 11th Review Meeting on the Implementation Plan Regarding the Handling of ALPS Treated Water,

Installation of New ALPS Treated Water Dilution/Discharge Facilities and Related Facilities

March 1, 2022

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Tokyo Electric Power Company Holdings, Inc.

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Responses to issues pointed out* at the review meeting, etc.

*: Documents 2-2, Attachment 2 for (the 97th) Specified Nuclear Facilities Monitoring and Assessment Review Meeting

Issues pointed out [1]

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

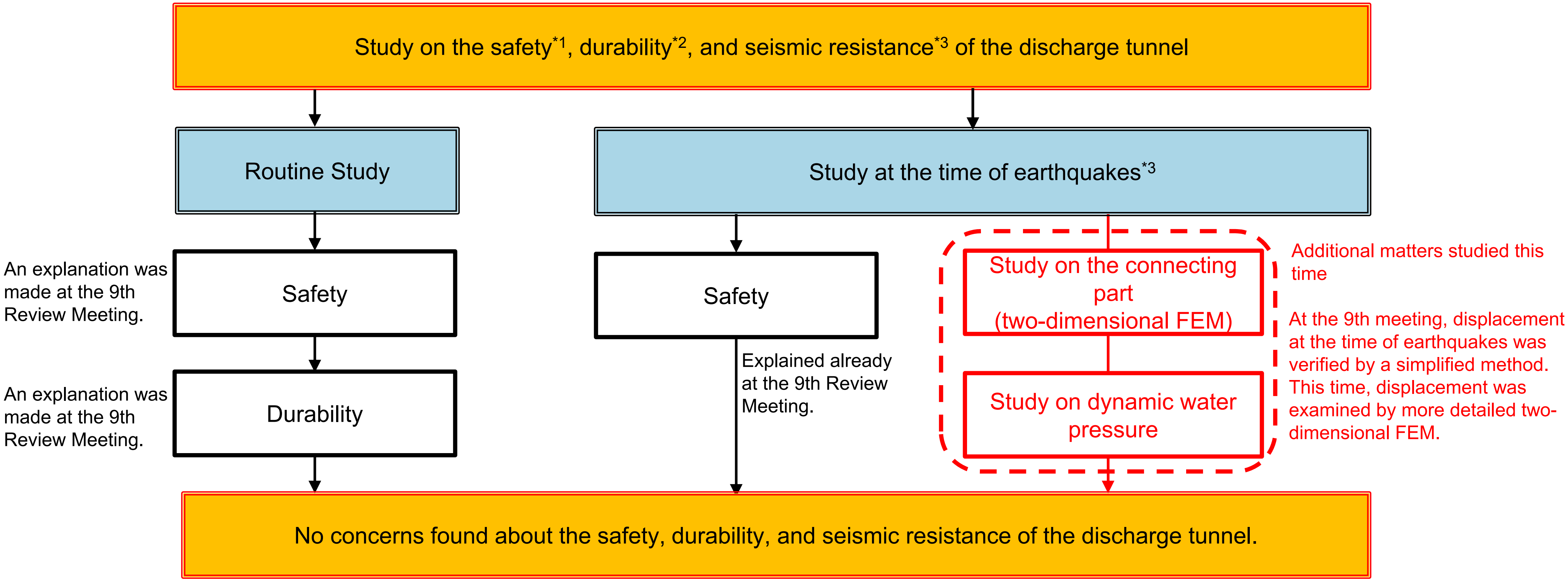
(1) Discharge Facility of ALPS Treated Water into the Sea

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

- Regarding Discharge Facility, allowable values for the displacement amount in the results of examining displacement at the time of earthquakes and the basis for setting the values should be organized and presented.
- As for the results of the stress intensity examination in the cross-sectional direction of the discharge tunnel, tolerance to stress increments due to ground displacement at the time of earthquakes should be organized and presented.

[1]-1.Details of the study on the 9th Review Meeting and additional study

- The following shows a flowchart study on the discharge tunnel.
- This study verified that the soundness of the connecting part and the soundness in consideration of dynamic water pressure.



Flowchart of study on the discharge tunnel structure

*1. Safety: The stress intensity of the material caused by the action of the load should be within the allowable stress intensity.
*2. Durability: During the design service period, the performance of the structure should not deteriorate caused by corrosion of steel materials by cracks or intrusion of chloride ions.
*3: Seismic resistance: Examination should be performed with Seismic class C.

2-1 (1) [5] Structure and strength of equipment, protection against natural phenomena such as earthquakes and tsunamis, prevention of misoperation, reliability, etc.

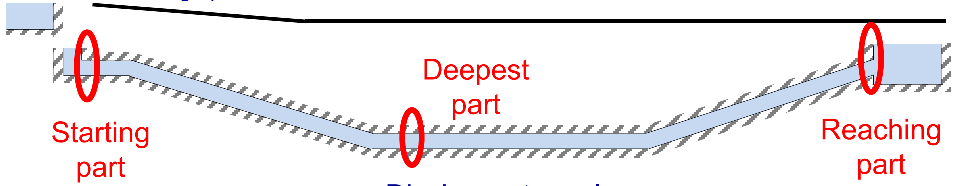
[1]-2 Results of stress intensity examination

- The result of stress intensity examination revealed the possession of the proof stress.

Load combination

Added this time

Load for study	In normal times	At the time of earthquakes* (During construction)	At the time of earthquakes* (When in service)
Dead load	○	○	○
Loading load	○	○	○
Earth pressure	○	○	○
Internal water pressure (including waves)	○		○
External water pressure (including waves)	○	○	○
Seismic inertial force		○	○



Areas for study

*In case of an earthquake, we examined two occasions separately the one is under construction and the other in service.
(Reason)
[During construction (no water)]: The internal water pressure does not act on it; thus, it is the most severe loading condition for safety at the time of an earthquake. However, the examination conducted under the assumption without water in the tunnel.
[When in service (at full water)]: The examination conducted under the assumption that the tunnel is filled with water after the completion of construction.

- The operating stress is compared with the allowable stress. The results of examining the part where the ratio of the operating stress to the allowable stress is maximum, and the load cases are shown in the table below.
- It has been confirmed that it is within the allowable stress intensity (operating stress/allowable stress intensity < 1.00) for stationary and seismic loads.

Results of examining the stress intensity of the lining plate (segment)

Areas for study	Load case	Target material	Stress	Operating stress intensity (N/mm^2)	Allowable stress intensity (N/mm^2)	Operating stress intensity/ Allowable stress intensity
Lining plate (starting part)	In normal times	Rebar	Bending moment	78*	200	0.39
Lining plate (deepest part)	In normal times	Rebar	Bending moment	91*	200	0.46

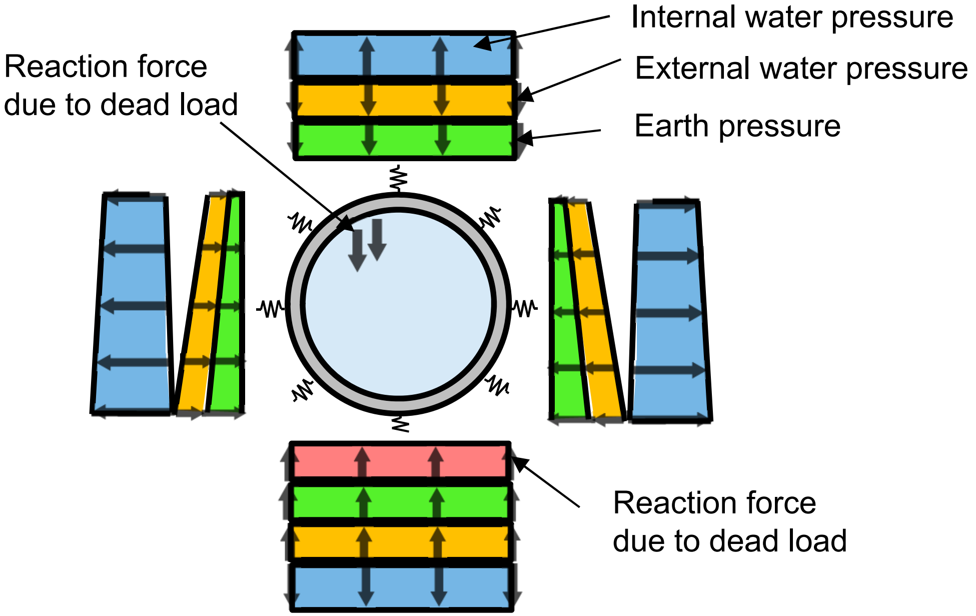
*Optimizing description in Attachment 5 of Chapter II 2.50 of the Implementation Plan

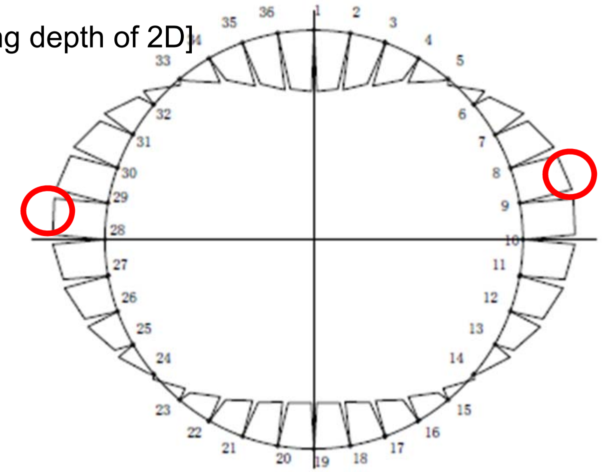
2-1 (1) [5] Structure and strength of equipment, protection against natural phenomena such as earthquakes and tsunamis, prevention of misoperation, reliability, etc.
[1]-3Results of stress intensity examination (2)

- Results of examining the stress intensity at areas for study

[In normal times, at full water (Short-term inside water level: T.P. + 9.3 m), earth covering depth of 2D]

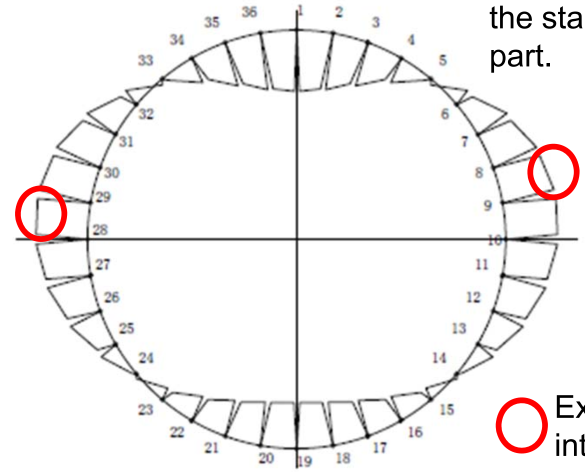
Image drawing of load distribution





Starting part: Section force diagram (bending moment)

* The scales of the section force diagrams are different between the starting part and the deepest part.



Deepest part: Section force diagram (bending moment)

Results of examining the stress intensity of the lining plate (segment)

Areas for study	Stress intensity examination (Operating/Allowance)
	Bending moment
Lining plate (starting part)	0.39
Lining plate (deepest part)	**0.46**

*Red: maximum value for stress intensity examination

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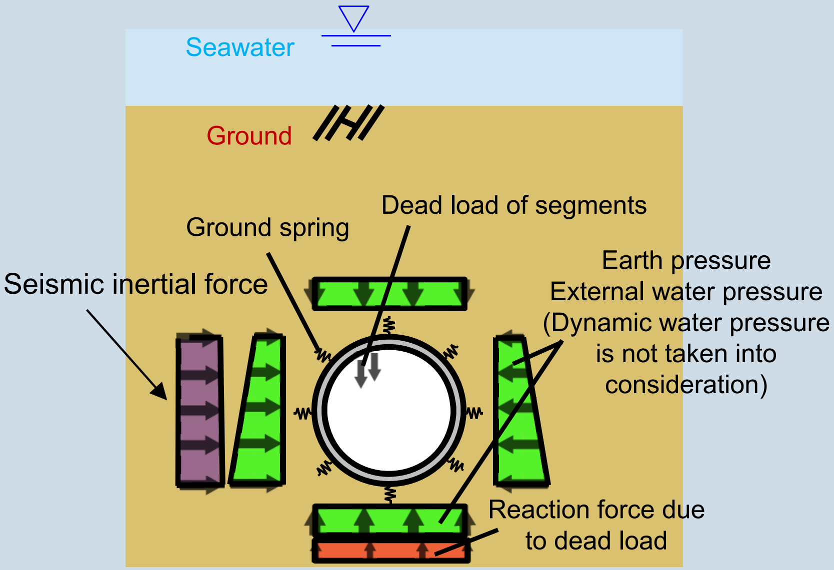
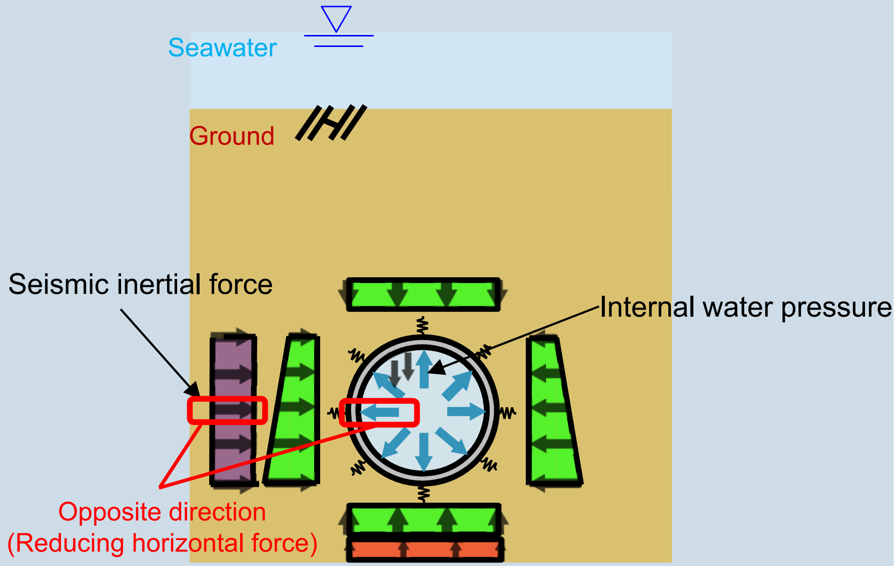
- As shown in the figure left, the discharge tunnel without water is the critical case at the time of earthquakes.
- When filled with full water, as shown in the right figure, the seismic inertial force acts in the opposite direction to the internal water pressure, reducing the horizontal force. Accordingly, it is not a critical case.

	at the time of earthquakes + No water (Critical case at the time of earthquakes)	at the time of earthquakes + At full water
Image drawing of load for study		
Description	• The above diagram shows the critical case when the earth pressure and the external water pressure are not offset because the internal water pressure does not act on it.	• The internal water pressure acts in the direction to reduce the seismic inertial force. With this, when the internal water pressure acts on it, apparent horizontal force does not increase, and therefore, it is not a critical case.

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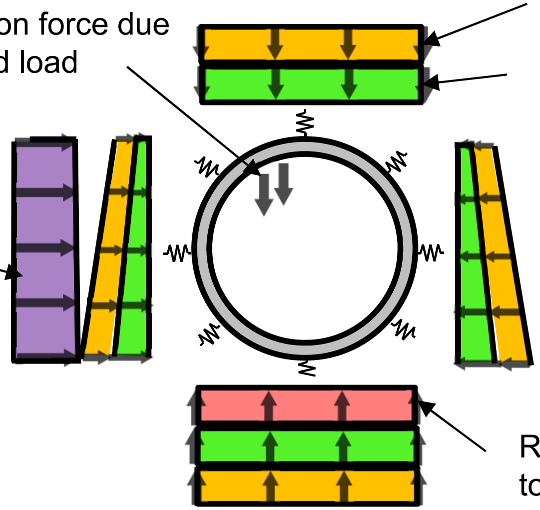
[Supplement] Section force diagram at the time of earthquakes

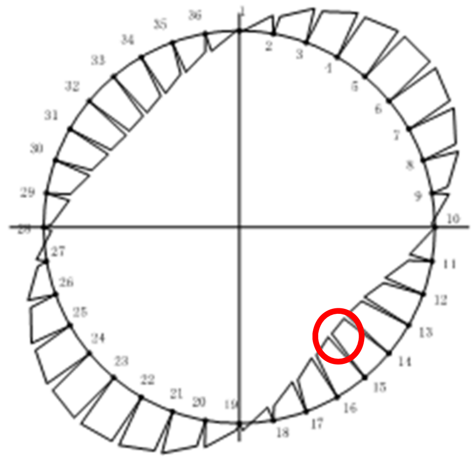
Results of examining the stress intensity at areas for study

[In normal times + at the time of earthquakes, no water, and overburden depth of 2D]

Assuming there is no water during construction (there is only external water pressure).

Image drawing of load distribution





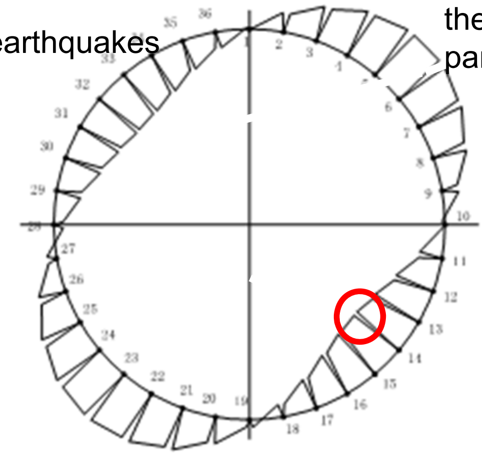
Starting part: Section force diagram (bending moment)

* The scales of the section force diagrams are different between the starting part and the deepest part.

Results of examining the stress intensity of the lining plate (segment) at the time of earthquakes

Areas for study	Stress intensity examination (Operating/Allowance)	
	Bending moment	Compression force
Lining plate (starting part)	0.15	0.27
Lining plate (deepest part)	0.15	**0.29**

*Red: maximum value for stress intensity examination



Deepest part: Section force diagram (bending moment)

Results of examining the stress intensity at areas for study

Results of examining the stress intensity of the lining plate (segment) at the starting part at the time of earthquakes

Areas for study	Load case	Target material	Stress	Operating stress intensity (N/mm²)	Allowable stress intensity (N/mm²)	Operating stress intensity/ Allowable stress intensity
Lining plate (starting part)	In normal times	Rebar	Bending moment	- (Entire compression)	200	-
	In normal times + at the time of earthquakes	Rebar	Bending moment	46	300	0.15
	In normal times	Concrete	Compression force	2.9	16	0.18
	In normal times + at the time of earthquakes	Concrete	Compression force	6.4	24	0.27

Results of examining the stress intensity of the lining plate (segment) at the deepest part at the time of earthquakes

Areas for study	Load case	Target material	Stress	Operating stress intensity (N/mm²)	Allowable stress intensity (N/mm²)	Operating stress intensity/ Allowable stress intensity
Lining plate (deepest part)	In normal times	Rebar	Bending moment	- (Entire compression)	200	-
	In normal times + at the time of earthquakes	Rebar	Bending moment	45	300	0.15
	In normal times	Concrete	Compression force	3.4	16	0.21
	In normal times + at the time of earthquakes	Concrete	Compression force	7.0	24	0.29

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2-1 (1) [5] Structure and strength of equipment, protection against natural phenomena such as earthquakes and tsunamis, prevention of misoperation, reliability, etc.

