ALPS Treated Water Discharge Status Update

November 30, 2023

TEPCO

Tokyo Electric Power Company Holdings, Inc.

1. Performance of the Third Discharge (P2~22)

2. Reviewing the first three discharges and plans for future discharges （P23～31）

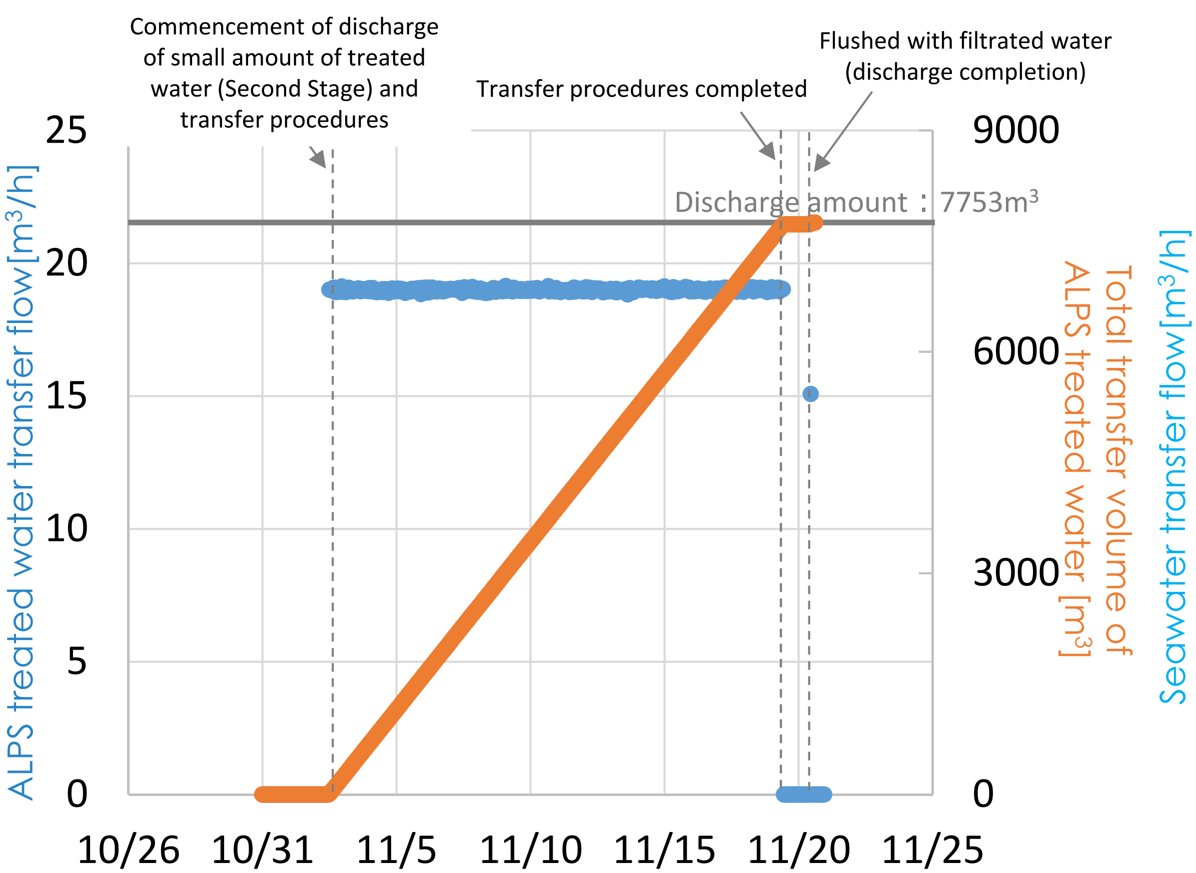
Foreword

- In this update, we will show you that there were no abnormalities in operating parameters or sea monitoring during the third discharge of ALPS treated water, review the first three discharges, and provide information about future discharges.
- We have implemented the following during the initial discharge of ALPS treated water into the sea:
  - ✓ During the First Stage of the third discharge of ALPS treated water, on October 31, a very small amount of ALPS treated water (approximately $1m^3$) was diluted with seawater (approximately $1,200m^3$) after which this water was held in the discharge vertical shaft (upper-stream storage) and sampled in order to verify that ALPS treated water is indeed being diluted as planned.
  - ✓ On November 2, we confirmed that the tritium concentration in the diluted ALPS treated water was less than 1,500Bq/liter and that the analysis value was within the range of uncertainty of calculated concentrations. So, on the same day (November 2), we commenced the discharge of ALPS treated water, and this third discharge was completed on November 20.

Discharged tank group	Tritium concentration	Commencement of discharge	Completion of discharge	Amount of discharge	Amount of tritium radioactivity
Group A	130,000 Bq/liter	November 2, 2023	November 20, 2023	$7,753m^3$	Approx. 1.0 trillion Bq

1-1. Operating parameter records during the discharge (1/3)