[Reference] Study case

Study case

Areas for study	Load patterns	Tunnel condition	Earth pressure	External water level
Lining plate (starting part)	In normal times	No water	2D	G. L. ± 0.00
		When internal water pressure is acted on (long-term*1)		
		When internal water pressure is acted on (short-term*2)		
		No water	0.175D	
		When internal water pressure is acted on (long-term)		
		When internal water pressure is acted on (short-term)		
	In normal times + at the time of earthquakes	No water*3	2D	
			0.175D	
Lining plate (deepest part)	In normal times	No water	2D	H.W.L(T.P.+0.757m)
		When internal water pressure is acted on (long-term)		L.W.L(T.P.-0.778m)
		When internal water pressure is acted on (short-term)		
		No water	0.175D	H.W.L(T.P.+0.757m)
		When internal water pressure is acted on (long-term)		L.W.L(T.P.-0.778m)
		When internal water pressure is acted on (short-term)		
	In normal times + at the time of earthquakes	No water*3	2D	H.W.L(T.P.+0.757m)
			0.175D	L.W.L(T.P.-0.778m)

Red:
Critical case of lining plate (starting part)

Blue:
Critical case of lining plate (deepest part)

*1) Inner water level T.P. + 6.40 m obtained based on the significant wave height of the 50-year-probability

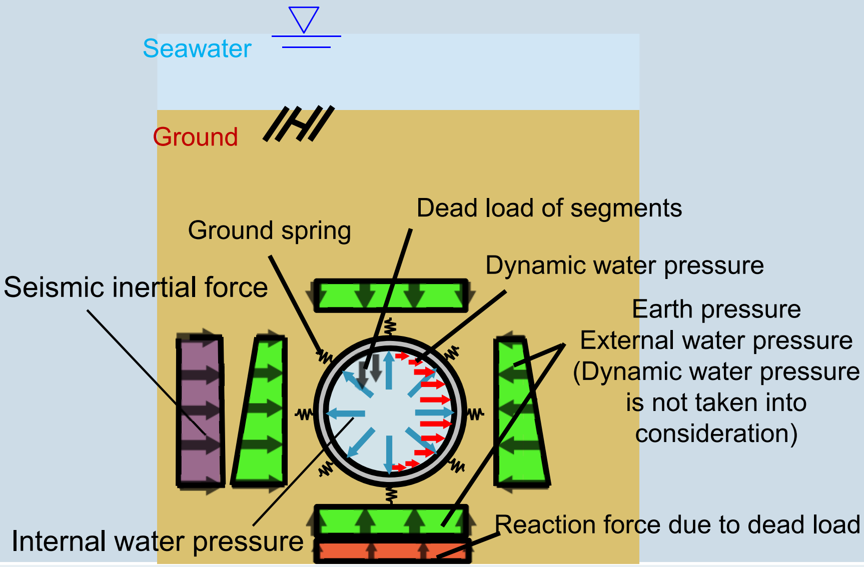
*2) Inner water level T.P. + 9.30 m obtained based on the maximum wave height of the 50-year-probability

*3) The most severe case at the time of an earthquake.

The Japanese version shall prevail.

[Reference] Necessity of considering dynamic water pressure at the time of earthquakes

- The dynamic water pressure inside the discharge tunnel at the time of earthquakes is calculated based on a case where the inside of the discharge tunnel is filled with diluted water.
- When comparing the dynamic water pressure with the internal water pressure inside the discharge tunnel, it was revealed that the dynamic water pressure was smaller; therefore, it was determined that there would be no need to study it.

	At the time of earthquakes when the internal water pressure and the dynamic water pressures are taken into account.
Image drawing of load for study	
Study results	It was determined that there is no need to consider the dynamic water pressure because it is smaller than internal pressure.
Remarks	• Internal water pressure (lower horizontal part): Approx. 200 - 370 kN/m^2 • Dynamic water pressure (inside the tunnel): Approx. 5 kN/m^2 at maximum (Dynamic water pressure = inner water weight x horizontal seismic coefficient 0.2) Since the pore water pressure inside the bedrock with an N value of 50 or more hardly rises, the dynamic water pressure from the outside is not considered (*).

*Even if the Westergaard equation calculates it, the internal water pressure would be more significant. The assessment result for the case of earthquakes would be more conservative when the dynamic water pressure is not considered.

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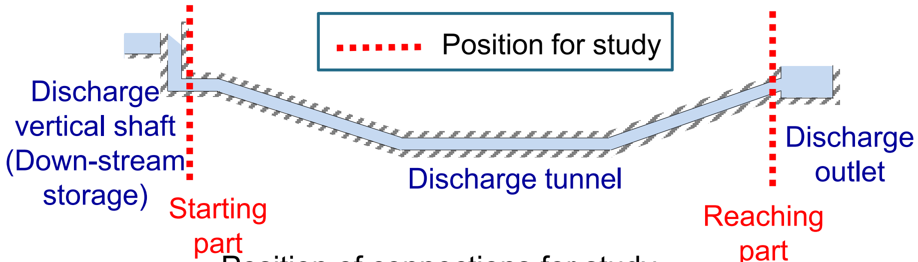
[1] -5. Study model at the time of earthquakes and displacement assessment methods

- For preparation at the time of an earthquake, studies on the case of sudden changes in the lining structure, such as the underground joint parts and the vertical shaft mounting part, requires consideration in detail *1 on the connection area of the discharge tunnel, the down-stream storage, and outlet caisson.
- In this study, for detailed examination on the case of an earthquake*2, we calculated the relative displacement Δ at the connection in the direction perpendicular to the discharge tunnel axis and in the discharge tunnel axis direction, using two-dimensional FEM analysis.
- The connecting bolt connecting the discharge tunnel, the down-stream storage, and the outlet caisson, will not break due to each force from the shearing force S and the tensile force P generated by the resistance against the displacement difference.

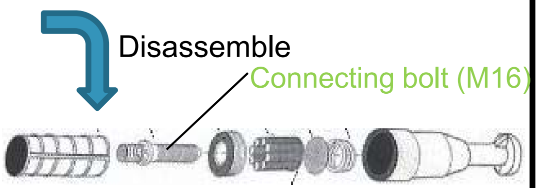


Position of connections for study at the time of an earthquake

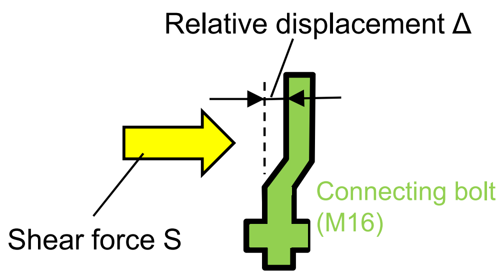
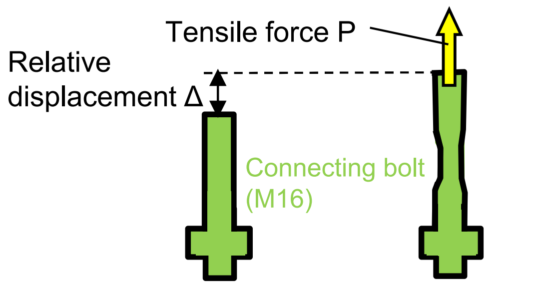
*1) Tunnel standard specifications, Page 62
*2) The results of studying displacement at the time of an earthquake by a simple method were reported at the 9th Review Meeting.

Ks=45,000kN/m
Kv=60,000kN/m
(Development of Screw Bolt (M16) for Small Diameter Segments; at the 65th Annual Scientific Lecture of the Japan Society of Civil Engineers in 2010)

Screw bolt joint (connection)



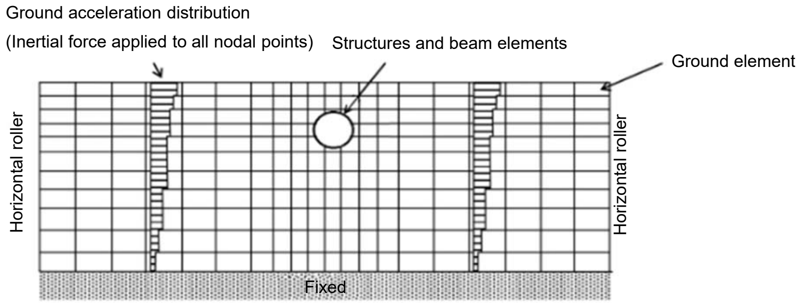
Segment and screw bolt joint (connection)

Study in the direction perpendicular to the tunnel axial	Study in the tunnel axial direction
	
• $S = ks \times \Delta$ • $\tau = S/A < \tau_a$ * ks: Shear spring constant of the connecting bolt τ: Shear stress intensity of the connecting bolt A: Cross-section of the connecting bolt	• $P = kv \times \Delta$ • $\sigma = P/A < \sigma_a$ * kv: Tension spring constant of the connecting bolt σ: Tensile stress intensity of the connecting bolt A: Cross-section of the connecting bolt

Outline of studying the connecting bolt

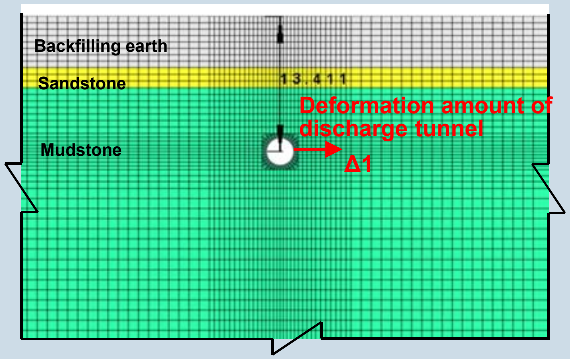
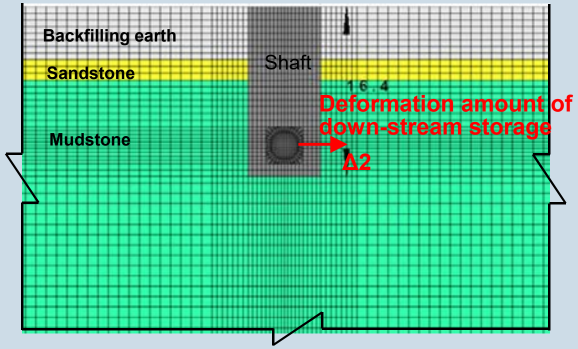
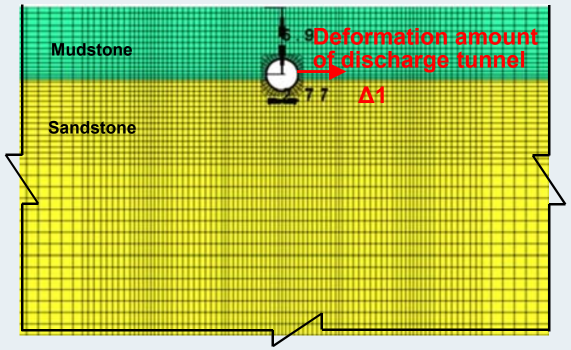
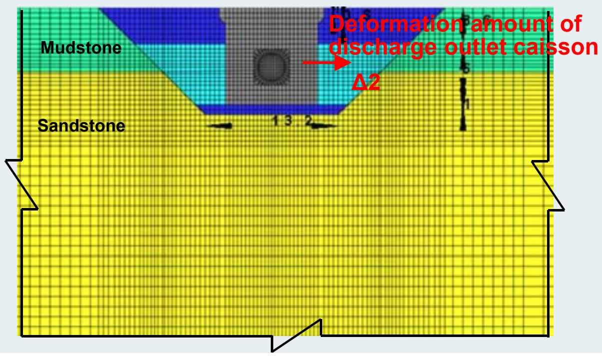
[1]-6. Study model of the direction perpendicular to the tunnel axis at the time of an earthquake

- The displacement difference Δ in the direction perpendicular to the tunnel axis at the connections the down-stream storage, the discharge outlet caisson, and the discharge tunnel at the time of an earthquake was calculated by two-dimensional FEM analysis.



Conceptual model diagram

- Surrounding ground: Modelled as plane strain element
- Tunnel: Modeled as beam element, shaft: Modeled as plane strain element
- Horizontal seismic coefficient: 0.2 applied uniformly
- Analysis area: Foundation layer is located at the lower part, and 5.0 H is secured for the side part
  (H: Depth from the tunnel to the foundation layer (= approx. 50 m))

Area for study	Analytical model (Cross-section of the tunnel)	Analytical model (Down-stream storage/Discharge outlet caisson)	Maximum relative displacement Δ (= Δ1 - Δ2)
Starting part			0.5mm
Reachingpa part			0.5mm

Direction perpendicular to the tunnel axis; model diagram and relative displacement

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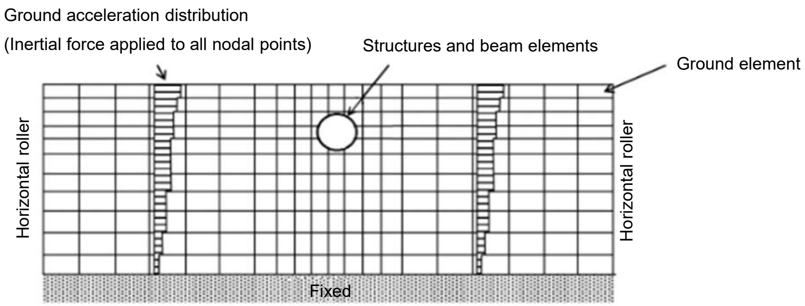
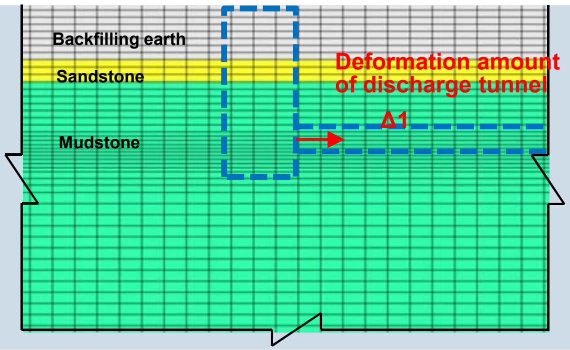
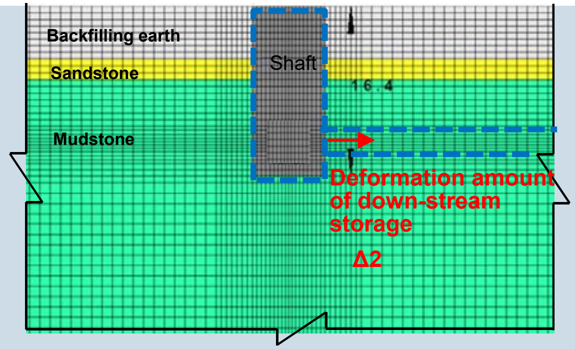
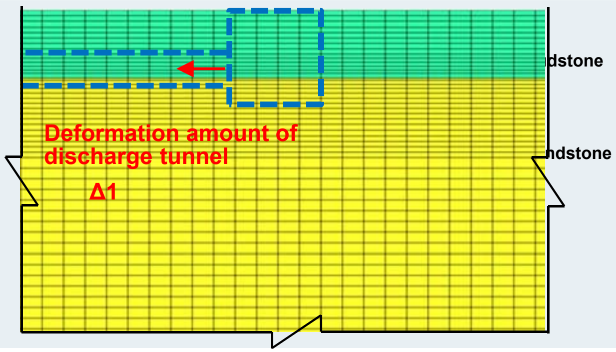
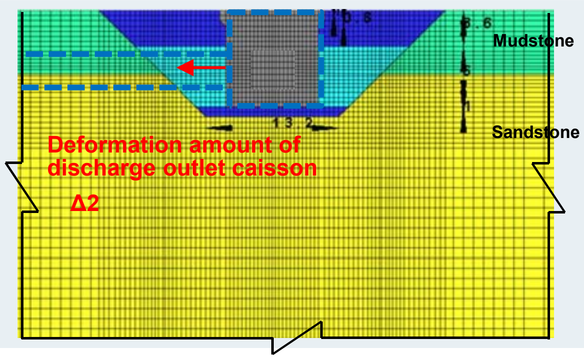
[1]-7.Study model of the tunnel axis direction at the time of an earthquake

- The displacement difference Δ in the tunnel axis direction in the connections of the down-stream storage, the discharge outlet caisson, and the discharge tunnel at the time of an earthquake was calculated by two-dimensional FEM analysis.



Conceptual model diagram

- Surrounding ground: Modelled as plane strain element
- Shaft: Modelled as plane strain element,
  (The tunnel is not modeled with the same displacement as the ground.)
- Horizontal seismic coefficient: 0.2 applied uniformly
- Analysis area: Foundation layer is located at the lower part, and 5.0 H is secured for the side part
  (H: Depth from the ground surface to the foundation layer (= approx. 50 m))
- Assuming in-service condition: Studied under the condition of internal water filled in both the tunnel and the shaft

Area for study	Analytical model (Cross-section of the tunnel)	Analytical model (Down-stream storage/Discharge outlet caisson)	Maximum relative displacement Δ (= Δ1 - Δ2)
Starting part			0.1mm
Reaching part			0.6mm

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Tunnel axis direction; model diagram and relative

[1]-8. Position for the detailed study on the connection (1)

- The figure left below shows the figure of the position of the detailed study at the connection of the down-stream storage and the discharge tunnel at the time of an earthquake.
- At the position for study shown in the figure lower left, we calculated the relative displacement of the connection in the direction perpendicular to the tunnel axis and the axial direction.

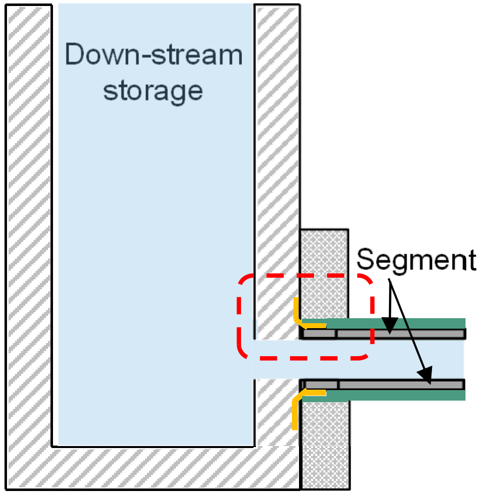
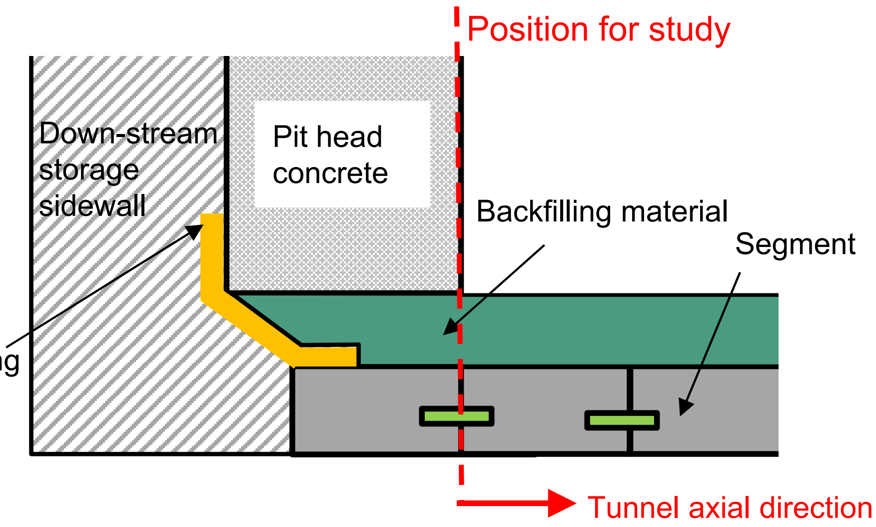
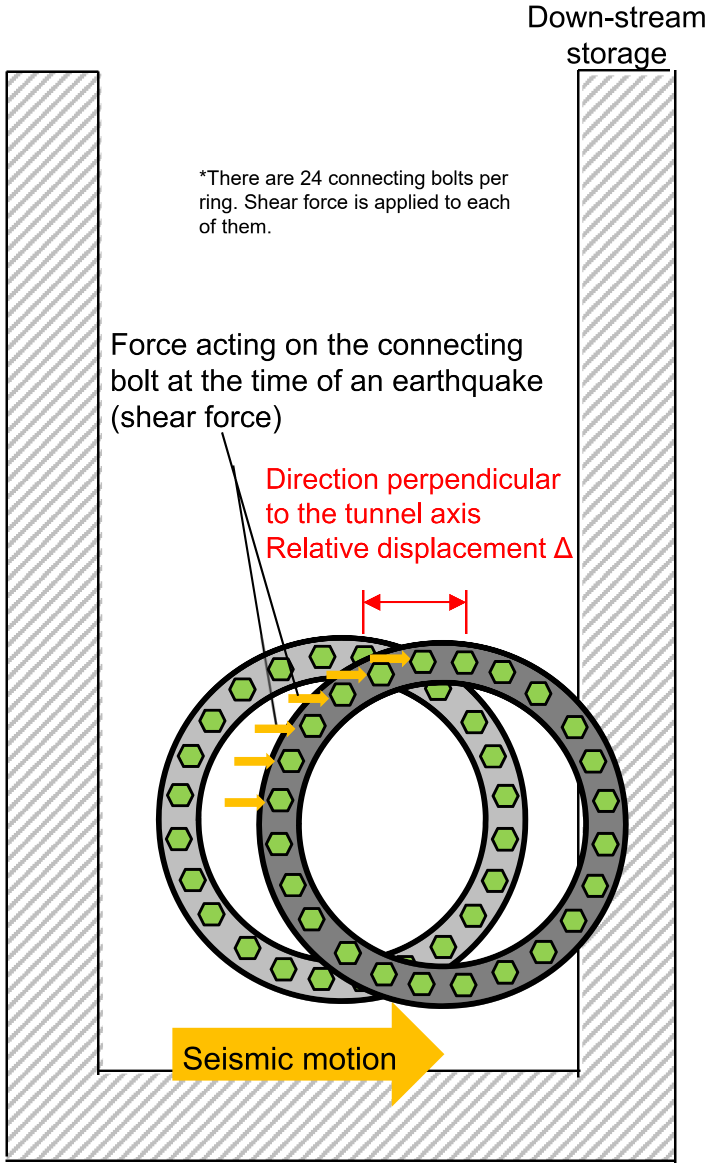


Image drawing of the connection between the down-stream storage and the discharge tunnel



Position for study and the tunnel axial direction; image drawing of sections for study



Direction perpendicular to the tunnel axis; image drawing of section for study

[1]-9. Position for the detailed study on the connection (2)

- The figure lower left shows the position for a detailed study on the connection between the discharge outlet caisson and the discharge tunnel at the time of an earthquake.
- At the position for study shown in the lower left figure, we calculated the relative displacement of the connection in the direction perpendicular to the tunnel axis and the axial direction.