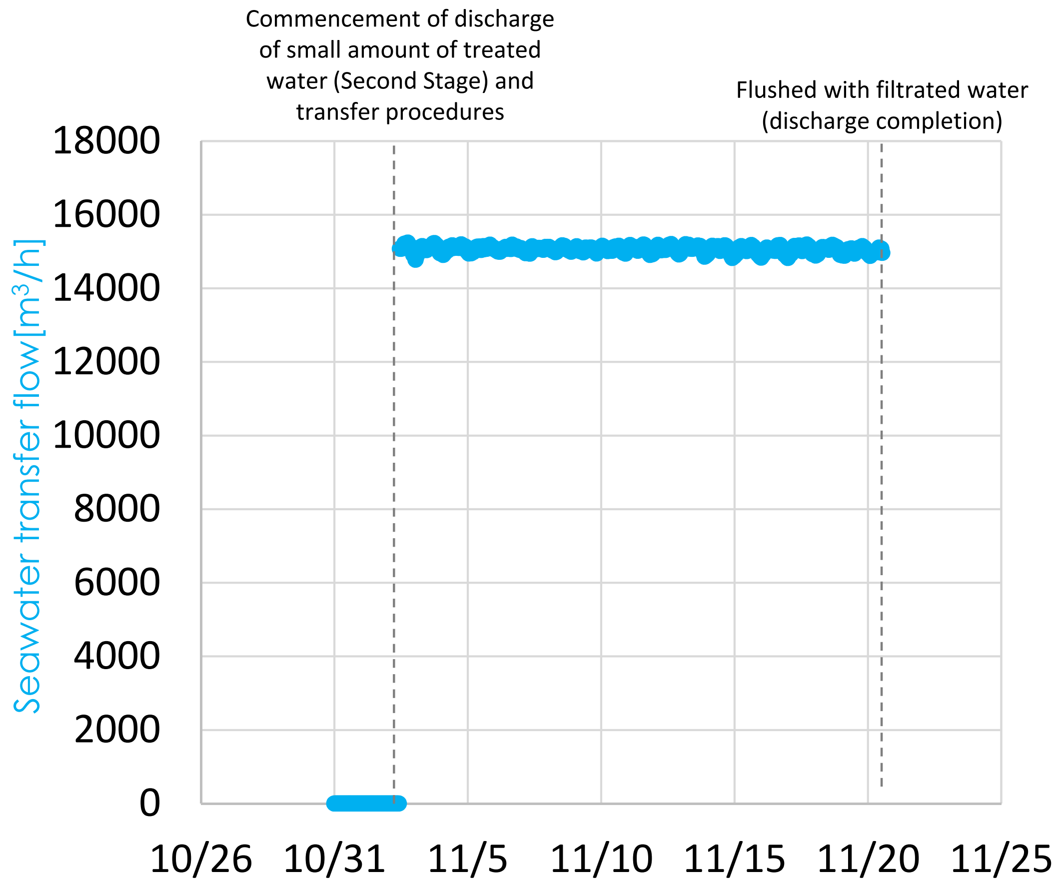
- We were able to operate ALPS treated water transfer systems and seawater systems without issue.



ALPS treated water transfer flow and total transfer volume of ALPS treated water

ALPS treated water transfer flow*1

Total transfer volume of ALPS treated water



Seawater transfer flow

Seawater transfer flow*2

*1： The flowmeters are reduplicate, so the higher of the figures from both meters was used.
*2： Total for systems A and B

1-1. Operating parameter records during the discharge (2/3)

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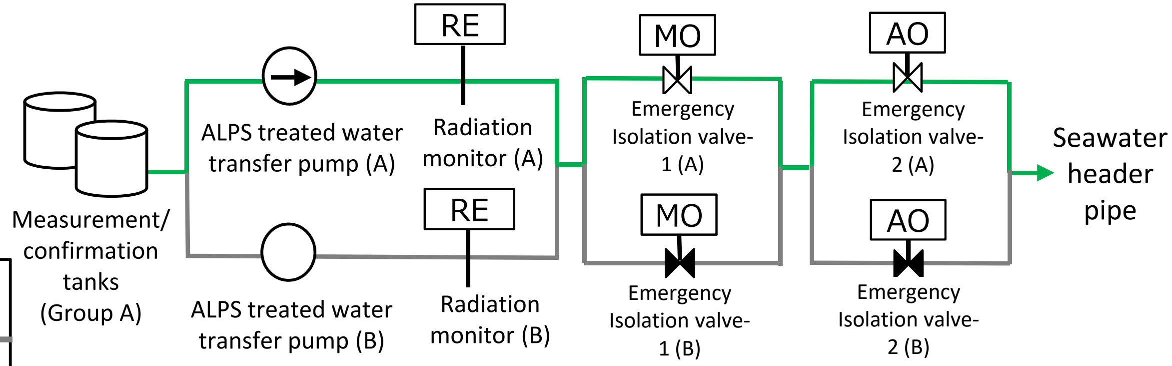
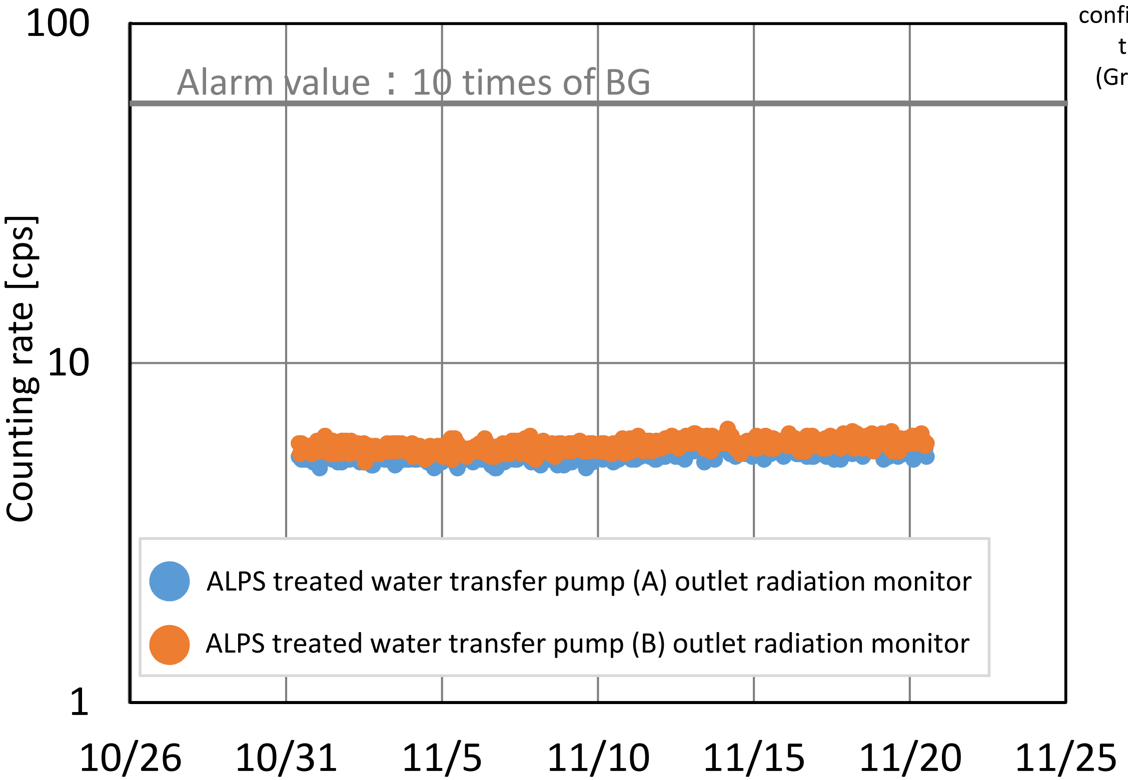
- No abnormalities were seen in the figures from the ALPS treated water transfer pump outlet radiation monitor.

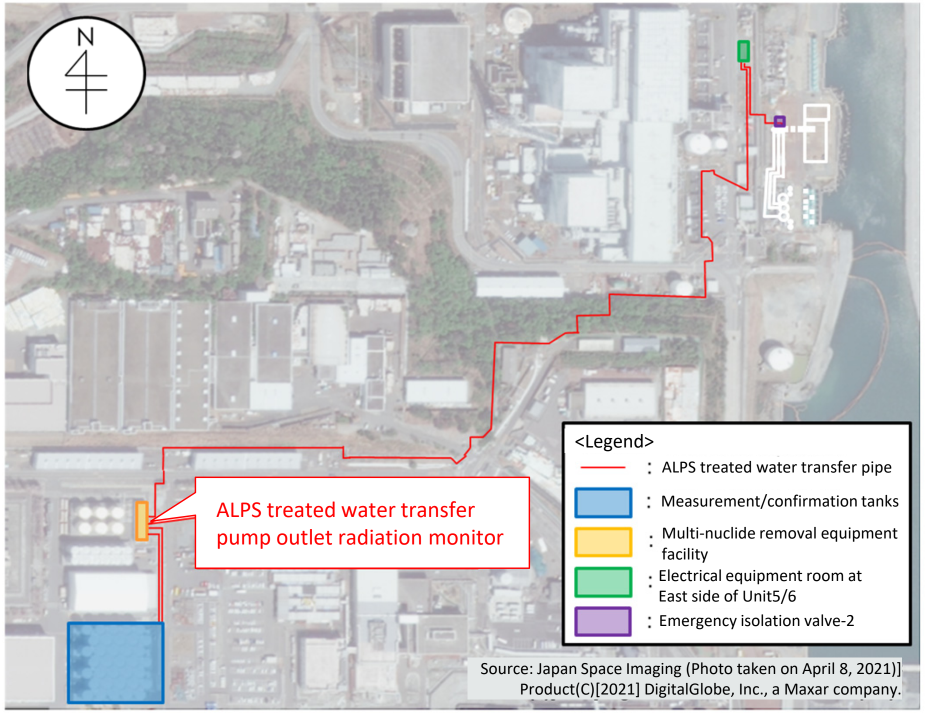


ALPS treated water transfer system schematic



Figures of ALPS treated water transfer pump outlet radiation monitor※

※： As shown in the schematic on the upper right, during the third discharge, ALPS treated water was passed through System A.
(System B was filled with filtrated water)



Overview of ALPS treated water dilution/discharge facility

1-1. Operating parameter records during the discharge (3/3)

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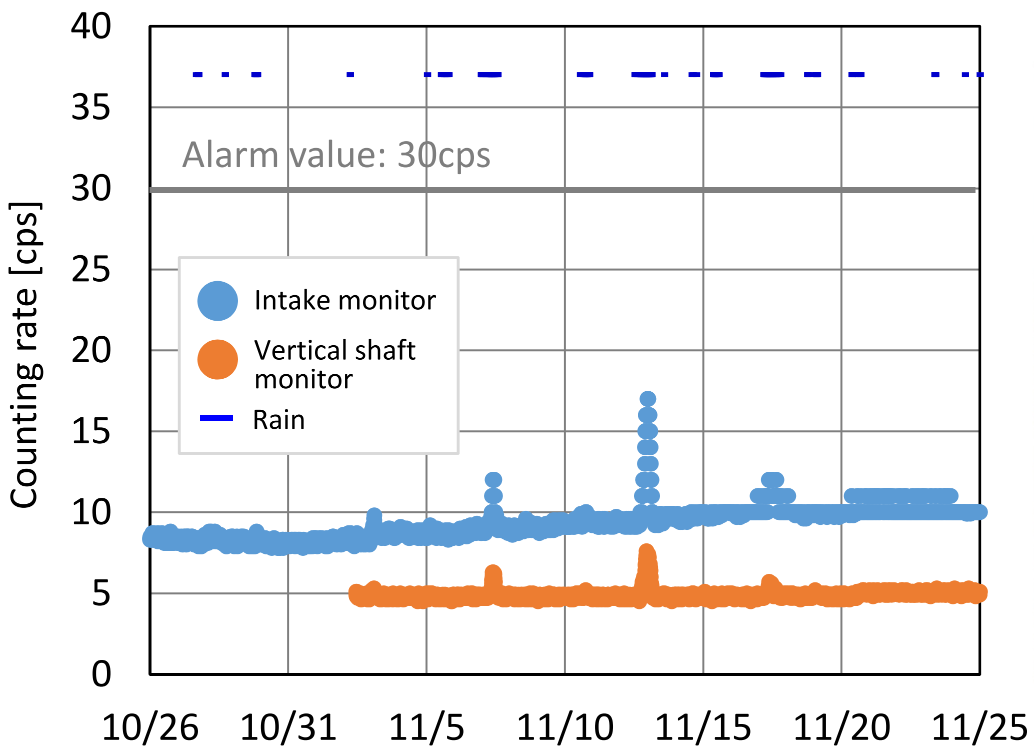
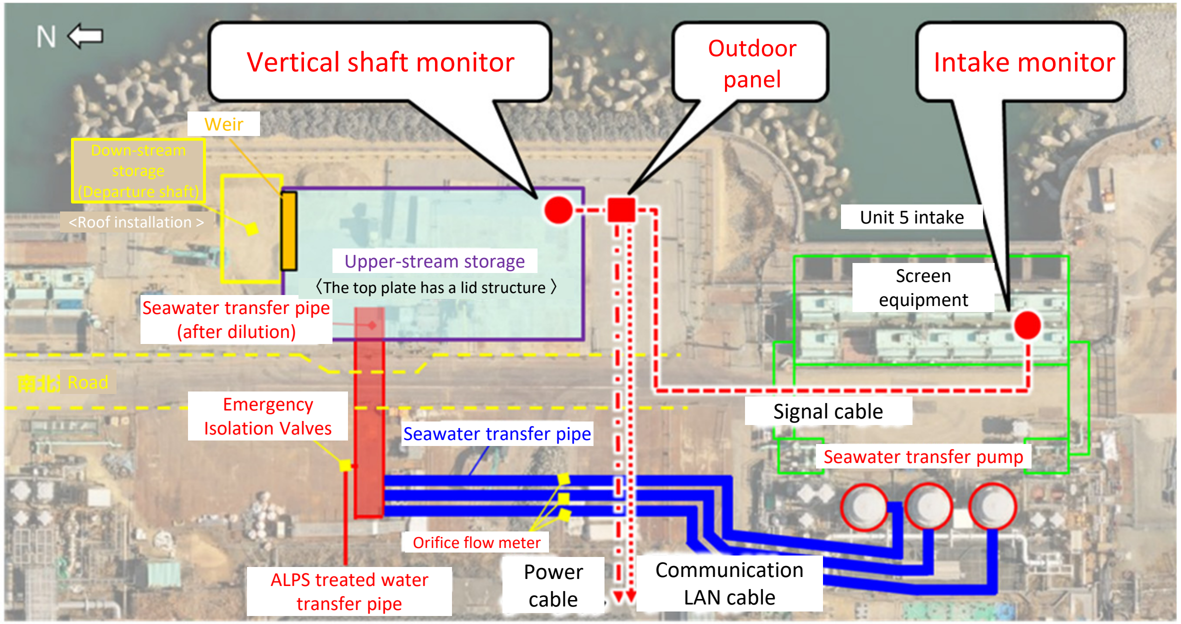
- A temporary spike assumed to be caused by rainfall was seen in the figures from the intake monitor, but there were no abnormal fluctuations.