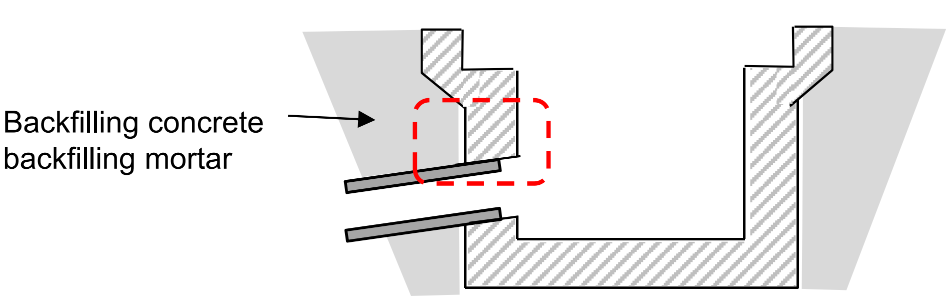
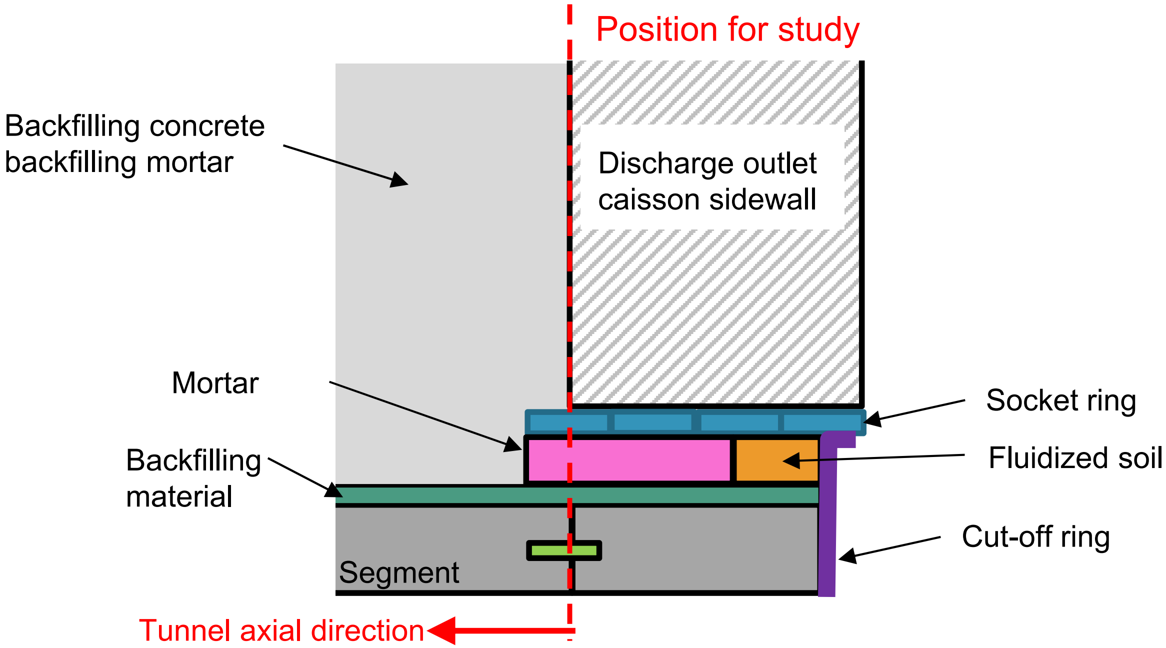
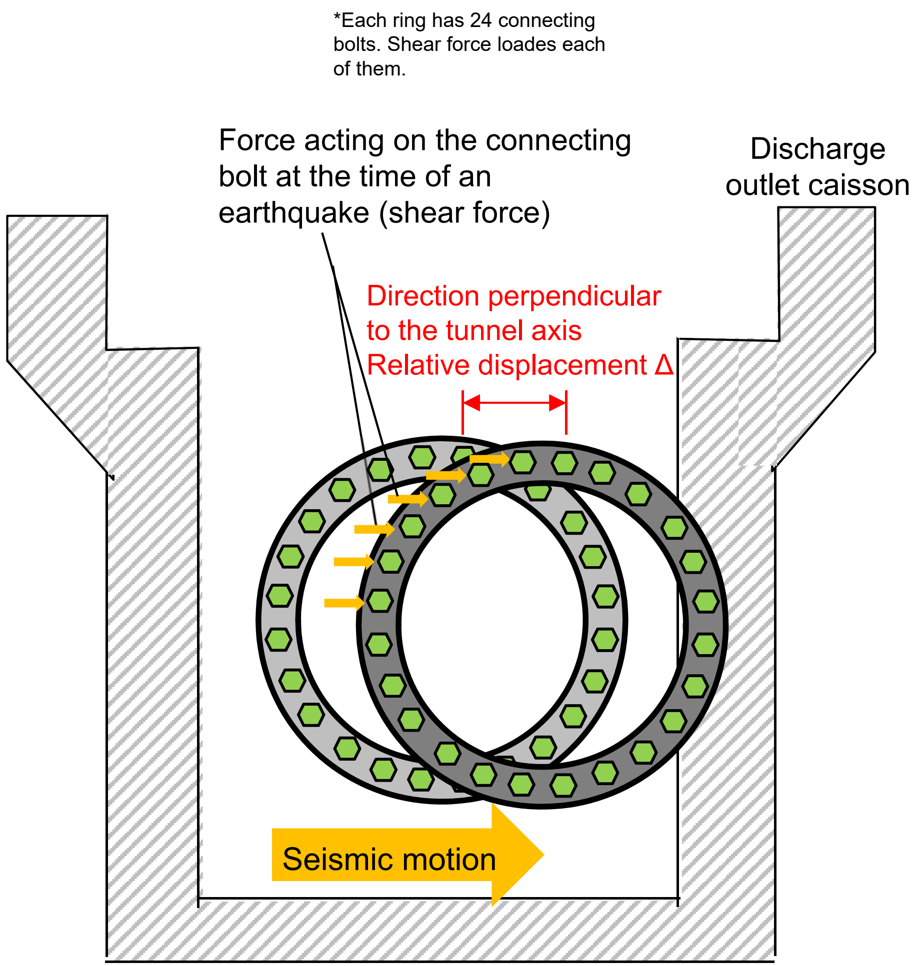


Image drawing of connection between the discharge outlet caisson and the discharge tunnel



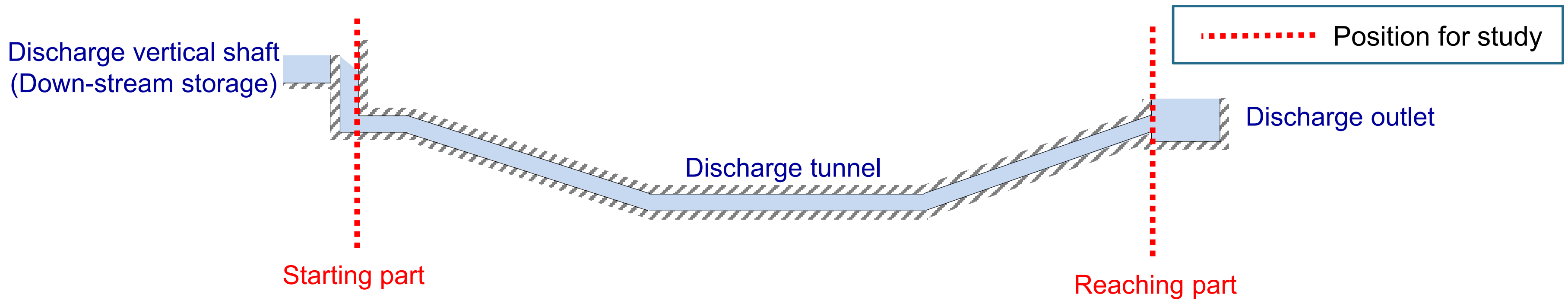
Position for study and the tunnel axial direction; image drawing of sections for study



Direction perpendicular to the tunnel axis; image drawing of section for study

[1]-10 Examination results of the direction perpendicular to the tunnel axis at the time of an earthquake

- The result of stress intensity examination confirmed the ensured proof stress.



- The operating stress is compared with the allowable stress. The results of examining the part where the ratio of the operating stress to the allowable stress is maximum, and the load cases are shown in the table below.
- It has been confirmed that it is within the allowable stress intensity relative to the seismic load (shear force accompanied by displacement of the connection)(operating stress/allowable stress < 1).

Results of the stress intensity examination at the connecting bolt at the time of an earthquake

Area for study	Load case	Target material	Relative displacement Δ (mm)	Shear force S(kN/units)	Shear stress intensity generated τ (N/mm^2)	Allowable shearing stress intensity τ_a (N/mm^2)	Stress intensity generated /Allowable stress intensity
Starting part	at the time of earthquakes	Connecting bolt	0.5	22.5	143	405	0.35
Reaching part	at the time of earthquakes	Connecting bolt	0.5	22.5	143	405	0.35

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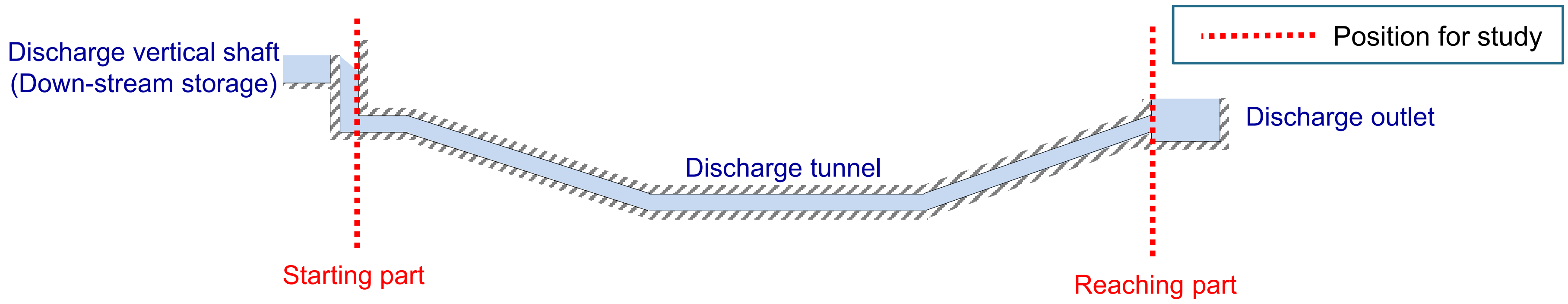
[1]-11 Examination results of the direction perpendicular to the tunnel axis at the time of an earthquake

- The result of stress intensity examination confirmed the ensured proof stress.



- The stress intensity generated at the connecting bolt is compared with the allowable stress intensity. The results of the part where the ratio of the operating stress intensity to the allowable stress intensity is maximum are shown in the table below.
- It has been confirmed that it is within the allowable stress intensity relative to the seismic load (tensile force accompanied by displacement of the connection)(operating stress/allowable stress < 1).

Results of the stress intensity examination at the connecting bolt at the time of an earthquake

Area for study	Load case	Target material	Relative displacement Δ (mm)	Tensile force P(kN/units)	Tensile stress intensity generated σ (N/mm^2)	Allowable tensile stress intensity σ_a (N/mm^2)	Stress intensity generated /Allowable stress intensity
Starting part	at the time of earthquakes	Connecting bolt	0.1	6.0	38	570	0.07
Reaching part	at the time of earthquakes	Connecting bolt	0.6	36.0	229	570	0.40

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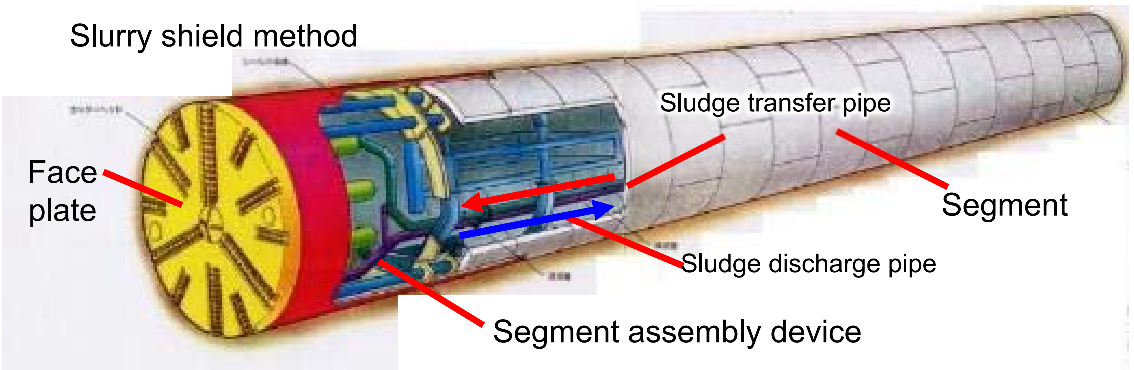
[Reference] Overview of discharge tunnel design

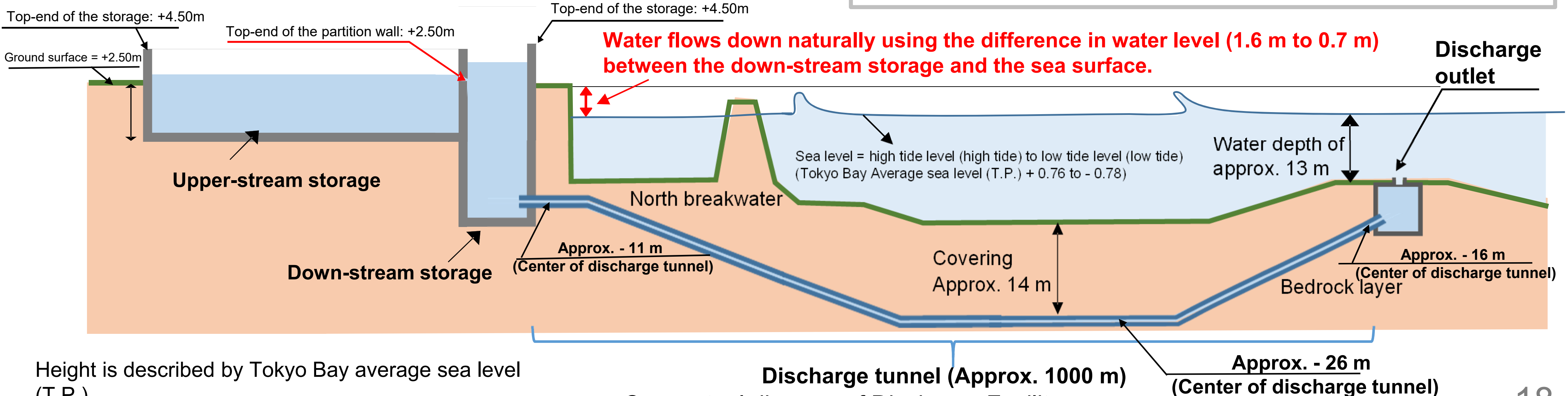
Design overview

- Water is made to flow through the bedrock layer to minimize the leakage risk and to ensure a highly earthquake-resistant structure. The design also has a design in consideration with the impact of typhoons (high waves) and storm surges (sea level rise).
- This time, a shield method is adopted, and double-layer seals are installed on the tunnel wall-facing materials made of reinforced concrete (segments) to ensure water cut-off performance.



Schematic diagram of a shield machine

Segment



Height is described by Tokyo Bay average sea level (T.P.).

Conceptual diagram of Discharge Facility

The Japanese version shall prevail.

[Reference] Study at the time of earthquakes

TEPCO

- On Page 62 of the 2016 established Tunnel Standard Specifications [Common Edition] and Explanation/[Shield Method Edition], describes the study at the time of earthquakes as follows:

> 2.10 Impact from earthquakes
> When it is considered that there may be an impact of an earthquake, according to the purpose of use of the tunnel and its importance, a study must be conducted by considering the siting conditions, the conditions of the natural ground, the magnitude of the seismic motion, the structure and shape of the tunnel, and other necessary conditions.

[Explanations] Regarding underground structures, in general, the mass of the tunnel is smaller than the mass of the soil removed by the construction of the tunnel. Therefore, the inertial force acting on the tunnel at the time of an earthquake is smaller than the inertial force of the surrounding ground. Because of seismic vibration is absorbed into the surrounding ground; unlike the ground structure, resonance phenomenon by the inertial force rarely occurs. When there is more than a certain degree of earth covering over tunnel, it is acceptable to consider that the seismic effect is relatively small because it is contemplated that the tunnel will approximately follow the deformation of the ground. However, a part of the cut-and-cover tunnel collapsed in the Hyogo-ken Nanbu Earthquake. After that, the concept of the seismic design for underground structures was reassessed, such as setting larger design seismic force and enhancing the toughness of the member.

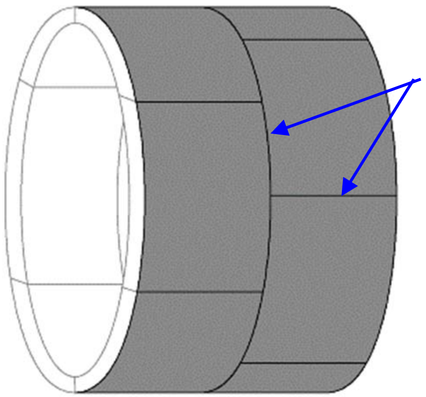
On the other hand, as to the shield tunnel, in the Hyogo-ken Nanbu Earthquake, the Niigata-ken Chuetsu-oki Earthquake, and the Tohoku Pacific Ocean Earthquake and Tsunami, though there was some damage in the small part of the main structure, the main structure did not collapse, unlike the cut-and-cover tunnel in the Hyogo-ken Nanbu Earthquake. It is considered that this is because, in the shield tunnel method, a tunnel is built in the relatively deep ground with the structure being stable circular. Having many joints, the structure easily follows the ground displacement. Based on this, when a tunnel is in the good ground with extensive eathcovering, a study on the seismic effect can be omitted in general. However, when the following conditions are applicable, the tunnel is considered to be affected by earthquakes, and careful examination is needed in particular.