Figures of Intake/Vertical shaft monitor



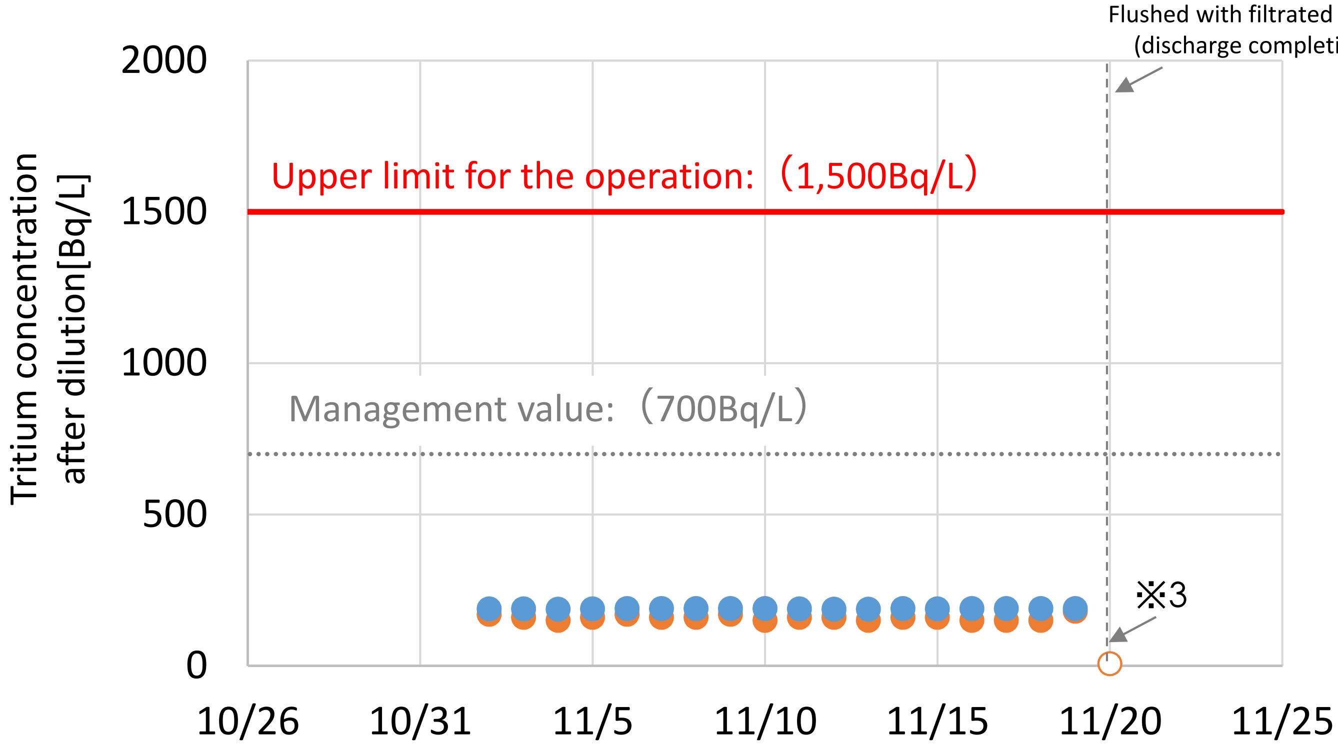
Overview of Intake/Vertical shaft monitor

※Compared with the vertical shaft monitor, the intake monitor is more easily affected by radiation from the surrounding environment (background radiation), so it is believed that the discrepancies are caused by the differences in installation locations.

It is believed that during rainfall, the concentration of radioactive materials in seawater increases due to the fallout runoff from onshore areas.

1-2. Tritium concentrations after dilution during the discharge TEPCO

- During the discharge period, water was sampled daily from the seawater pipe to analyze tritium concentrations.
  ⇒Confirmed to be less than the upper limit for the operation: 1,500Bq/liter
- Furthermore, on November 20, the ALPS treated water transfer pipe was flushed with an amount of filtrated water that exceeds the volume of the pipe and samples were taken afterwards. An analysis of these samples showed no detection (ND; concentrations of radioactive substances were below detection limit) thereby confirming that the water inside the ALPS treated water transfer pipe had been flushed with filtrated water.



Tritium concentrations after dilution（calculated values and analysis values）

● Calculated values※1

● Analysis values(Detected values)

○ Analysis values (below the detection limit)

※1：Calculated using the following formula
（Uncertainty has been considered for each parameter）

Tritium concentrations after dilution (Calculated values)

$$= \frac{\text{Tritium concentrations in ALPS treated water}^{※2} \times \text{ALPS treated water transfer flow}}{\text{Seawater transfer flow} + \text{ALPS treated water transfer flow}}$$

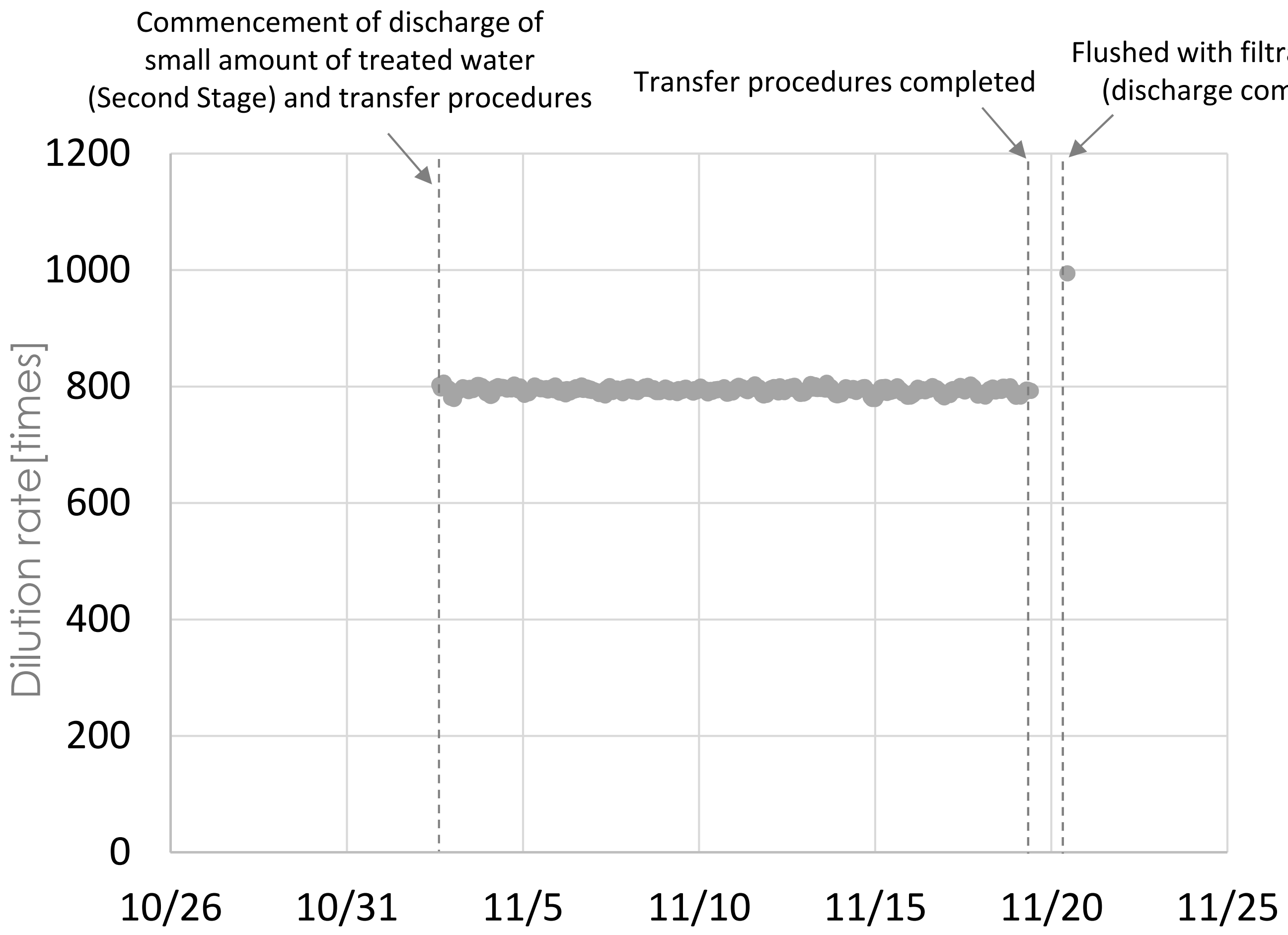
※2：Analysis values at measurement/confirmation tanks

※3：No calculated values since the pipes were flushed out with filtrated water.

	11/2	11/3～11/19	11/20
Calculated value: Time of data acquisition	14:00	7:00	－
Analysis value: Time of specimen sampling	14:13	7:00～10:00	11:54

[Reference] Dilution rate of ALPS treated water

- The dilution rate has always been kept at over 100 times during the discharge.



Dilution rate of ALPS treated water

● Dilution rate※1

※1：Calculated using the following formula

$$\text{Dilution rate} = \frac{\text{Seawater flow rate}^{※2} + \text{ALPS treated water flow rate}^{※3}}{\text{ALPS treated water flow rate}^{※3}}$$

※2： Total for systems A and B
※3： The flowmeters are reduplicate, so the higher of the figures from both meters was used for calculation

[Reference] Total radioactivity of nuclides to be measured and assessed (29 nuclides)

- The following chart shows the total radioactivity (bq) for nuclides to be measured and assessed (29 nuclides) during the third discharge (Group A). (Calculated from analysis values※1 (Bq/liter) and discharge volume (7,753m³) for each nuclide)

  ※1: It was confirmed that the sum of the ratios of legally required concentrations of the nuclides targeted for measurement/assessment is 0.25 and less than 1.

- The total radioactivity from nuclides for which analysis values were below detection limit (ND) have not been included.

Nuclide	Analysis value [Bq/L]	Total radioactivity [Bq]	Nuclide	Analysis value [Bq/L]	Total radioactivity [Bq]	Nuclide	Analysis value [Bq/L]	Total radioactivity [Bq]
C-14	1.4E+01	1.1E+08	Sb-125	<9.4E-02	－	U-234※3	<2.4E-02	－
Mn-54	<2.5E-02	－	Te-125m※2	<3.3E-02	－	U-238※3	<2.4E-02	－
Fe-55	<1.6E+01	－	I-129	1.9E+00	1.5E+07	Np-237※3	<2.4E-02	－
Co-60	3.3E-01	2.6E+06	Cs-134	<2.9E-02	－	Pu-238※3	<2.4E-02	－
Ni-63	<9.0E+00	－	Cs-137	3.8E-01	2.9E+06	Pu-239※3	<2.4E-02	－
Se-79	<8.9E-01	－	Ce-144	<4.0E-01	－	Pu-240※3	<2.4E-02	－
Sr-90	4.1E-02	3.2E+05	Pm-147※2	<3.4E-01	－	Pu-241※2	<6.5E-01	－
Y-90※2	4.1E-02	3.2E+05	Sm-151※2	<1.3E-02	－	Am-241※3	<2.4E-02	－
Tc-99	<2.0E-01	－	Eu-154	<7.7E-02	－	Cm-244※3	<2.4E-02	－
Ru-106	<2.3E-01	－	Eu-155	<2.6E-01	－			

※2 Analysis values were assessed with radioactive equilibrium

※3 Gross Alpha measurements

1-3. Sea area monitoring history（1/11）

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○ Measurement results of tritium concentrations in water sampled in the vicinity of the discharge outlet (within 3km of the power station) and outside of the vicinity of the discharge outlet (within a 10km square in front of the power station) since the commencement of the first discharge on August 24 were all below indices (discharge suspension level and investigation level).