(1) When the lining structure, such as underground joints, branch portions, and shaft mounting portions, suddenly change (This includes changes in the types of segments, the existence of second lining, etc.)
[2] When it is in soft ground.
(3) When ground conditions, such as soil texture, the covering, and foundation depth, change suddenly.
[4] When the tunnel has a sharp curved section.
[5] When there is a possibility of liquefaction in a loose saturated sand ground.

2-1 (1) [5] Structure and strength of equipment, protection against natural phenomena such as earthquakes and tsunamis, prevention of misoperation, reliability, etc.

[Reference] Water cut-off for segments

- Leakage from the shield tunnel (water coming in and out from the outside and inside) is limited to the joint of the segments.
- Water leakage from the joint is cut off by applying seals (rubber that expands into the water, exhibiting the cut-off capability).
- Seals are usually installed in only one layer, but this time, because of the internal water pressure acting on them, they are applied to two layers in the circumferential direction and in the extending direction (the whole circumference) of the discharge tunnel to ensure water cut-off.
- It was confirmed that there is no water leakage through the seals, considering the contact surface stress of the seals, the amount of aperture, and the amount of unevenness.



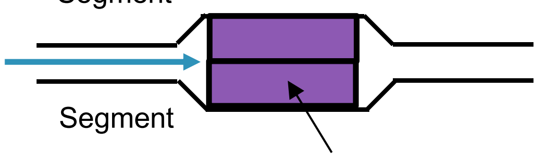
Assumed leakage point

Segments made of reinforced concrete

Seal	Specifications
Thickness	Approx. 4 mm
Width	Approx. 17 mm
Material	Chloroprene synthetic rubber system

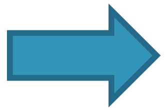
Specifications of seal

[Principle of water cut-off]

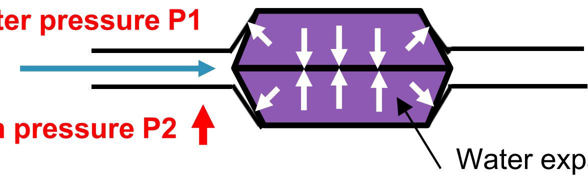


When assembling segments

In case of water leakage



With the deformation of the ground, etc., even if an aperture is generated between segments, the water channel will be blocked by the water expansion of the seal.



Cut-off state due to water expansion

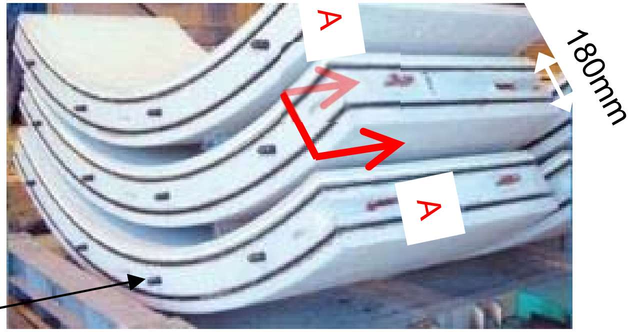
Document 1-1 (repost), the 9th Review Meeting on the Implementation Plan Regarding the Handling of ALPS Treated Water

TEPCO

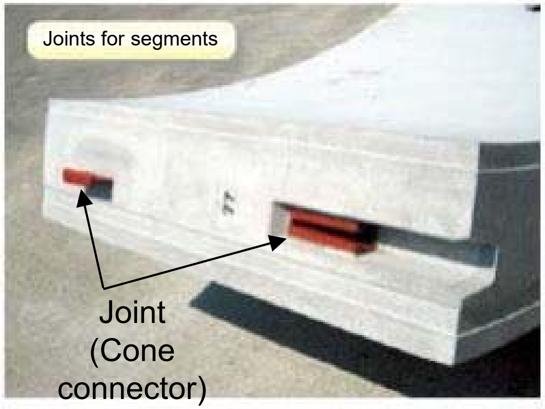
[Reference] Joints for segments (1/2)

Joints for segments

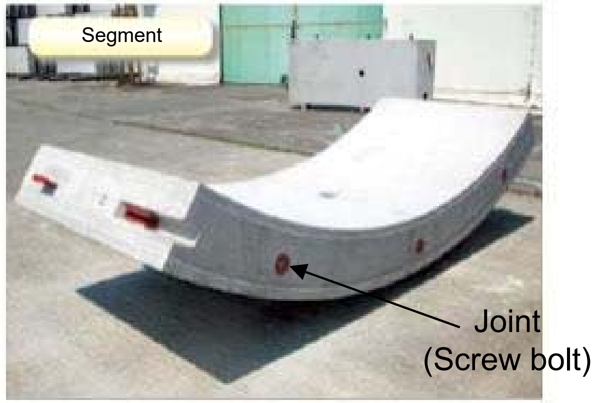
- There are two types of joints between segments: joints in the circumferential direction of the segments (cone connector joint) and those in the extension direction of the discharge tunnel (screw bolt joint).



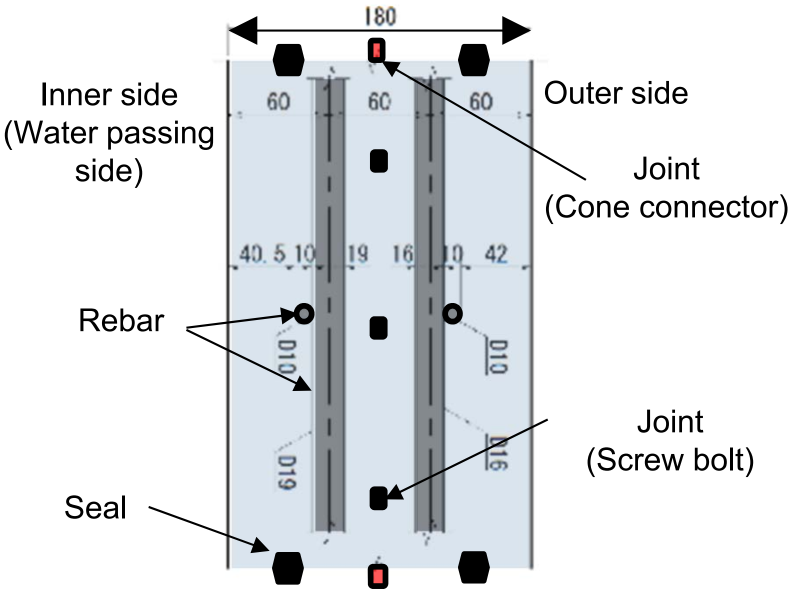
Segments made of reinforced concrete



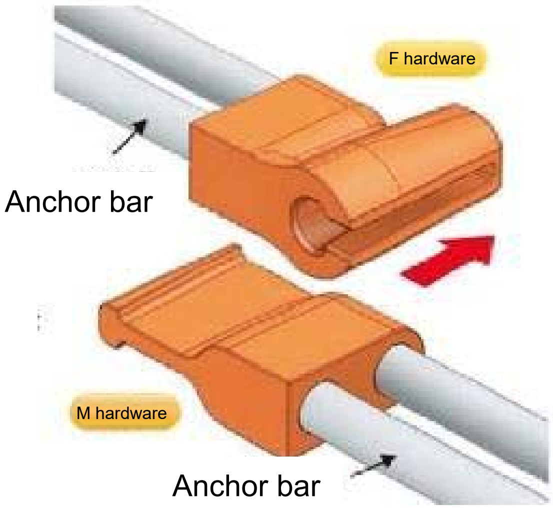
Joints in the circumferential direction (Cone connector)



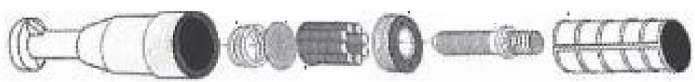
Joints in the extension direction (Screw bolt)



A-A cross-sectional view



Cone connectors in details

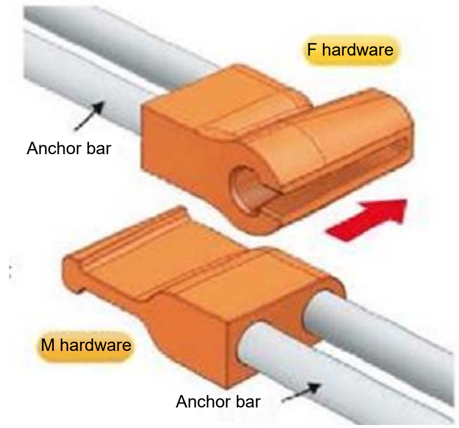
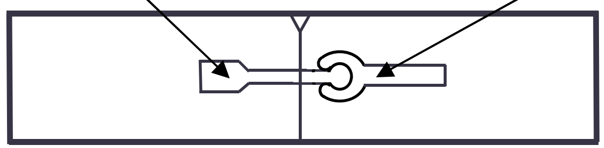
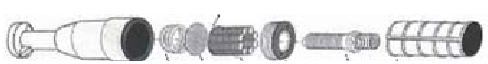
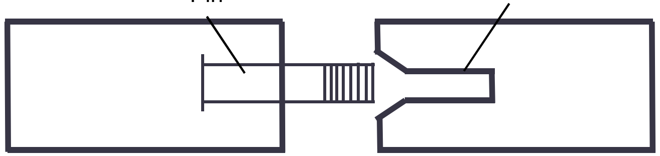
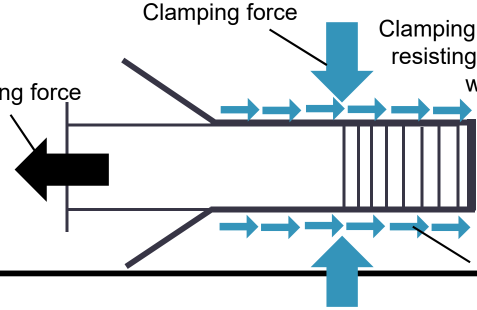


Screw bolts in details

2-1 (1) [5] Structure and strength of equipment, protection against natural phenomena such as earthquakes and tsunamis, prevention of misoperation, reliability, etc.

[Reference] Joints for segments (2/2)

Structural features of the joints

Joint types	Characteristic features
 Cone connector joint (Wedge joint structure)	➢ Using the wedge effect, segments are clamped by pulling them together. ➢ Joints have high rotational rigidity, making it difficult to transform segments. ➢ Wedges are driven in the axial direction of the tunnel so that joints will not be exposed in the tunnel. 
 Screw bolt joint (Pin insertion joint structure)	➢ Segments are clamped by pressing them together, resulting in higher work efficiency. ➢ Setting a proper margin between the pin and the pin pore size, it is possible to resist the drawing force with the frictional force.  

Responses to issues pointed out* at the review meeting, etc.

*: Documents 2-2, Attachment 2 for (the 97th) Specified Nuclear Facilities Monitoring and Assessment Review Meeting

Issues pointed out [2]

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

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

[1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater

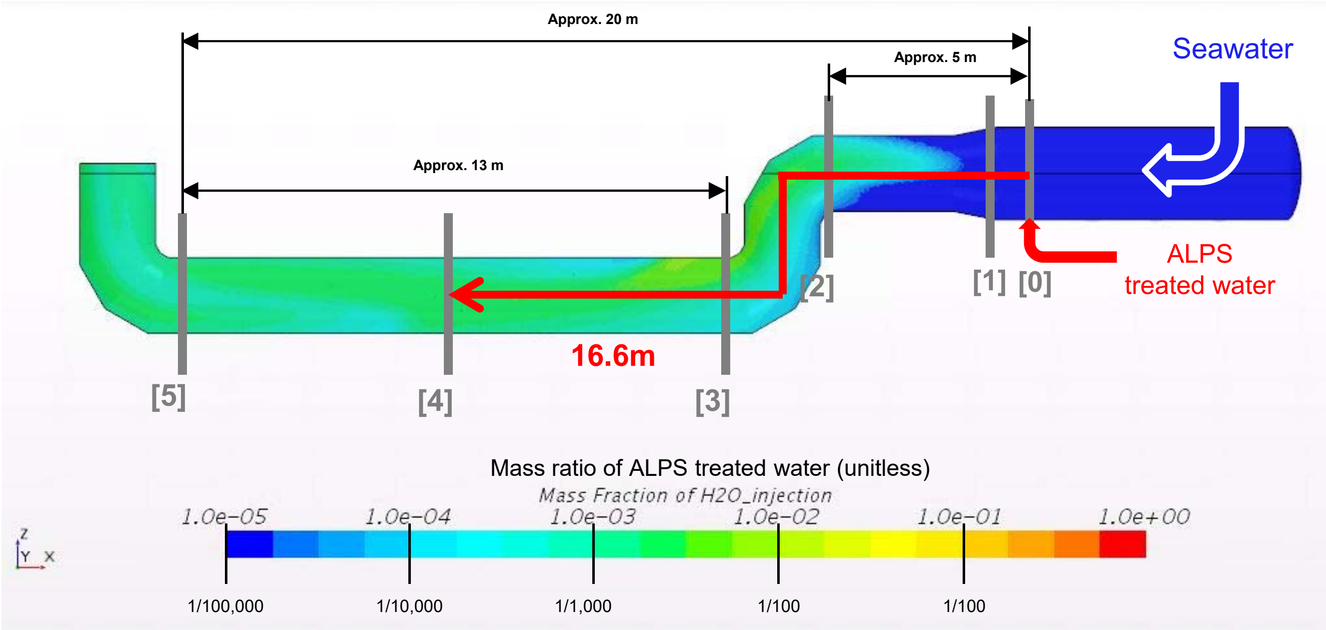
- In response to the results of simulating the mixing/dilution of ALPS treated water with seawater, rather than the Average concentration distribution in the seawater pipe header, the criteria for judging that the concentration is nearly below 1,500 Bq/L, as well as the position satisfying those criteria, including the concept, should be specified. When the above-mentioned is ensured with operation and procedures, how that can be incorporated into the design should also be indicated.

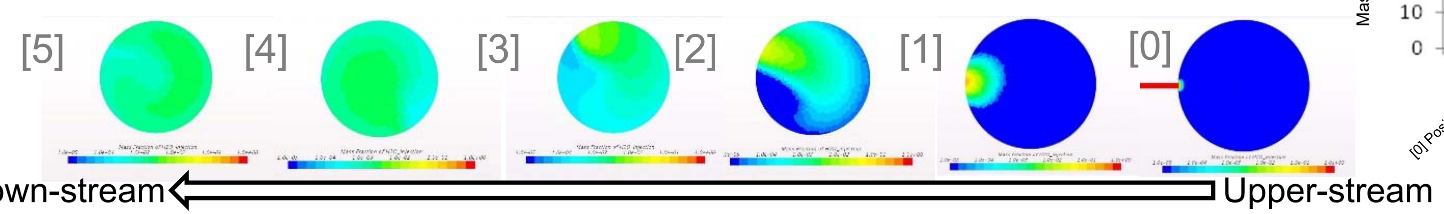
[3] Methods of seawater intake and discharging ALPS treated water after dilution

- The effect caused by the determination of the discharge vertical shaft structure on the other facilities, including seawater pipe headers, should be explained.

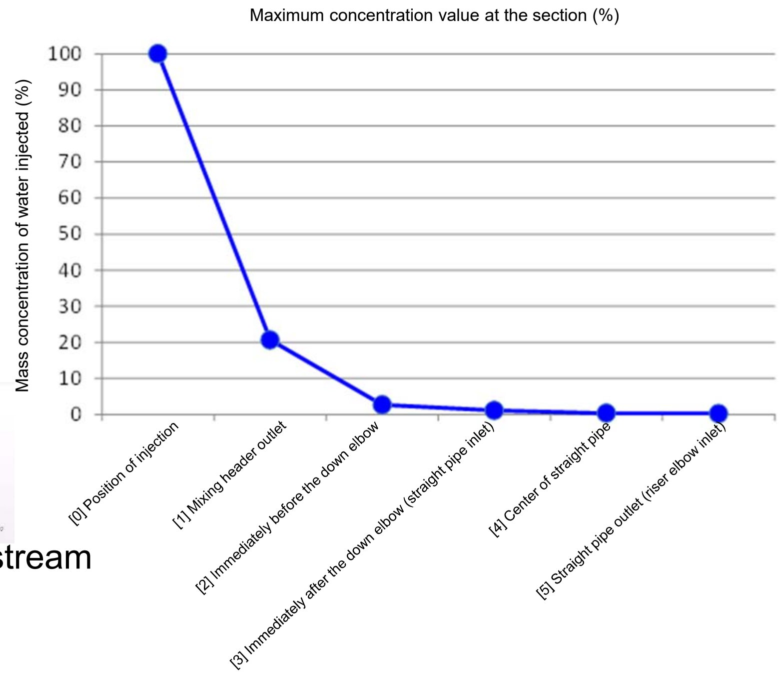
2-1 (1) [1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater
[2]-1. Judgement criteria for mixing/dilution

- Fluid analysis calculated the mass concentration of ALPS treated water injected at sections inside the seawater pipe.
  - In evaluating the seawater flow rate of 340,000 m^3/day and ALPS treated water flow rate of 500 m^3/day, the theoretical mass concentration was 0.14%.
- Based on the maximum mass concentration of ALPS treated water on the respective sections, the status under which mixing/dilution progress was evaluated.
  - [4] After the center of the straight pipe, the maximum mass concentration of the ALPS treated water was below 1%, and it was determined that the mixing/dilution had progressed on the whole.





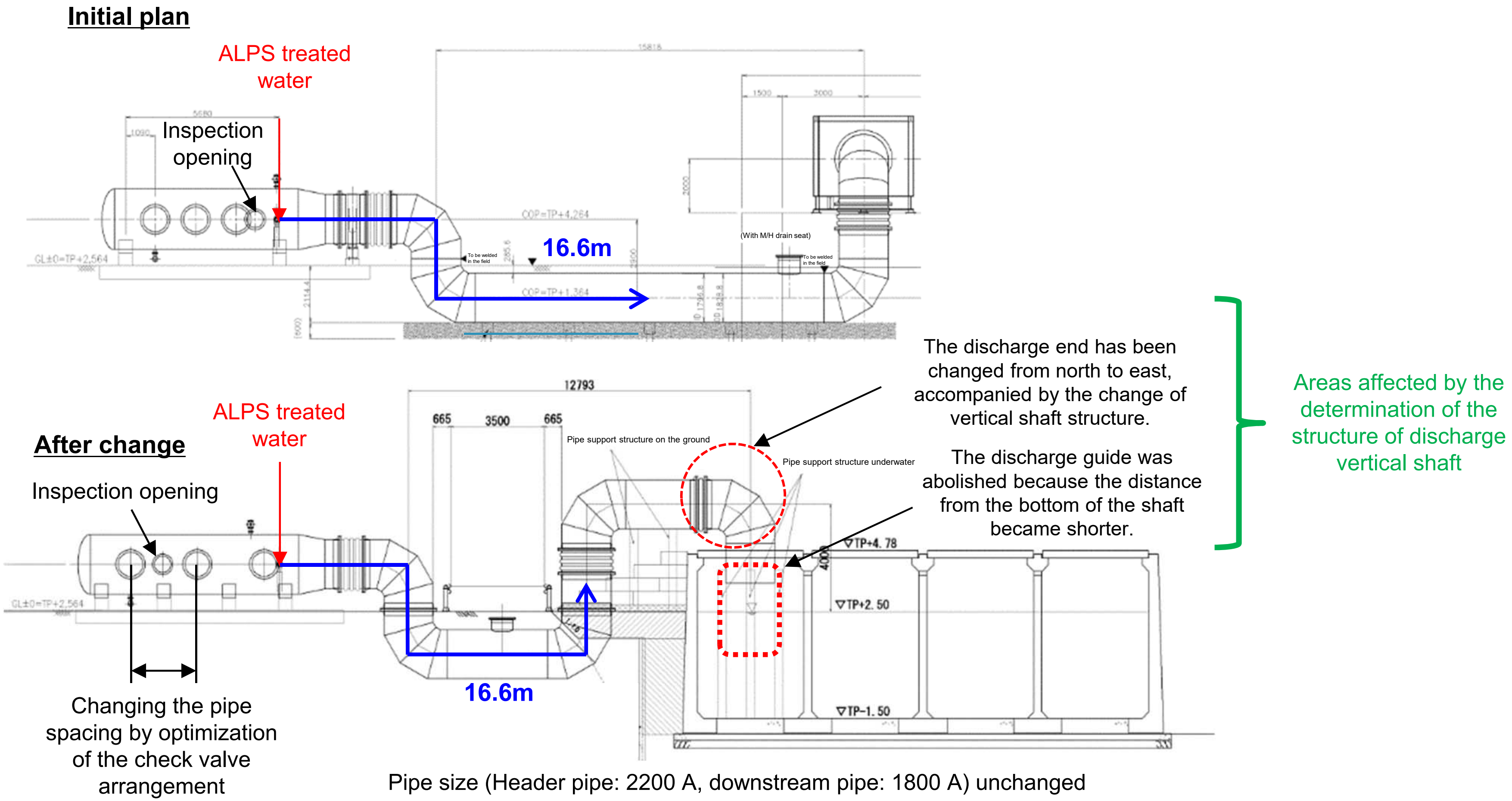
Name	Maximum concentration value at the section (%)
[0] Position of injection	100
[1] Mixing header outlet	20.6
[2] Immediately before the down elbow	2.65
[3] Immediately after the down elbow (straight pipe inlet)	1.10
[4] Center of straight pipe	0.30
[5] Straight pipe outlet (riser elbow inlet)	0.23



The Japanese version shall prevail.

2-1 (1) [1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater [2] -2. Change in the pipe shape accompanied by the determination of discharge vertical shaft structure

- The design of the seawater pipe has changed associated with the determination of the discharge vertical shaft structure.
  - In modifying the design, without changing the pipe diameter, the pipe length, which is longer than the (4) of the center of straight pipe, was secured with the maximum mass concentration of ALPS treated water below 1% in the previous analysis.
  - Fluid analysis based on the changed shape has been conducted to verify the effect of mixing/dilution.
    - ✓ In performing the reanalysis, the maximum mass concentration will be assessed by modeling the seawater pipe header through the end of the pipe.



Pipe size (Header pipe: 2200 A, downstream pipe: 1800 A) unchanged

2-1 (1) [1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater [2]-3. Control of the discharge amount according to the tritium concentration

TEPCO

- Since the tritium concentration of ALPS treated water varies from approx. 150,000 Bq/L to approx. 2,160,000 Bq/L, it is necessary to control the flow rate of ALPS treated water according to its tritium concentration so that the tritium concentration after dilution falls below 1,500 Bq/L.

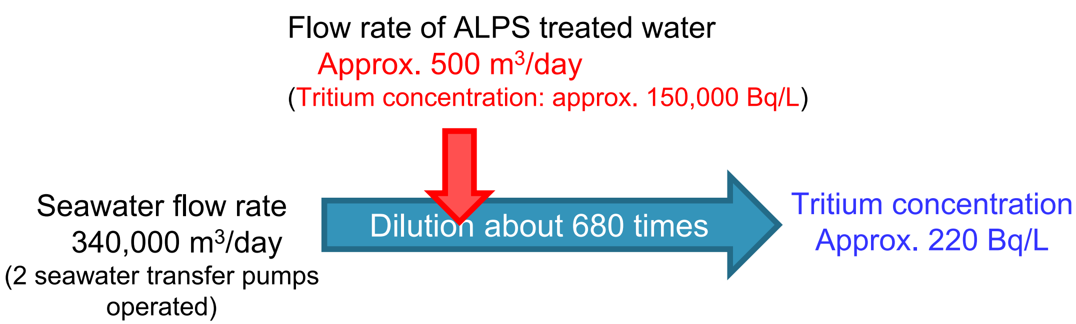
$$\text{Tritium concentration after dilution with seawater} = \frac{\text{Tritium concentration in ALPS treated water} \times \text{ALPS treated water flow rate (controlling with flow rate control valve)}}{\text{ALPS treated water flow rate (controlled by flow rate control valve)} + \text{seawater flow rate}}$$

(Example)

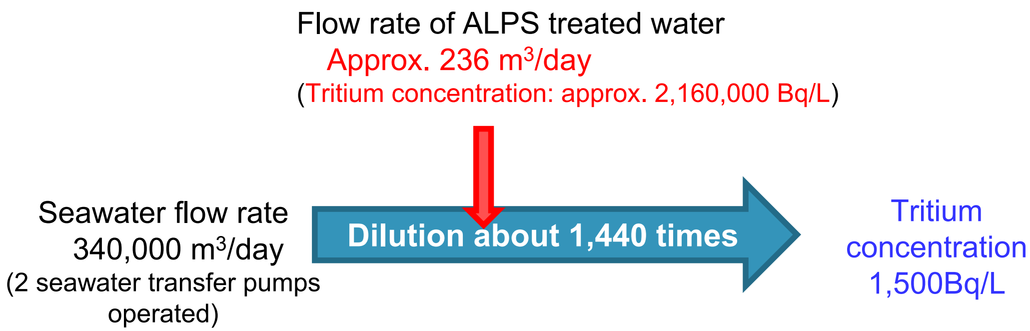
[1] When the tritium concentration is 150,000 Bq/L, even if the flow rate of ALPS treated water is set at a maximum of 500 m^3/day, the diluted tritium concentration will be approx. 220 Bq/L.
(If the tritium concentration of ALPS treated water exceeds 1,020,000 Bq/L, the flow rate of ALPS treated water will be reduced.)

[2] When the tritium concentration is 2,160,000 Bq/L, the flow rate of ALPS treated water needs to be controlled to approx. 236 m^3/day so that the diluted tritium concentration will be the maximum 1500 Bq/L.

[1] When the tritium concentration is 150,000 Bq/L



[2] When the tritium concentration is 2,160,000 Bq/L



* Uncertainty due to flow rate measurement and analysis is not included.
The tritium concentration at the time of discharging into the sea is calculated.

The Japanese version shall prevail.

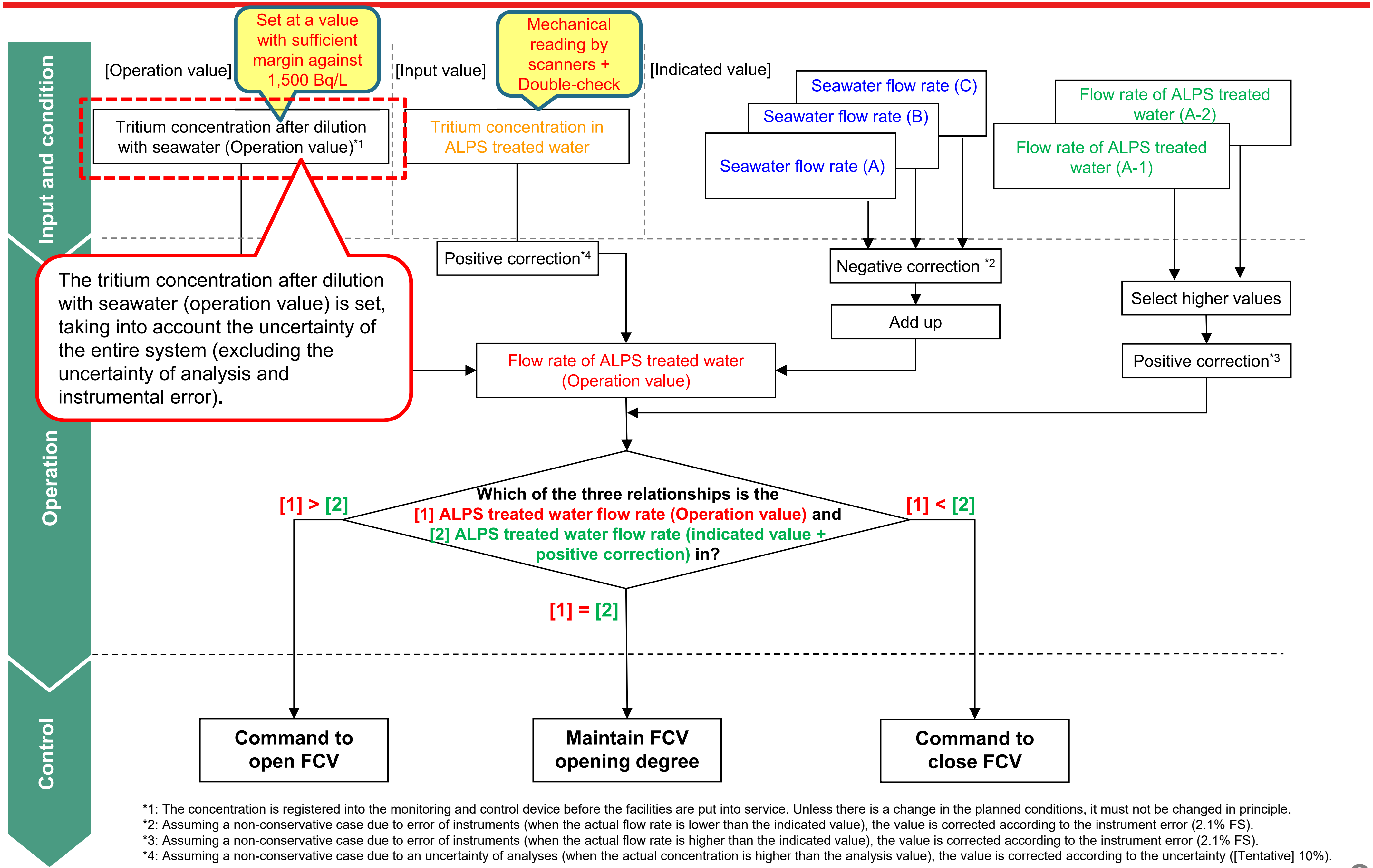
2-1 (1) [1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater [2]-4. Tritium concentration at the time of actual discharge

TEPCO

- When the annual release of tritium is set to a level below 22 trillion becquerels, the daily amount of ALPS treated water that can be discharged according to the tritium concentration is as follows (considering 80% of the facility availability rate):
  - When the tritium concentration is approx. 150,000 Bq/L; approx. 500 m^3 /day
  - When the tritium concentration is approx. 620,000 Bq/L; approx. 120 m^3 /day
  - When the tritium concentration is approx. 2,160,000 Bq/L; approx. 35 m^3 /day
- To promote the use of the site after dismantling tanks, the discharge policy prioritizes the ALPS treated water with a lower tritium concentration (see slide 38). Based on this, even if it is ALPS treated water with a higher tritium concentration, the concentration will be decreased because of its expected attenuation due to a half-life period by the time of discharge.
  (Even if it is at approx. 2,160,000 Bq/L at present, assuming that the discharge timing is 2050, it will be reduced to approx. 400,000 Bq/L.)

- As described above, based on the daily discharge amount of ALPS treated water when the annual release of tritium is set at a level below 22 trillion Bq, as well as the policy of prioritizing ALPS treated water with a lower tritium concentration, even if considering the uncertainty due to dilution/mixing (maximum mass concentration 0.3% of the ALPS treated water on the section (4) and the maximum mass concentration 0.23% of ALPS treated water on the section (5) relative to the theoretical mixing value of 0.14%), the tritium concentration at the time of actual release will be sufficiently lower than 1500 Bq/L. Therefore, it will not exceed 1500 Bq/L at the respective sections.
- We plan to control the mixing/dilution ratio of ALPS treated water with seawater, considering the uncertainty of the entire system related to the discharge of ALPS treated water into the sea, including those mentioned above.

2-1 (1) [1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater
[2]-5 Controlling the mixing/dilution ratio of ALPS treated water with seawater

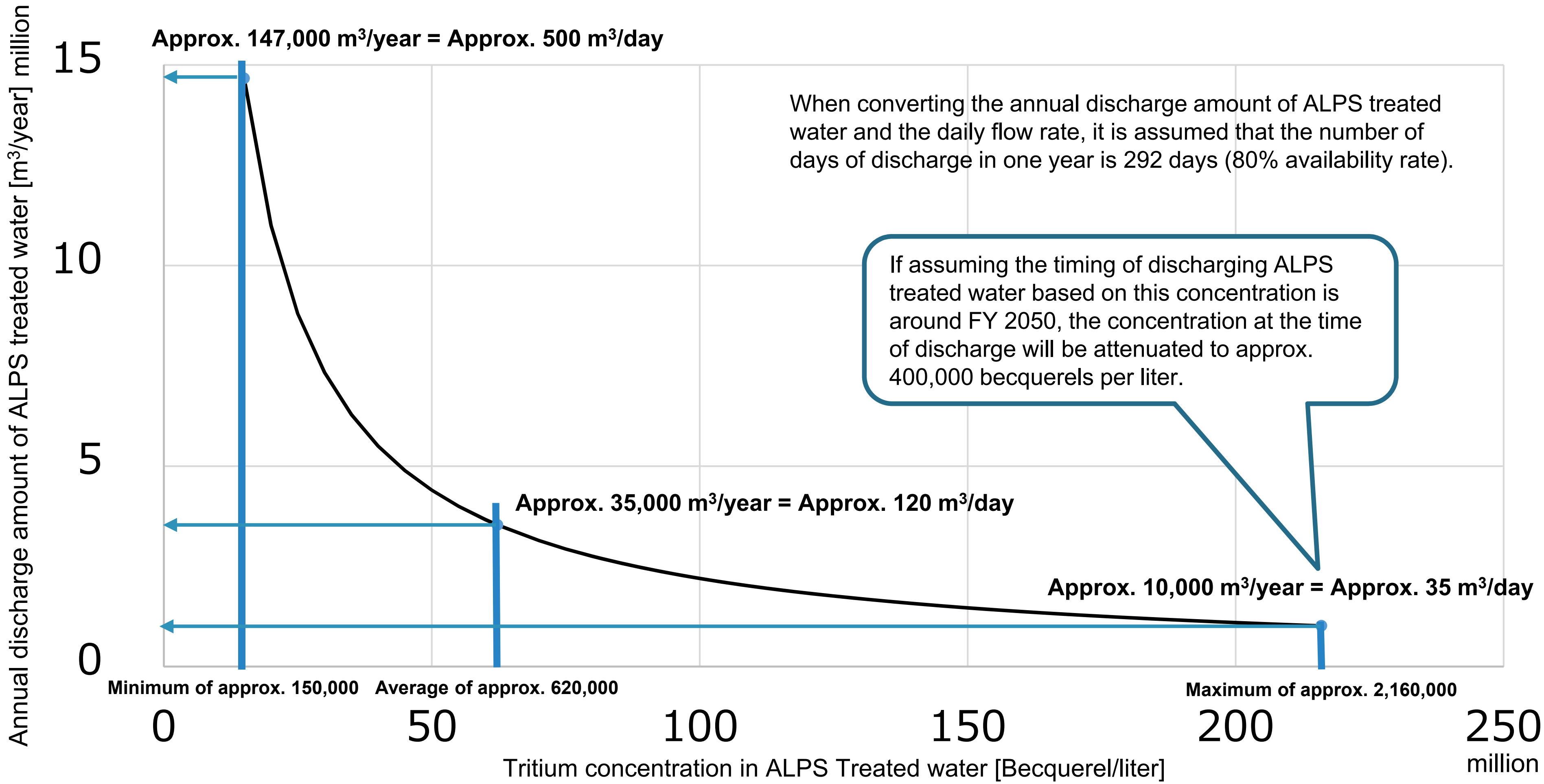


*1: The concentration is registered into the monitoring and control device before the facilities are put into service. Unless there is a change in the planned conditions, it must not be changed in principle.
*2: Assuming a non-conservative case due to error of instruments (when the actual flow rate is lower than the indicated value), the value is corrected according to the instrument error (2.1% FS).
*3: Assuming a non-conservative case due to error of instruments (when the actual flow rate is higher than the indicated value), the value is corrected according to the instrument error (2.1% FS).
*4: Assuming a non-conservative case due to an uncertainty of analyses (when the actual concentration is higher than the analysis value), the value is corrected according to the uncertainty ([Tentative] 10%).

2-1 (1) [1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater

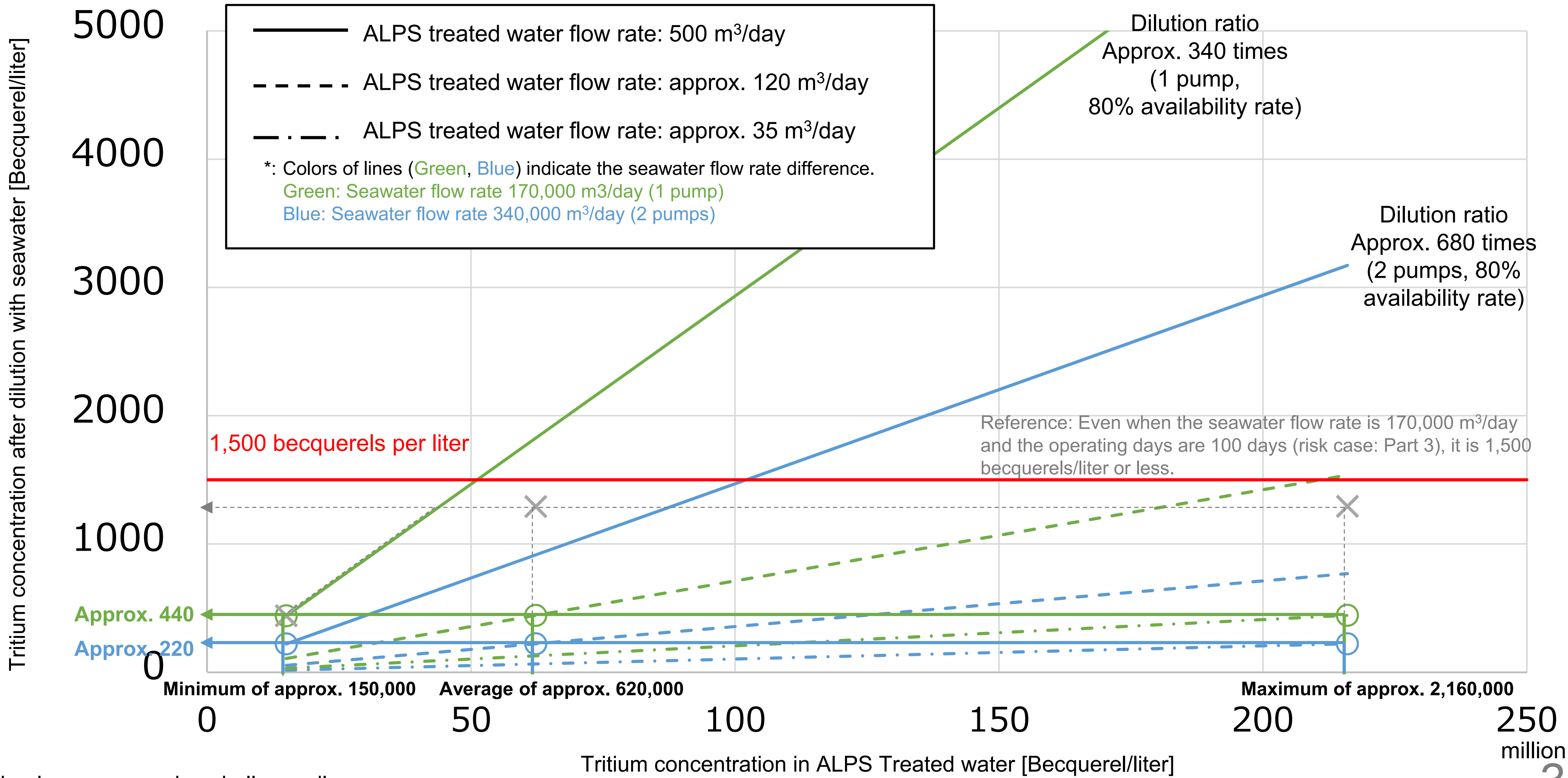
[Reference] Relation between the amount of annual discharge of ALPS treated water, and the tritium concentration of ALPS treated water

- When the annual discharge of tritium is set to a level below 22 trillion becquerels, the amount of water that can be released in 1-year changes according to the concentration of tritium in ALPS treated water (the lower the concentration, the greater the release amount).



2-1 (1) [1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater
[Reference] Relation between tritium concentration and ALPS treated water flow rate

- By combining the tritium concentration in the ALPS treated water, the flow rate of ALPS treated water, and the flow rate of seawater, the facility capable of continuing steady discharge of ALPS treated water while maintaining the tritium concentration after diluting with seawater at a level less than 1,500 becquerels/liter will be materialized



2-1 (1) [1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater [Reference] Discharge Simulation

- Case A and case B where entire quantity tritium at the time of accident existed, and where total tritium quantity was the least according to current information respectively, were assessed.