○ For quick tritium measurements taken in the vicinity of the discharge outlet, we will initially increase the frequency from once a week to daily after the commencement of the discharge and promptly disclose the results.

（Unit：Bq/L）

	Sampling location	Frequency	August											
			24 *1	24 conventional *1,2	25	26	26 conventional *3	27	28	29	30	30 conventional *2,3	31	31 conventional *3
In the vicinity of the discharge outlet	T-1	Once a week*	<6.3	<0.34	<5.6	<6.6	0.97	<6.2	<7.3	<5.9	<6.4	1.0	<6.8	–
	T-2	Once a week*	<6.3	<0.33	<5.5	<6.5	1.1	<6.2	<7.3	<5.9	<6.3	1.3	<6.8	–
	T-0-1	Once a week*	<8.0	<0.34	<6.8	<6.1	0.66	<6.1	–*4	–*4	<6.8	<0.32	<8.2	–
	T-0-1A	Once a week*	<4.6	2.6	<7.6	<6.2	0.087	<6.1	–*4	–*4	<6.9	0.43	10	–
	T-0-2	Once a week*	<8.1	<0.35	<6.8	<6.1	0.92	<6.1	–*4	–*4	<6.8	1.4	<8.2	–
	T-0-3A	Once a week*	<4.7	<0.33	<7.6	<6.8	<0.068	<6.8	–*4	–*4	<7.6	<0.32	<5.1	–
	T-0-3	Once a week*	<8.0	<0.34	<6.9	<6.1	0.14	<6.1	–*4	–*4	<6.8	<0.31	<8.3	–
	T-A1	Once a week*	<6.6	<0.32	<7.6	<6.8	0.13	<6.8	–*4	–*4	<7.6	1.1	<5.1	–
	T-A2	Once a week*	<6.6	<0.32	<7.6	<6.8	0.065	<6.8	–*4	–*4	<7.7	1.5	<5.1	–
	T-A3	Once a week*	<6.6	<0.32	<6.9	<6.8	<0.072	<6.8	–*4	–*4	<7.6	1.1	<5.2	–
Outside the vicinity of the discharge outlet	T-D5	Once a week	–	–	–	–	–	–	–	–	–	–	<6.8	0.59
	T-S3	Once a month	–	–	–	–	–	–	–	–	<7.6	0.070	–	–
	T-S4	Once a month	–	–	–	–	–	–	–	–	<7.7	0.073	–	–
	T-S8	Once a month	–	–	–	–	–	–	–	–	<7.7	0.062	–	–

※：A "less than" symbol (<) indicates that the analysis result was less than the detection limit.

：Term of discharge of ALPS treated water (Group B)

*：Monitored daily for the time being after the commencement of discharge

*1：Sampled after the commencement of discharge at 3PM

*2：Detection limit 0.4 Bq/L

*3：Detection limit 0.1 Bq/L

*4：Sampling suspended due to rough seas

1-3. Sea area monitoring history（2/11）

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（Unit：Bq/L）

	Sampling location	Frequency	September											
			1	2	3	4	4 conventional *1	5	6	6 conventional *1	7	8	9	10
In the vicinity of the discharge outlet	T-1	Once a week*	<7.2	<6.8	<5.8	<6.6	0.68	<7.1	<7.1	−	<6.1	<5.9	<6.0	<7.8
	T-2	Once a week*	<7.4	<6.8	<5.8	<6.6	0.90	<7.1	<7.1	−	<6.1	<5.9	<6.0	<7.8
	T-0-1	Once a week*	<7.3	<7.3	<6.8	<6.9	<0.34	<6.6	<6.6	−	<8.7	<6.9	<8.0	<7.0
	T-0-1A	Once a week*	<7.3	<8.2	<6.8	<6.9	<0.33	<7.0	<6.6	−	<8.7	<6.9	<8.0	<7.1
	T-0-2	Once a week*	<7.3	<7.3	<6.7	<7.0	0.74	<6.5	<6.6	−	<8.6	<6.8	<8.0	<7.0
	T-0-3A	Once a week*	<7.0	<7.8	<6.5	<5.9	<0.33	<7.6	<6.3	−	<5.3	<7.4	<6.5	<6.5
	T-0-3	Once a week*	<7.3	<8.2	<6.7	<6.8	<0.34	<7.8	<6.6	−	<8.7	<6.9	<8.0	<7.1
	T-A1	Once a week*	<7.1	<7.9	<6.5	<5.9	1.1	<7.6	<6.3	−	<5.3	<7.4	<6.4	<6.5
	T-A2	Once a week*	<7.1	<7.8	<6.5	<7.3	0.88	<7.6	<6.2	−	<5.3	<7.3	<6.6	<6.4
	T-A3	Once a week*	<7.1	<7.9	<6.5	<7.3	0.82	<7.6	<6.3	−	<5.3	<7.3	<6.5	<6.5
Outside the vicinity of the discharge outlet	T-D5	Once a week	−	−	−	−	−	−	<7.1	<0.34	−	−	−	−
	T-S3	Once a month	−	−	−	−	−	−	−	−	−	−	−	−
	T-S4	Once a month	−	−	−	−	−	−	−	−	−	−	−	−
	T-S8	Once a month	−	−	−	−	−	−	−	−	−	−	−	−

※：A “less than” symbol (<) indicates that the analysis result was less than the detection limit.