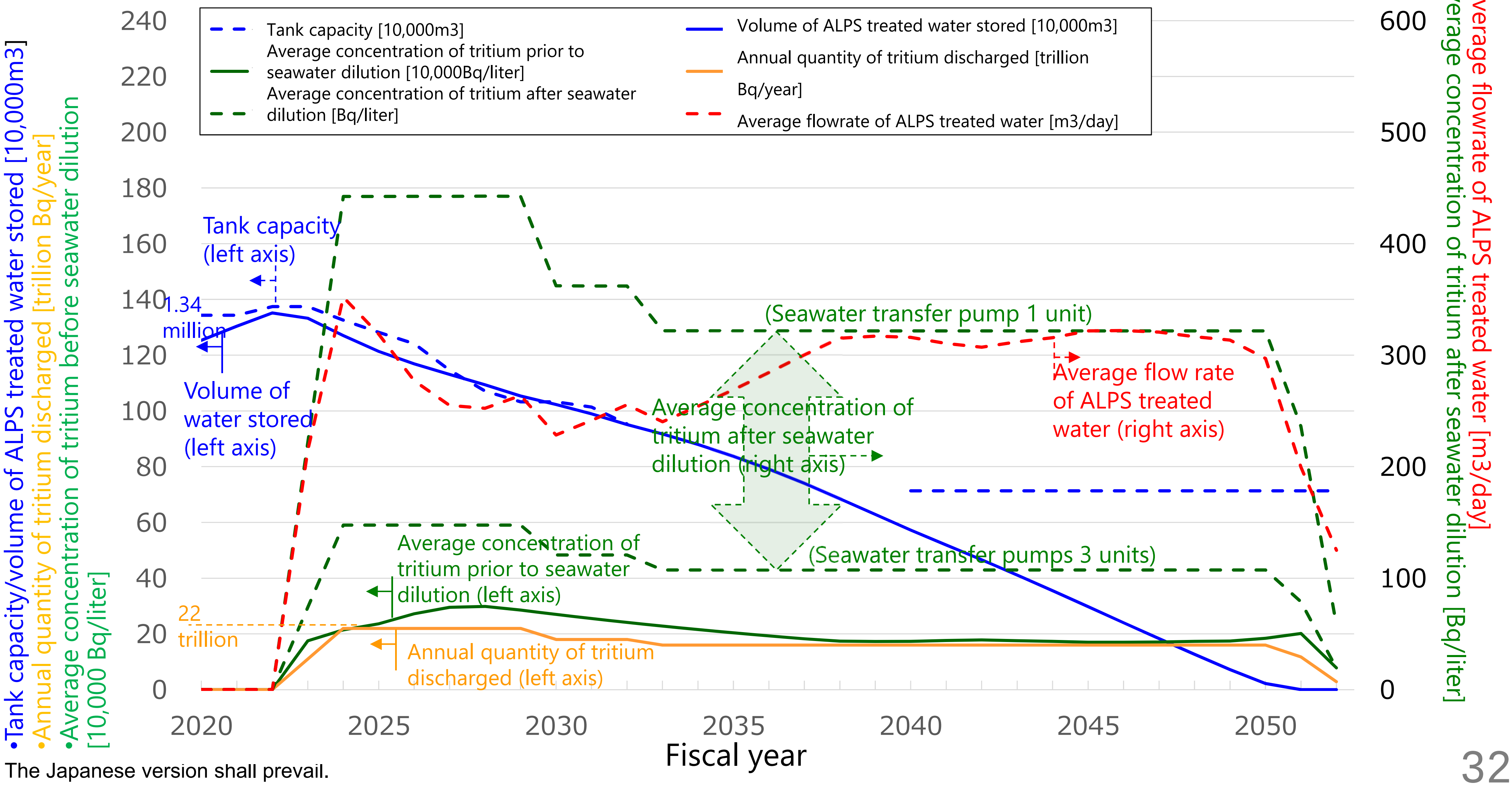
- The total annual quantity of tritium released was changed for each case so as not to impact the site utilization plan. If the **total discharge quantity was set so that sea discharge would be completed in FY2051**, Case A would have an annual maximum of 22 trillion Bq and Case B would have an annual maximum of 16 trillion Bq.

<Reference: Storage status of ALPS treated water, etc. and Sr removed water (before ALPS treatment) as of April 2021>

Tritium concentration [Bq/liter]	~300,000	300,000~ 600,000	600,000~ 1.2 million	1.2 million ~ 1.8 million	1.8 million ~ 2.4 million	Assumed to be 450,000
Volume stored	Approx. 219,000m³	Approx. 391,000m³	Approx. 473,000m³	Approx. 50,000m³	Approx. 24,000m³	Estimated as of December 2020 Approx. 96,000m³

2-1 (1) [1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater [Reference] Case A (the total amount of tritium in the buildings is maximum)

- FY2023: 11 trillion Bq/year (carefully start with discharging small amounts = set to be half the volume of that in and after FY2024)
- FY2024-FY2029: 22 trillion Bq/year
- FY2030-FY2032: 18 trillion Bq/year
- In and after FY2033: 16 trillion Bq/year

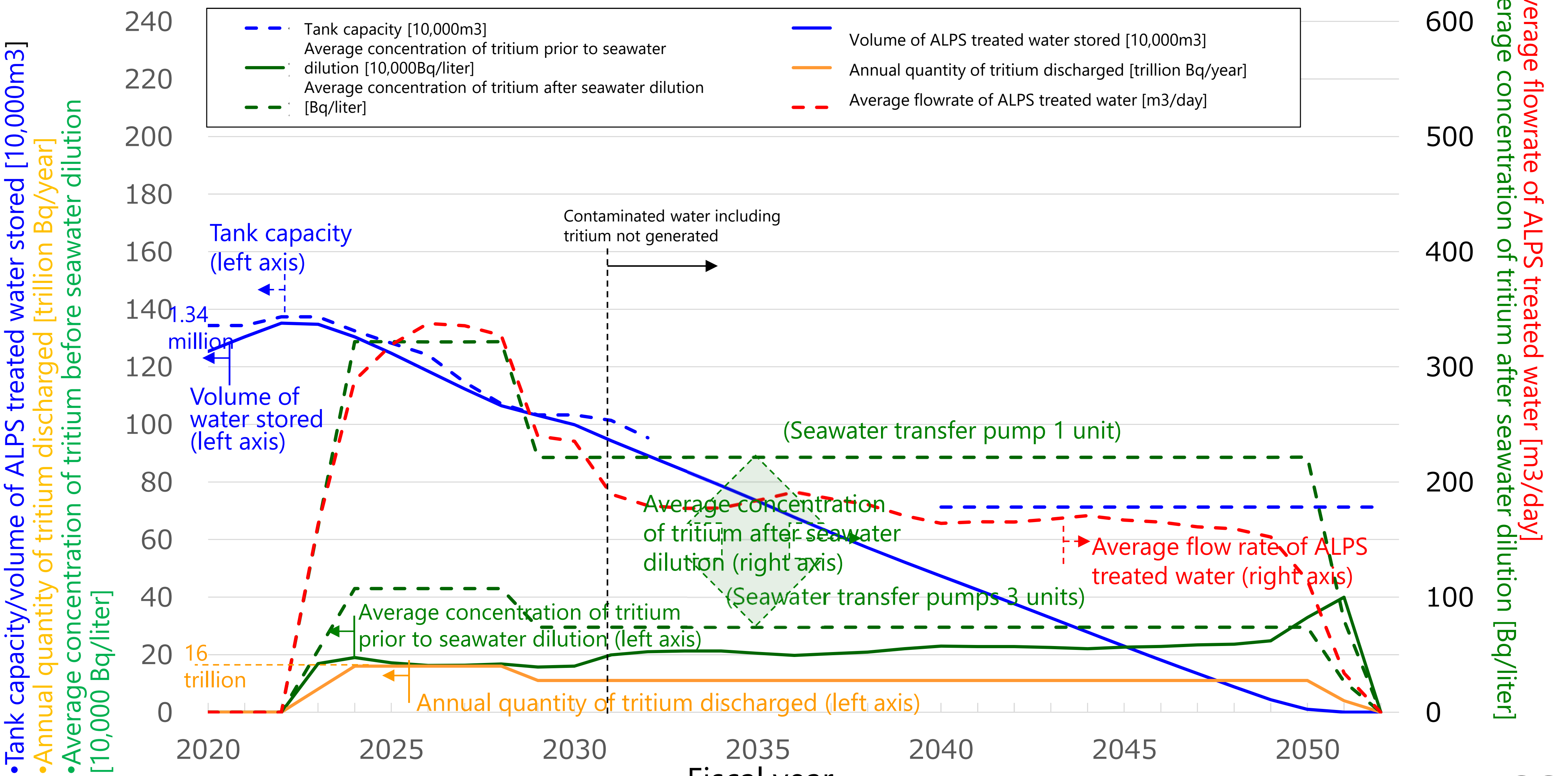


The Japanese version shall prevail.

2-1 (1) [1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater

[Reference] Case B (the total amount of tritium in the buildings is the minimum)

- FY2023: 8 trillion Bq/year (carefully start with discharging small amounts = set to be half the volume of that in and after FY2024)
- FY2024-FY2028: 16 trillion Bq/year
- In and after FY2029: 11 trillion Bq/year



The Japanese version shall prevail.

2-1 (1) [1] Control and monitoring of mixing/dilution ratio of ALPS treated water with seawater [Reference]: Discharge simulation (common conditions and parameters)

TEPCO

Common conditions

Annual quantity of tritium discharged (below 22 trillion Bq/year)	Set total discharge quantity so that sea discharge will be completed in FY2051 while not impacting the on-site utilization plan
Date for initiating simulation evaluation	April 1, 2021 (simulation by the year)
Date initiating discharge	April 1, 2023
Flow rate of ALPS treated water	Maximum 500m^3/day
Flow rate of seawater for dilution	170,000m^3/day (one sea water pump) ~ 510,000m^3/day (three sea water pumps)
Order for discharge of ALPS treated water	Discharge from the K4 tank used as measurement/confirmation facility, approx. 30,000m^3, with water with thinnest concentration of tritium discharged first Then, discharge from other tanks and newly generated ALPS treated water in the order of thinnest tritium concentration first.
Tritium decay	A half-life of 12.32 years is considered (approx. 5.5% decay annually), consider decay factor for newly generated volumes as well.
Volume of ALPS treated water generated	Assume that the volume of contaminated water generated will gradually drop 10m^3/day every year and reach 100m^3/day after FY2025.
Days discharged	292 days (availability factor 80%)

Parameters

Case	A (Case with maximum total tritium quantity)	B (Case with minimum total tritium quantity according to current information)
Concentration of newly generated tritium	448,000 Bq/liter (January 5, 2021, maximum in 2021)	215,000 Bq/liter (June 1, 2021, minimum in 2021
Total quantity of tritium inside building (as of April 1, 2021)	Approx. 1150 trillion Bq (total of 3400 trillion Bq from the accident still inside buildings and tanks)	Approx. 81 trillion Bq (Estimated based on volume of accumulated water in buildings and its concentration)

Responses to issues pointed out* at the review meeting, etc.

*: Documents 2-2, Attachment 2 for (the 97th) Specified Nuclear Facilities Monitoring and Assessment Review Meeting

Issues pointed out [3]

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

(1) Annual release of tritium

- In controlling the annual release of tritium, other than stopping discharge operation mechanically through interlocks, an explanation should be given on the basic contents of the annual discharge plan that TEPCO verbally explained this time, and the discharge control methods based on the plan.

[3]-1. Overview

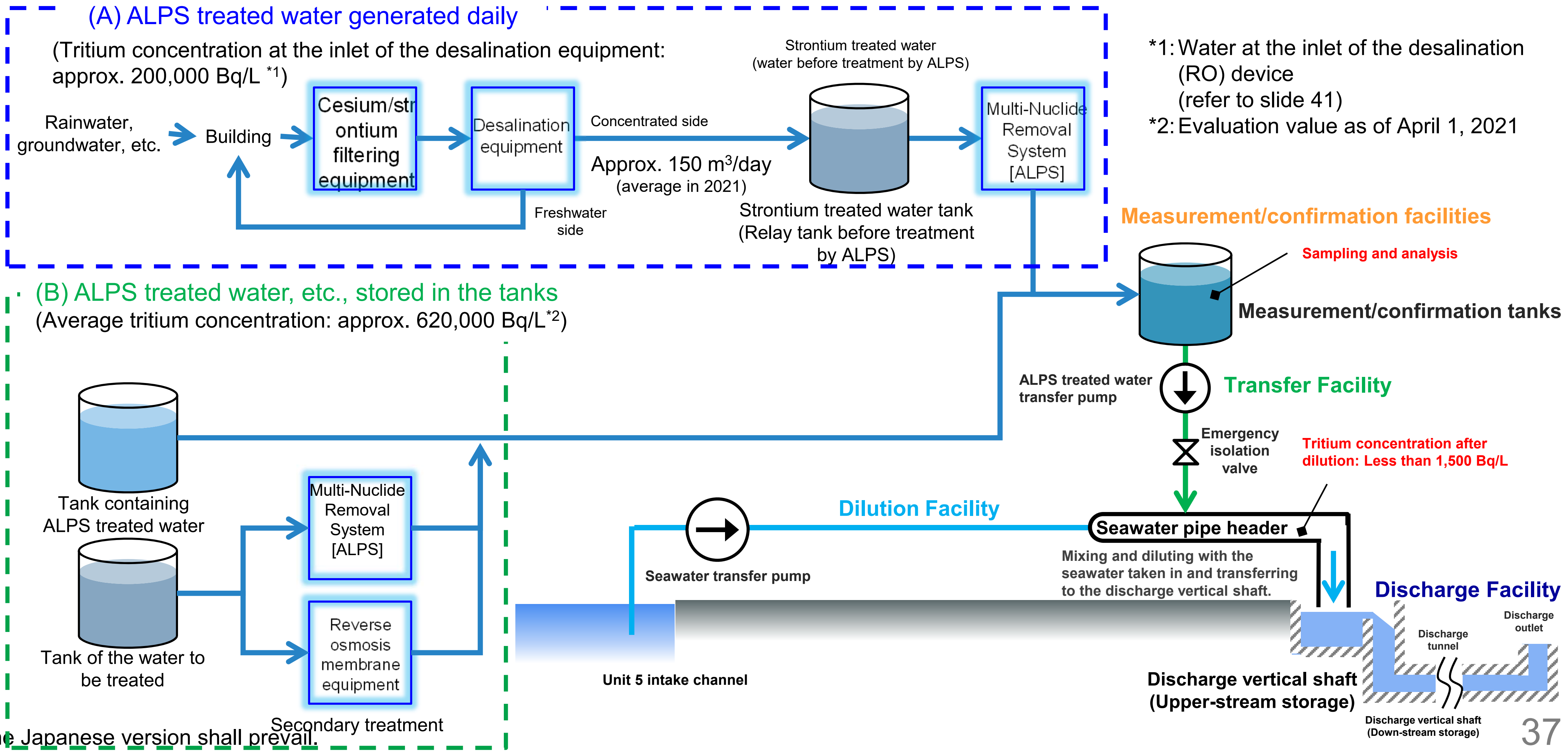
- Controlling the annual release of tritium at the time of planning
  - In every fiscal year, in line with our announcement on the result of the total release of tritium in the applicable fiscal year, we plan to develop the discharge plan for the following fiscal year by carefully investigating the status of the amount of contaminated water generated (changes), the tritium concentration(changes) at the inlet of the desalination equipment (RO) , and the future site use plan (area and timing required) by the end of the fiscal year (see slides 37 and 38 for details).

- Controlling the annual release of tritium during operation
  - In addition to the above, by installing interlocks on the facilities as explained at the 5th Review Meeting, we will also control the amount during operation so that the amount will not exceed 22 trillion Bq/year. (Refer to slide 40)

[3]-2. Basic policy of discharge plan

TEPCO

- The ALPS treated water to be released in the future includes "(A) ALPS treated water to be generated daily" and "(B) ALPS treated water, etc. stored in the tanks."
- The basic policy is to discharge ALPS treated water in order of lower tritium concentration. The amount of water in "(B)" that falls below the tritium concentration in "(A)" is limited (refer to slide 31); accordingly, "(A)" and "(B)" will be discharged alternately.



*1: Water at the inlet of the desalination (RO) device (refer to slide 41)
*2: Evaluation value as of April 1, 2021

The Japanese version shall prevail.

[3]-3. Discharge planning procedure

TEPCO

- Under the steady operation of alternately discharging "(A). ALPS treated water generated daily" and "(B). ALPS treated water, etc., stored in the tanks", within the range of 22 trillion Bq/year of the annual release of tritium, we will develop a discharge plan each year for the following fiscal year based on the following concept.

"(A). ALPS treated water generated daily"

- ✓ [1] Tritium concentration at the inlet of desalination (RO) device × [2] Amount of contaminated water generated = [3] Annual release of tritium of "(A)"

"(B). ALPS treated water, etc., stored in the tanks"

- ✓ [4] Annual release of tritium (22 trillion Bq/year) - [3] = [5] Annual release of tritium of "(B)"
- ✓ [6] Annual release of tritium of "(B)":
  Based on "the medium- to long-term action plan for decommissioning," the area required to start disassembling of tanks determines the amount of water.
- ✓ [5] ÷ [6] = [7] Average tritium concentration of "(B)"
- ✓ Prioritizing ALPS treated water with a lower tritium concentration so that the Average tritium concentration falls below the value specified in (7) while considering the operation (installing the transfer line to the measurement/confirmation facilities or ALPS from the storage tanks), we will make a discharge order plan of tank groups within the range of discharge amount of (6).

Water type	Average tritium concentration (Bq/L)	Annual release of water [m^3/year]	Annual release of tritium (Bq/year)
A	[1] Tritium concentration at the inlet of desalination (RO) device	[2] Amount of contaminated water generated x 365 [days/year]	[3]: [1] x 1000[L/m^3] x [2] x 365 [days/year]
B	[5] ÷ [6] ÷ 1000[L/m^3]	[6] Based on the site use plan	[5]: [4]-[3]
Total	-	-	[4] : 22 trillion (based on the government policy)

The Japanese version shall prevail.

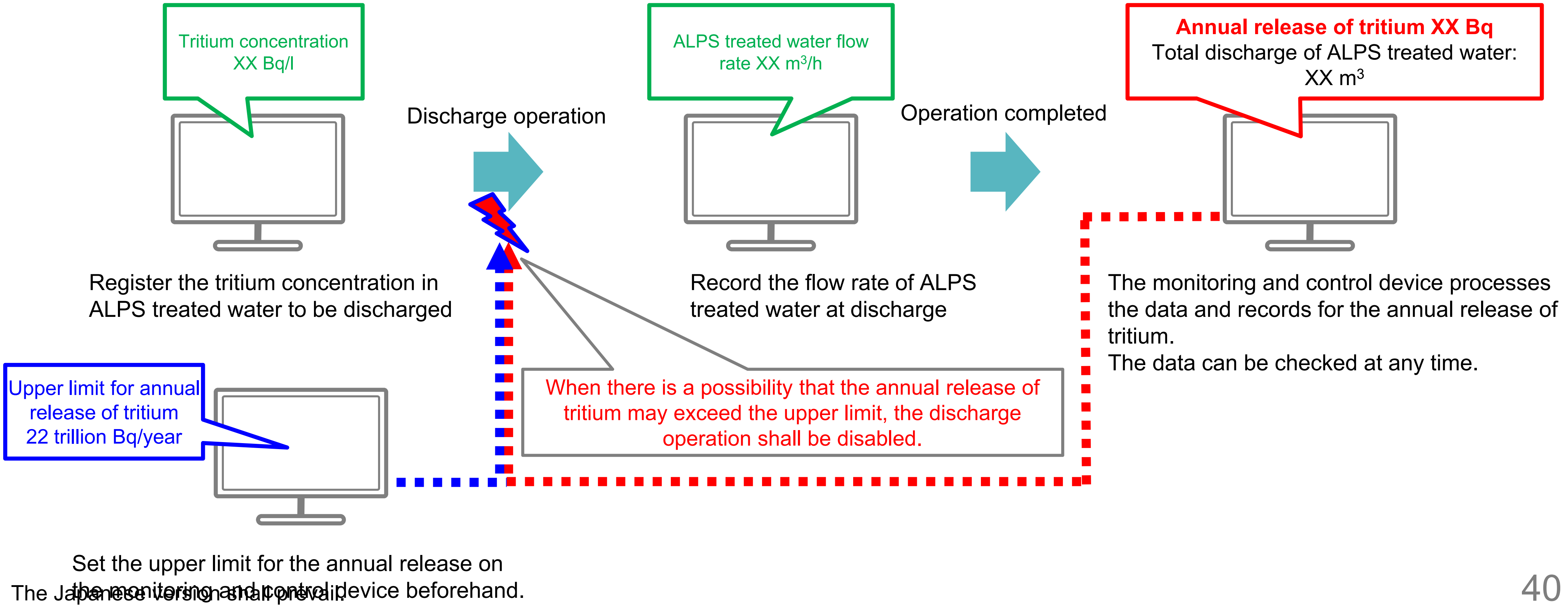
[3]-4. Response to cases where the postulate in the discharge plan is changed

- As a postulate of developing a discharge plan, (1) tritium concentration at the inlet of desalination (RO) device and (2) the amount of contaminated water generated are considered.

- If these parameters change significantly during the fiscal year, by comparing the tritium concentration of the (A) ALPS treated water generated daily and (B) ALPS treated water, etc., stored in the tanks selected in the discharge plan, water with the lower tritium concentration will be discharged with priority. In this case, the amount will be controlled so as not to exceed 22 trillion Bq per year using interlocks on the facilities shown in slide 40.

2-2 (1) Annual release of tritium
[Supplement] Interlocks that do not exceed the target discharge management value

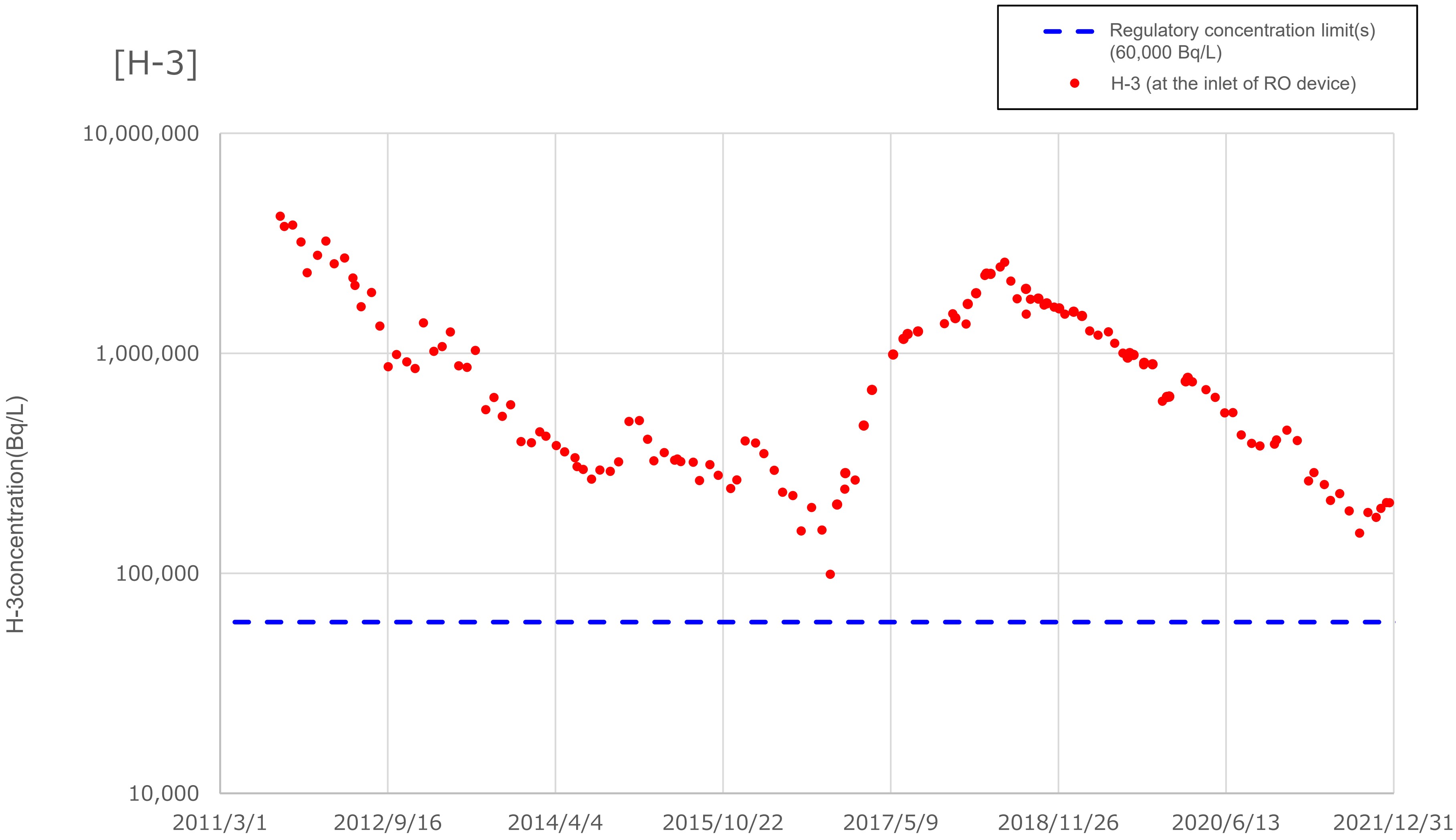
- In the ALPS treated water dilution/Discharge Facility, the tritium concentration in ALPS treated water to be discharged is registered to the monitoring and control device each time before discharge, and the monitoring and control device monitors the flow rate of ALPS treated water at discharge, counting and recording the total flow rate.
- As for annual tritium discharge, the monitoring and control device sums up the results obtained by multiplying the tritium concentration registered each time of discharge and the integrated flow rate, and the data can be checked at any time.
- This device can also set the upper limit of the annual release of tritium, and is equipped with an interlock system that does not allow the system to shift to the discharge operation when there is a possibility of exceeding the limit. In this way, the system is controlled so as not to exceed the target discharge management value for discharge per year (22 trillion Bq).



2-2 (1) Annual release of tritium

[Reference] Transition of tritium concentration at the inlet of desalination (RO) device

TEPCO



* Data after April 30, 2015, is published on the TEPCO website under “Analysis results of daily radioactive materials at the Fukushima Daiichi Nuclear Power Station.”

Responses to issues pointed out* at the review meeting, etc.

*: Documents 2-2, Attachment 2 for (the 97th) Specified Nuclear Facilities Monitoring and Assessment Review Meeting

Issues pointed out [4]

(Reference) Overall policy

- These facilities focus on stopping discharge as safety measures. Still, when considering risk mitigation of the entire specified nuclear facility, in addition to its safety measures, the necessity of implementing steady discharge for an extended period should be incorporated into the design concept.
- Overall feasibility of the site use plan associated with the following should be presented, and the validity of the future policy, tank removal by discharging ALPS treated water and installation of facilities needed for decommissioning.

[4]-1. Necessity of steady discharge for a long time

- ALPS treated water Dilution/Discharge Facilities and the related facility are intended to be used for safe and steady decommissioning work, such as fuel debris and spent fuel retrieval, through discharging ALPS treatment water stored in the tanks into the sea. The discharge needs to be carried out steadily for a long time.
  It is positioned as a future risk mitigation measure of the specified nuclear facility as follows:

  - ✓ With the discharge of the ALPS treated water stored in the tanks, we will achieve the overall construction process according to the medium- to long-term roadmap and implement risk reduction measures according to the risk map.

[4]-2. Feasibility of the site use (1/2)

TEPCO

- For the safe and steady decommissioning work, such as fuel debris and spent fuel retrieval, facilities expected to be needed in the future and their construction timing are described the table below. After implementing the necessary procedures, we will secure the sites required to construct these facilities and make use of them effectively.

Timing for the start of the use	Around the 2020s	Around the 2030s	Around the 2040s
Scheduled start of construction	**Around first half of the 2020s**	**Around second half of the 2020s**	**2030s and beyond**
Examples of necessary facilities	· Facilities necessary to reduce the risk of fuel debris		
	Related to the phased expansion of retrieval scale	Related to the further expansion of the retrieval scale	
	✓ Retrieval device maintenance system ✓ Fuel debris storage facilities ✓ Training facility ✓ Fuel debris and waste transfer system		
	· Facilities necessary to reduce the risk of spent fuel pools (SFPs)		-
	✓ Dry cask temporary storage facilities (for unit 1 - 6 SFPs) ✓ Storage facilities for high-dose equipment inside SFPs, etc.	✓ Dry cask temporary storage facilities (for common pool)	
	· Facilities necessary to reduce the risk of radioactive waste		
	✓ Solid waste storage ✓ Large waste storage ✓ Solid waste volume reduction facility ✓ Recycling facilities, etc.	✓ Storage and volume reduction facilities for high-dose solid waste generated from debris retrieval	
	· Other facilities necessary for risk reduction		

* Not all facilities will be built in the area where tanks are removed.
This is an assumption as of now, and may change depending on the progress of future studies and new knowledge.

[4]-3. Feasibility of the site use (2/2)

- In discharging at a level below the annual 22 trillion becquerels as indicated in the government policy, we will set the annual amount of water discharged from the tanks in consideration of the site use (see slide 38) so that we can build the facilities mentioned in the previous pages and proceed with the discharge so as not to affect decommissioning.

- The current assessment assumes that in the even if the discharge is carried out at a level below 22 trillion becquerels per year, it will have no impact on decommissioning (see slides 31 to 34).

<Government Policy>
3. Specific methods for releasing ALPS treated water into the sea
(2) Release methods to minimize reputational damage
[4] In addition, regarding the annual total release of tritium, it should be discharged at a level below the target discharge management value of the Fukushima Daiichi NPS before the Accident (22 trillion becquerels per year), and this should be periodically reassessed. Note that this amount is within the range of the actual discharge amount from other nuclear power plants in Japan and overseas.

The following slides are for reference.

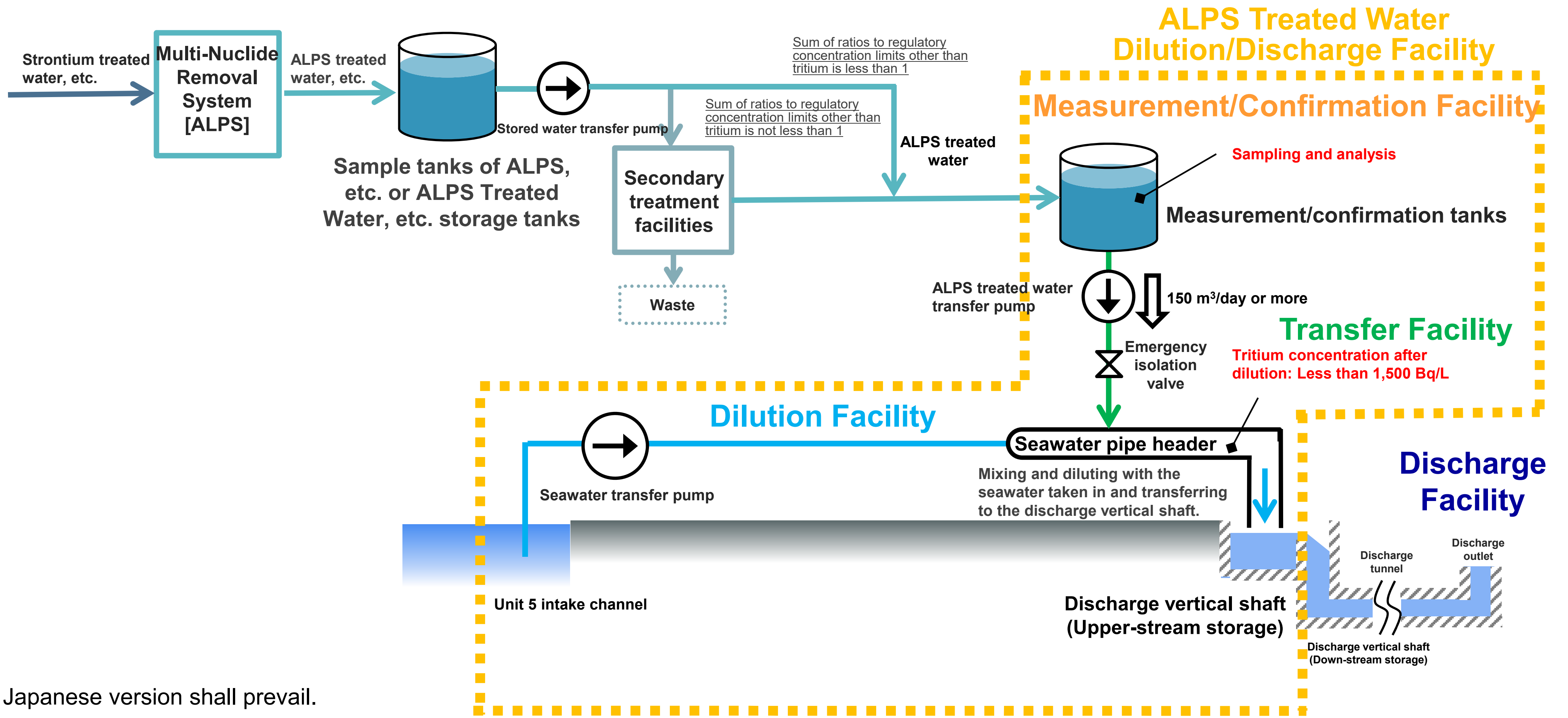
[Reference] Overview of the ALPS treated water dilution/Discharge Facility

Objective

The facilities ensure that the water treated by multi-nuclide removal equipment until the radionuclide concentration becomes sufficiently low is the ALPS treated water (water in which the sum of the ratios to regulatory concentrations limits of nuclides other than tritium is less than 1), dilute the treated water with seawater, and then discharge it into the sea.

Facility overview

The measurement/confirmation facilities homogenize the concentration of radionuclides in a measurement/confirmation tank and a tank group, and then collect and analyze samples to ensure that the water is ALPS treated water. Thereafter, the Transfer Facility send the ALPS treated water to the seawater pipe header, and then the Dilution Facility dilute the water with seawater taken in by the seawater transfer pump from 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.



The Japanese version shall prevail.

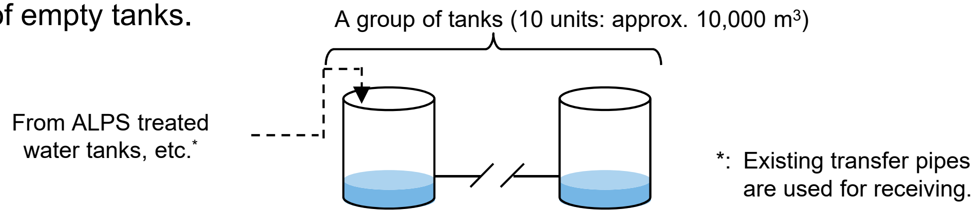
[Reference] Overview of the ALPS treated water Dilution/Discharge Facilities (measurement/confirmation facilities)

Measurement/confirmation facilities

- 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 agitated to become homogenized, and then sampled for analysis.

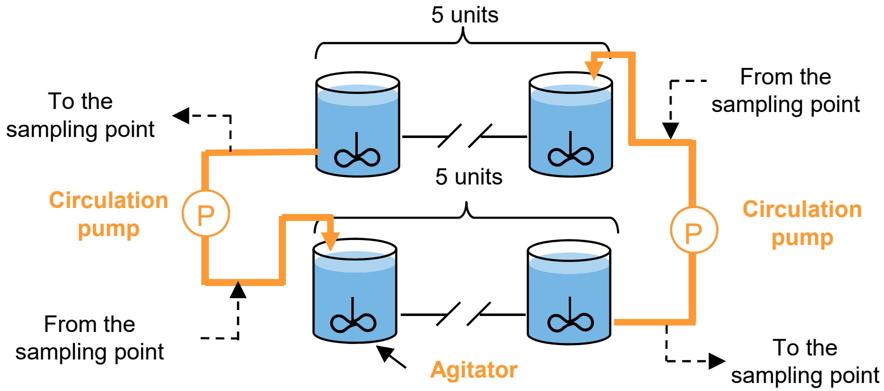
(1) Receiving process

ALPS treated water from ALPS treated water storage tanks, etc., is transferred into a group of empty tanks.



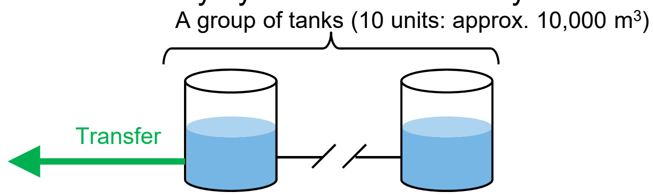
(2) Measurement/confirmation process

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

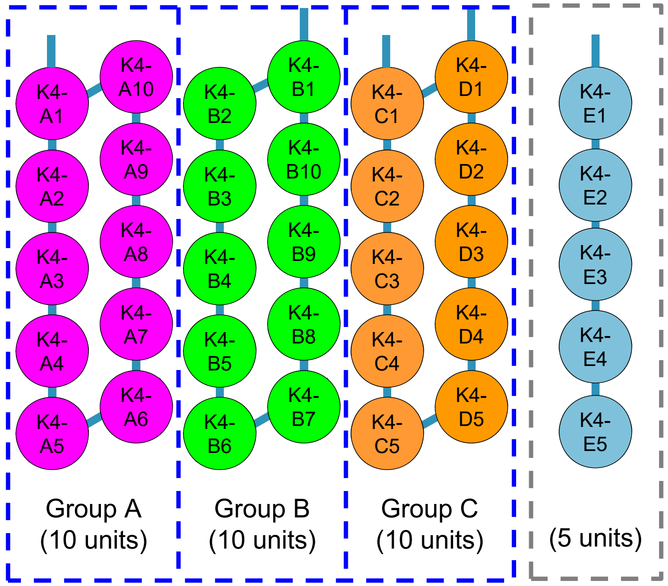


[3] Discharge process

After confirming that the ALPS treated water satisfies the discharge criteria, the water is transferred to the Dilution Facility by the Transfer Facility.