*1：Detection limit 0.4 Bq/L

[light blue box]：Term of discharge of ALPS treated water (Group B)

*：Monitored daily for the time being after the commencement of discharge

1-3. Sea area monitoring history（3/11）

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(Unit：Bq/L)

	Sampling location	Frequency	September											
			11 *1	11 conventional *1,2	12	12 conventional *2	13	13 conventional *2	14	15	16	17	18	18 conventional *3
In the vicinity of the discharge outlet	T-1	Once a week*	<7.0	Being measured	<7.2	－	<7.2	－	<6.5	<7.3	<6.7	<7.0	<7.6	<0.31
	T-2	Once a week*	<7.0	Being measured	<7.2	－	<7.2	－	<6.5	<7.4	<6.8	<6.9	<7.6	<0.31
	T-0-1	Once a week*	<6.8	0.10	<7.7	－	<6.6	－	<7.5	<7.8	<7.6	<7.8	<7.4	<0.36
	T-0-1A	Once a week*	<6.8	0.12	<7.8	－	<6.5	－	<7.5	<7.7	<7.5	<7.7	<7.3	<0.34
	T-0-2	Once a week*	<6.8	Being measured	<7.7	－	<6.5	－	<7.5	<7.7	<7.6	<7.7	<7.3	<0.31
	T-0-3A	Once a week*	<6.2	0.10	<7.0	－	<5.9	－	<6.6	<7.4	<6.8	<6.9	<7.6	<0.35
	T-0-3	Once a week*	<6.8	0.16	<7.8	－	<6.5	－	<7.5	<7.7	<7.5	<7.8	<7.3	<0.34
	T-A1	Once a week*	<7.0	Being measured	<7.0	－	<5.9	－	<6.7	<5.5	<7.2	<5.5	<6.7	<0.31
	T-A2	Once a week*	<7.0	Being measured	<7.0	－	<5.9	－	<6.7	<5.5	<7.3	<5.4	<6.7	<0.31
	T-A3	Once a week*	<7.0	Being measured	<7.0	－	<5.9	－	<6.7	<5.5	<7.2	<5.5	<6.7	<0.31
Outside the vicinity of the discharge outlet	T-D5	Once a week	－	－	－	－	<7.2	0.11	－	－	－	－	－	－
	T-S3	Once a month	－	－	<7.1	<0.068	－	－	－	－	－	－	－	－
	T-S4	Once a month	－	－	<7.1	0.087	－	－	－	－	－	－	－	－
	T-S8	Once a month	<6.2	0.098	－	－	－	－	－	－	－	－	－	－

※：A "less than" symbol (<) indicates that the analysis result was less than the detection limit.

[light blue box]：Term of discharge of ALPS treated water (Group B)

*：Monitored daily for the time being after the commencement of discharge

*1：Sampled before 9AM, prior to the completion of the discharge
*2：Detection limit 0.1 Bq/L
*3：Detection limit 0.4 Bq/L

1-3. Sea area monitoring history（4/11）

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（Unit：Bq/L）

	Sampling location	Frequency	September											
			19	20	20 conventional *1	21	22	23	24	25	25 conventional *1	26	27	27 conventional *1
In the vicinity of the discharge outlet	T-1	Once a week*	<5.0	<6.9	–	<5.0	<5.3	<6.5	<6.7	<7.2	<0.31	<5.6	<6.2	–
	T-2	Once a week*	<5.0	<6.9	–	<5.0	<5.3	<6.5	<6.7	<7.2	<0.31	<5.6	<6.3	–
	T-0-1	Once a week*	<5.5	<7.9	–	<6.5	<6.3	<6.5	<7.6	<8.7	<0.35	<7.9	<6.2	–
	T-0-1A	Once a week*	<5.6	<8.2	–	<6.5	<6.3	<6.5	<7.5	<8.7	<0.35	<7.9	<6.2	–
	T-0-2	Once a week*	<5.6	<7.9	–	<6.5	<6.2	<6.5	<7.5	<8.7	<0.30	<7.9	<6.2	–
	T-0-3A	Once a week*	<5.0	<6.1	–	<5.0	<5.3	<6.5	<6.7	<7.2	<0.35	<5.6	<6.2	–
	T-0-3	Once a week*	<5.5	<7.9	–	<6.5	<6.3	<6.5	<7.5	<8.7	<0.35	<7.9	<6.2	–
	T-A1	Once a week*	<6.9	<5.9	–	<6.6	<7.0	<7.6	<5.1	<6.3	<0.30	<7.3	<6.6	–
	T-A2	Once a week*	<6.9	<5.9	–	<6.7	<7.0	<7.6	<5.1	<6.3	<0.30	<7.3	<6.7	–
	T-A3	Once a week*	<7.0	<6.3	–	<6.6	<7.0	<7.6	<5.1	<6.3	<0.29	<7.3	<6.6	–
Outside the vicinity of the discharge outlet	T-D5	Once a week	–	<6.1	<0.34	–	–	–	–	–	–	–	<6.3	<0.35
	T-S3	Once a month	–	–	–	–	–	–	–	–	–	–	–	–
	T-S4	Once a month	–	–	–	–	–	–	–	–	–	–	–	–
	T-S8	Once a month	–	–	–	–	–	–	–	–	–	–	–	–

※：A “less than” symbol (<) indicates that the analysis result was less than the detection limit.

*1：Detection limit 0.4 Bq/L

*：Monitored daily for the time being after the commencement of discharge

1-3. Sea area monitoring history（5/11）

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(Unit：Bq/L)

	Sampling location	Frequency	September			October								
			28	29	30	1	2	2 conventional *1	3	4	4 conventional *1	5 *2	5 conventional *1,2	6
In the vicinity of the discharge outlet	T-1	Once a week*	<6.7	<4.9	<7.3	<6.0	<5.8	<0.34	<6.7	<6.9	—	<5.8	<0.31	<5.8
	T-2	Once a week*	<6.7	<4.7	<7.3	<6.0	<5.7	<0.33	<6.6	<6.8	—	<5.7	<0.31	<5.7
	T-0-1	Once a week*	<6.8	<6.8	<7.9	<8.3	<7.0	<0.35	<6.5	<7.3	—	<7.8	<0.31	<7.0
	T-0-1A	Once a week*	<6.8	<6.8	<7.9	<8.0	<6.9	<0.35	<6.4	<7.3	—	<7.6	5.2	<7.4
	T-0-2	Once a week*	<6.8	<6.9	<8.0	<8.4	<7.0	<0.36	<6.4	<7.2	—	<7.6	<0.33	<7.0
	T-0-3A	Once a week*	<6.7	<4.7	<7.4	<6.2	<5.8	<0.35	<6.8	<6.9	—	<5.9	<0.32	<5.8
	T-0-3	Once a week*	<6.8	<7.0	<7.7	<8.0	<7.0	<0.35	<6.4	<7.2	—	<7.7	<0.32	<6.4
	T-A1	Once a week*	<9.3	<7.8	<8.1	<8.0	<5.6	<0.30	<7.3	<7.5	—	<7.7	<0.30	<7.0
	T-A2	Once a week*	<5.5	<7.8	<8.0	<8.0	<5.7	<0.30	<7.5	<7.5	—	<7.7	<0.31	<7.0
	T-A3	Once a week*	<7.2	<7.6	<8.0	<8.1	<5.6	<0.30	<7.4	<7.4	—	<7.6	<0.30	<7.1
Outside the vicinity of the discharge outlet	T-D5	Once a week	—	—	—	—	—	—	—	<6.8	<0.35	—	—	—
	T-S3	Once a month	—	—	—	—	—	—	—	—	—	—	—	—
	T-S4	Once a month	—	—	—	—	—	—	—	—	—	—	—	—
	T-S8	Once a month	—	—	—	—	—	—	—	—	—	—	—	—

※：A “less than” symbol (<) indicates that the analysis result was less than the detection limit.