K4 area tank groups: 35 units



Chapter 2.50 ALPS treated water dilution/Discharge Facility

Chapter 2.5 ALPS treated water tanks

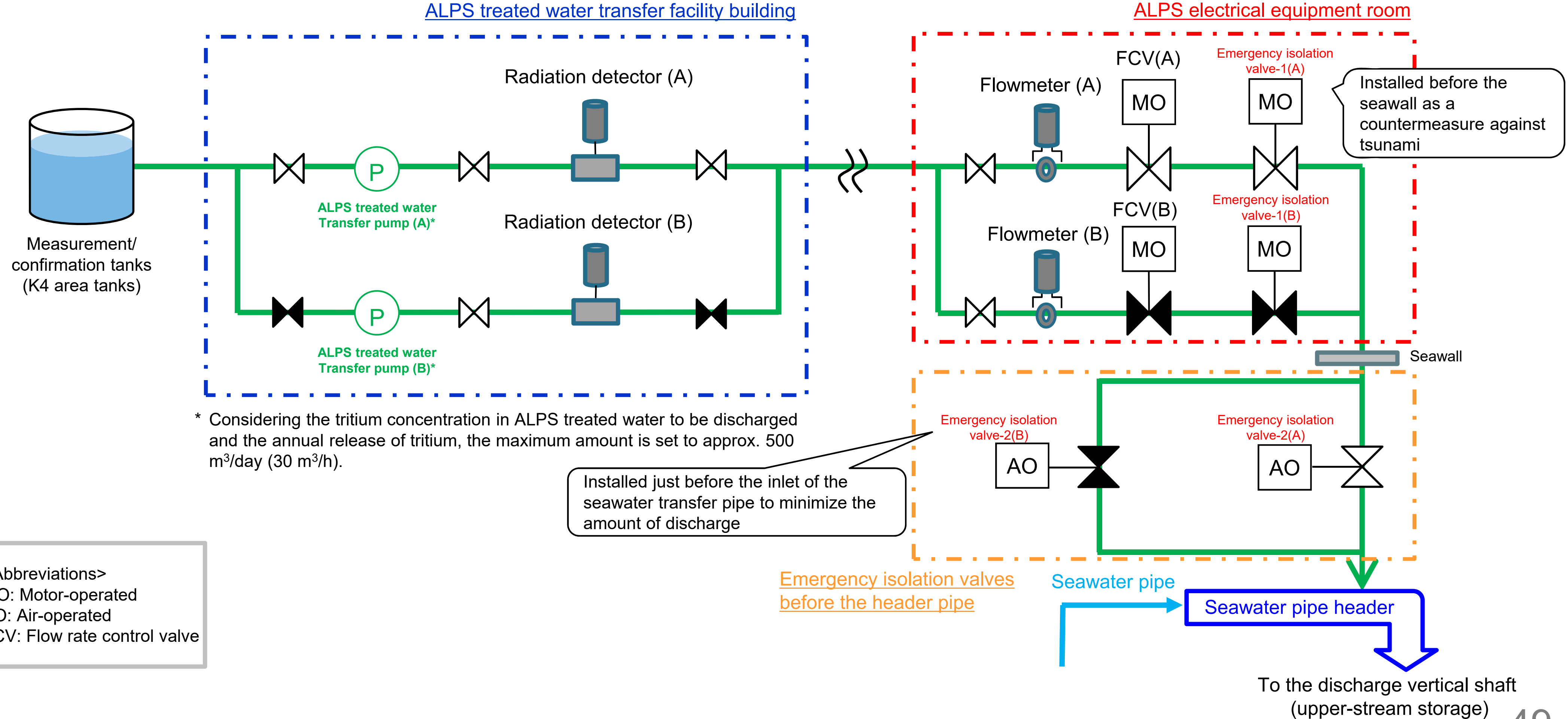
	Group A	Group B	Group C
1st round	Receiving	-	-
2nd round	Measurement/ confirmation	Receiving	-
3rd cycle	Discharge	Measurement/ confirmation	Receiving
4th round	Receiving	Discharge	Measurement/ confirmation
...	Measurement/ confirmation	Receiving	Discharge

The Japanese version shall prevail.

[Reference] Overview of the ALPS treated water Dilution/Discharge Facilities (Transfer Facility)

Transfer Facility

- The Transfer Facility consist of ALPS treated water transfer pumps and transfer pipes.
- Two ALPS treated water transfer pumps are prepared, a unit in operation and a backup unit, to transfer ALPS treated water from measurement/confirmation tanks to the Dilution Facility.
- Emergency isolation valves are provided both before the seawater pipe header and 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 release of tritium, the maximum amount is set to approx. 500 m^3/day (30 m^3/h).

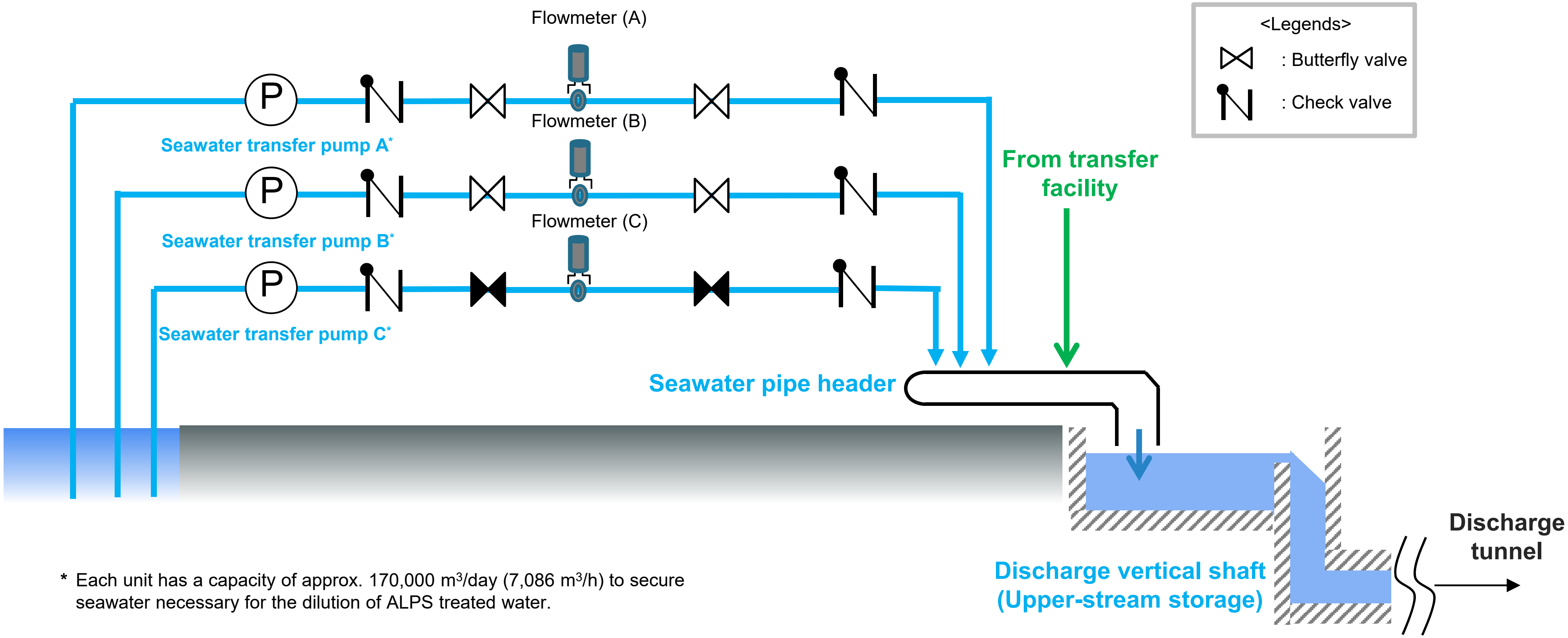
<Abbreviations>
MO: Motor-operated
AO: Air-operated
FCV: Flow rate control valve

[Reference] Overview of the ALPS treated water Dilution/Discharge Facilities (Dilution Facility)

Excerpt from document 2-1 for the 97th Review Meeting on Monitoring and Evaluation of the Specified Nuclear Facility

TEPCO

- Dilution Facility
  - Consisting of seawater transfer pumps, seawater pipes (including a header pipe), and a discharge vertical shaft (upper-stream storage), the Dilution Facility dilute ALPS treated water with seawater, transfer 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.



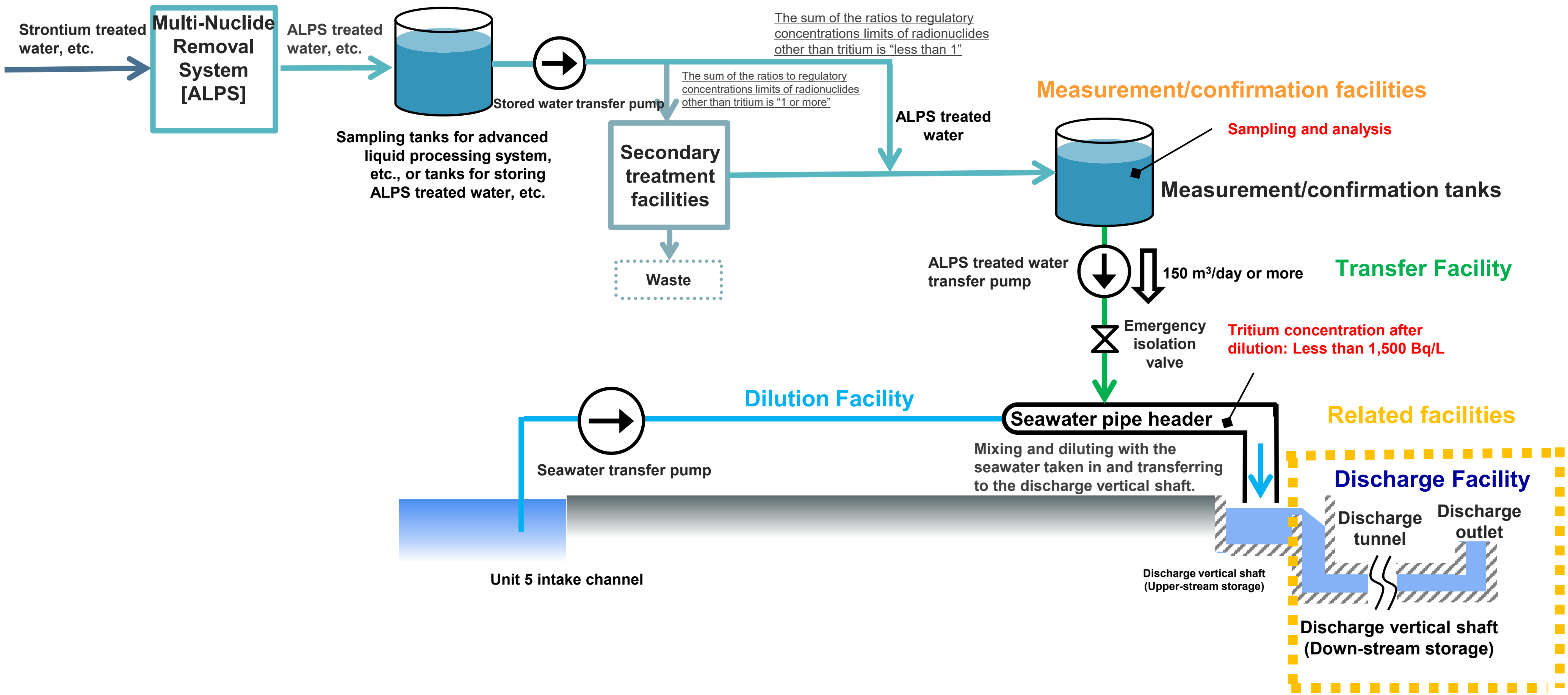
* Each unit has a capacity of approx. 170,000 m^3/day (7,086 m^3/h) to secure seawater necessary for the dilution of ALPS treated water.

The Japanese version shall prevail.

[Reference] Overview of related facilities (Discharge Facility)

TEPCO

- **Objective**
  Drainage water is discharged from the ALPS treated water Dilution/Discharge Facilities (water diluted with seawater so that the sum of the ratios to regulatory concentrations limits of all radionuclides including tritium is less than 1) into the sea from a location approximately 1 km away from the coast.
- **Facility overview**
  The Discharge Facility consist of a discharge vertical shaft (down-stream storage), a discharge tunnel, and a discharge outlet to achieve the above objective.

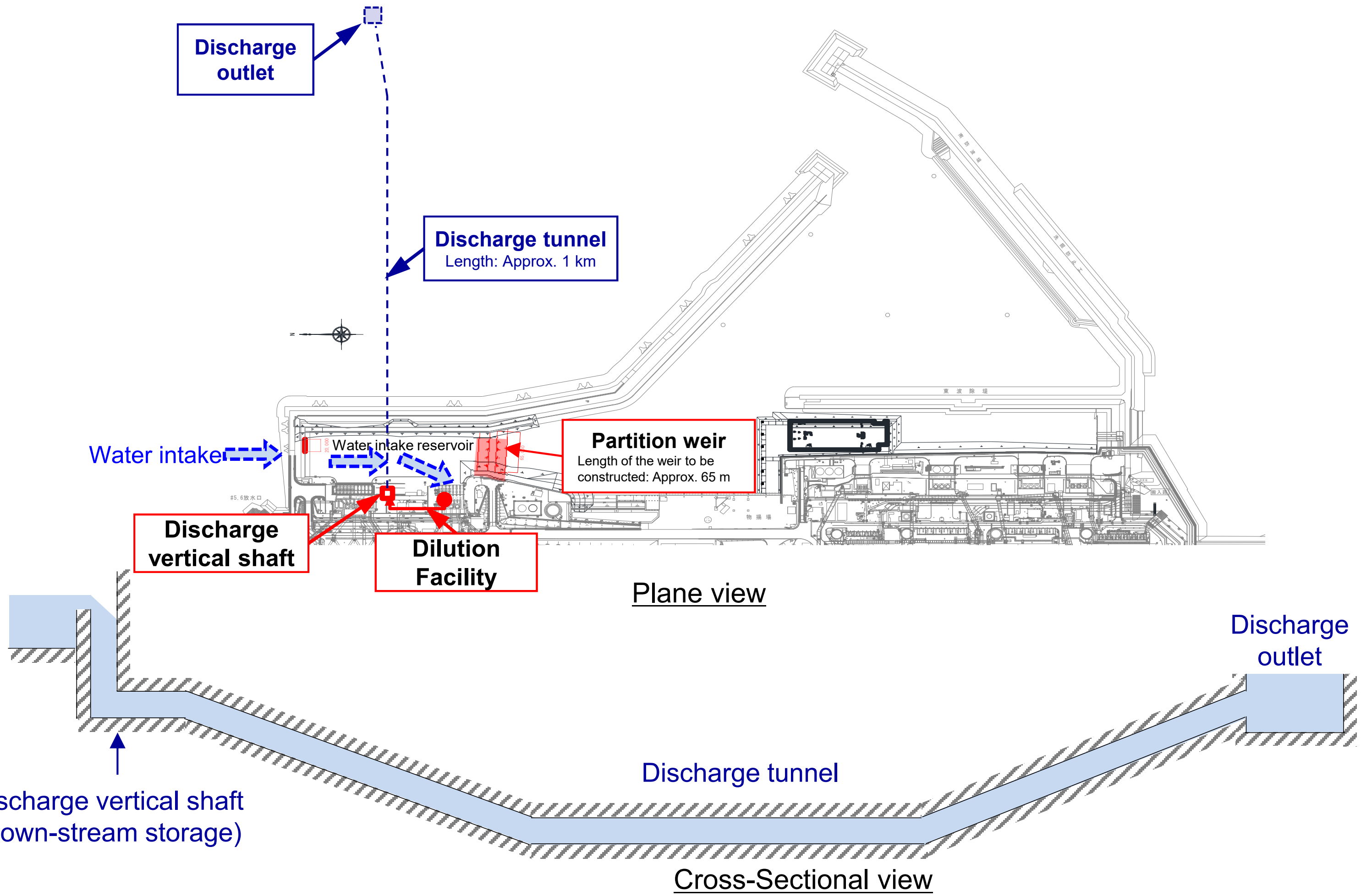


[Reference] Overview of related facilities (Discharge Facility) (1/2)

TEPCO

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.



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

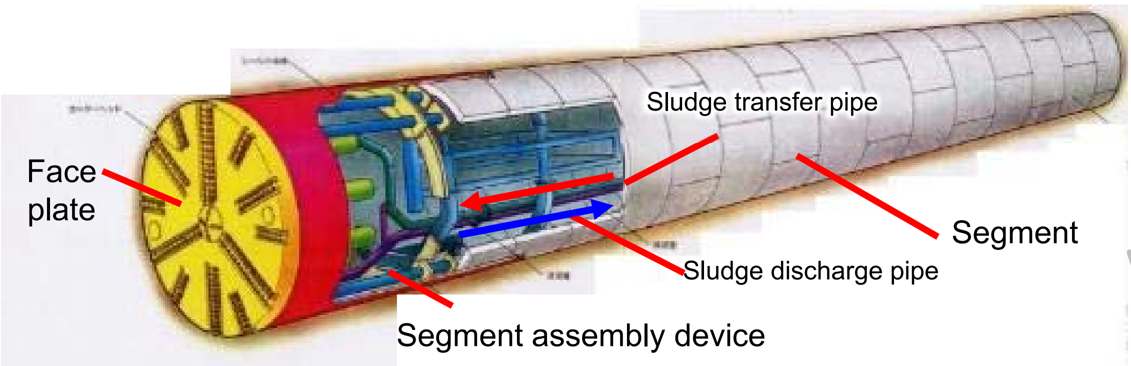
TEPCO

Overview of the structural design

- Water is made to flow through the bedrock layer to minimize 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, secure construction will minimize the possibility of trouble.



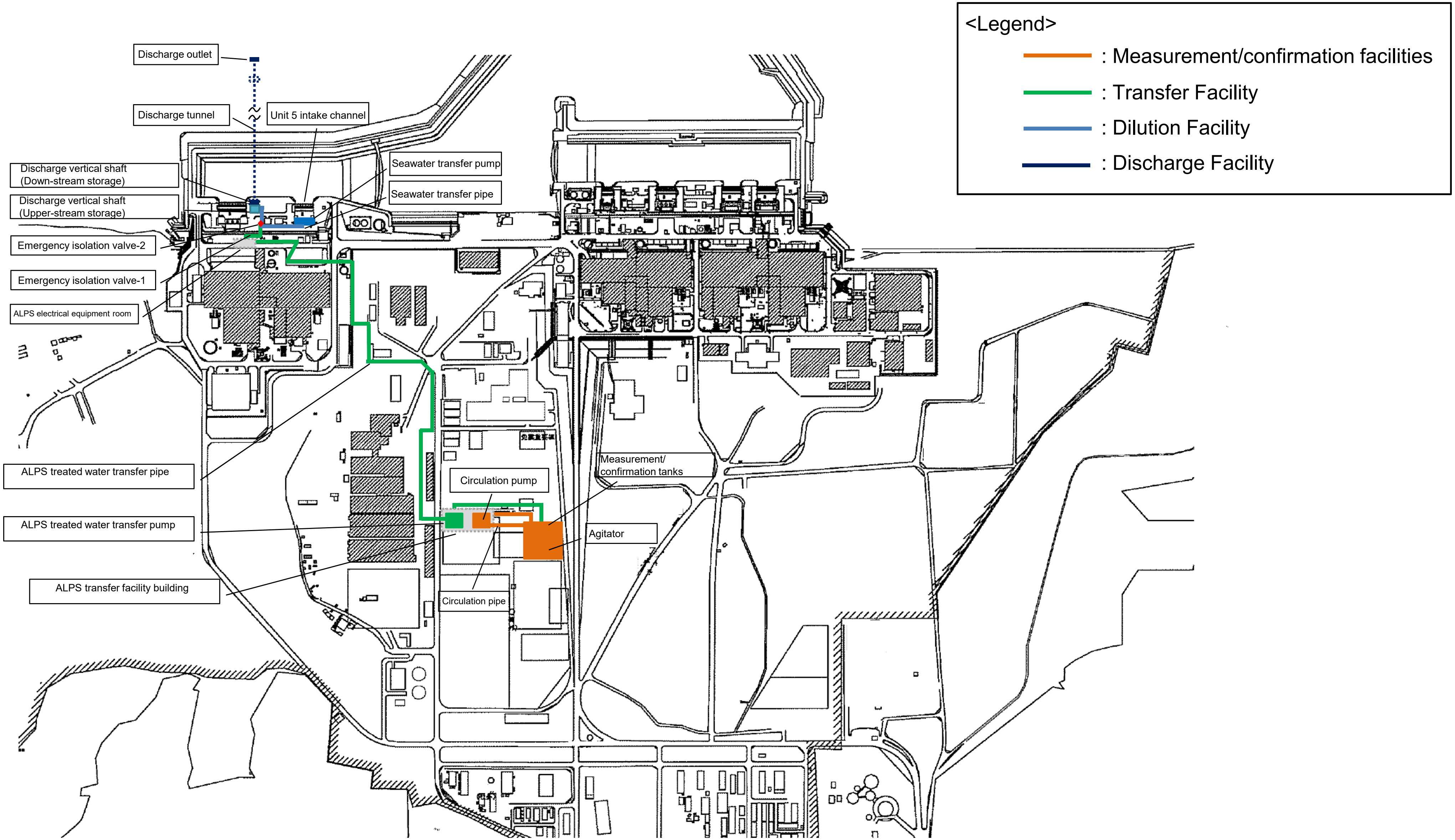
*: The slurry shield method was adopted this time.

Schematic diagram of a shield machine

Segment

[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

Excerpt from document 2-1 for the 97th Review Meeting on Monitoring and Evaluation of the Specified Nuclear Facility

TEPCO

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