[shaded box]：Term of discharge of ALPS treated water (Group C)

*：Monitored daily for the time being after the commencement of discharge

*1：Detection limit 0.4 Bq/L

*2：Sampled after the commencement of discharge at 2PM

1-3. Sea area monitoring history（6/11）

TEPCO

(Unit：Bq/L)

	Sampling location	Frequency	October											
			7	8	9	9 conventional *1	10	11	12	12 conventional *1	13	14	15	16
In the vicinity of the discharge outlet	T-1	Once a week*	<5.8	<6.1	<7.2	Being measured	<6.9	<6.5	<6.3	－	<6.5	<6.1	<5.5	<6.0
	T-2	Once a week*	<5.8	<6.1	<7.1	Being measured	<6.9	<6.6	<6.3	－	<6.5	<6.2	<5.5	<6.0
	T-0-1	Once a week*	<6.7	<8.2	<7.9	Being measured	－*2	<7.3	<7.3	－	<7.3	<8.7	<7.3	<7.8
	T-0-1A	Once a week*	**9.4**	<8.2	**11**	Being measured	－*2	<7.3	**14**	－	**11**	<8.7	**14**	**16**
	T-0-2	Once a week*	<6.8	<8.1	<7.9	Being measured	－*2	<7.3	<7.3	－	<7.3	<8.7	<7.3	<7.8
	T-0-3A	Once a week*	<5.8	<6.1	<7.2	Being measured	－*2	<6.8	<6.3	－	<6.5	<6.1	<5.6	<6.0
	T-0-3	Once a week*	<6.7	<8.2	<7.8	Being measured	－*2	<7.3	<7.2	－	<7.2	<8.6	<7.3	<7.8
	T-A1	Once a week*	<6.4	<5.5	<6.7	Being measured	－*2	<6.8	<8.7	－	<8.6	<6.2	<7.2	<7.2
	T-A2	Once a week*	<5.9	<5.5	<6.7	Being measured	－*2	<6.8	<8.6	－	<8.6	<5.6	<7.2	<7.2
	T-A3	Once a week*	<5.8	<5.5	<6.8	Being measured	－*2	<6.8	<8.6	－	<8.6	<5.7	<7.2	<7.2
In the vicinity of the discharge outlet	T-D5	Once a week	－	－	－	－	－	－	<6.4	Being measured	－	－	－	－
	T-S3	Once a month	－	－	－	－	－	－	<6.4	Being measured	－	－	－	－
	T-S4	Once a month	－	－	－	－	－	－	<6.4	Being measured	－	－	－	－
	T-S8	Once a month	－	－	－	－	－	－	<6.5	Being measured	－	－	－	－

※：A “less than” symbol (<) indicates that the analysis result was less than the detection limit.

(light blue box)：Term of discharge of ALPS treated water (Group C)

*：Monitored daily for the time being after the commencement of discharge

*1：Detection limit 0.1 Bq/L

*2：Sampling suspended due to bad weather condition

1-3. Sea area monitoring history（7/11）

TEPCO

(Unit：Bq/L)

	Sampling location	Frequency	October											
			16 conventional *1	17	18	19	19 conventional *1	20	21	22	22 *2	23 conventional *1,2	24	25
In the vicinity of the discharge outlet	T-1	Once a week*	4.3	<6.5	<7.1	<7.2	–	<5.5	<5.6	<5.3	<6.5	1.3	<6.5	<5.8
	T-2	Once a week*	0.66	<6.5	<7.1	<7.1	–	<5.5	<5.6	<5.2	<6.5	0.80	<6.5	<5.8
	T-0-1	Once a week*	1.0	<6.7	<5.9	<8.3	–	<7.0	<6.8	<7.3	<6.7	1.3	<7.8	<7.5
	T-0-1A	Once a week*	14	<6.7	<5.8	<8.5	–	<7.0	22	16	<6.7	0.71	<7.7	<7.5
	T-0-2	Once a week*	1.2	<6.7	8.9	<8.4	–	<7.0	<6.8	<7.3	<6.7	0.40	<7.7	<7.5
	T-0-3A	Once a week*	0.74	<6.5	<7.1	<7.1	–	<5.5	<5.6	<5.3	<6.5	<0.33	<6.5	<5.8
	T-0-3	Once a week*	1.0	<6.7	<6.7	<8.4	–	<7.0	<6.8	<7.3	<6.7	1.0	<7.7	<7.5
	T-A1	Once a week*	0.50	<8.3	<7.2	<7.5	–	<7.5	<8.5	<5.7	<6.8	0.37	<7.5	<7.8
	T-A2	Once a week*	0.56	<8.3	<7.2	<7.5	–	<7.5	<8.4	<5.7	<6.9	<0.31	<7.5	<7.8
	T-A3	Once a week*	0.80	<8.3	<7.2	<7.5	–	<7.5	<8.5	<5.7	<6.8	<0.32	<7.5	<7.8
In the vicinity of the discharge outlet	T-D5	Once a week	–	–	–	<7.5	<0.34	–	–	–	<6.9	Being measured	–	–
	T-S3	Once a month	–	–	–	–	–	–	–	–	–	–	–	–
	T-S4	Once a month	–	–	–	–	–	–	–	–	–	–	–	–
	T-S8	Once a month	–	–	–	–	–	–	–	–	–	–	–	–

※：A "less than" symbol (<) indicates that the analysis result was less than the detection limit.

[shaded box]：Term of discharge of ALPS treated water (Group C)

*：Monitored daily for the time being after the commencement of discharge

*1：Detection limit 0.4 Bq/L

*2：Sampled before 9AM, prior to the completion of the discharge

1-3. Sea area monitoring history（8/11）

TEPCO

（Unit：Bq/L）

	Sampling location	Frequency	October							November				
			26	27	28	29	30	30 conventional *2	31	1	1 conventional *2	2 *3	2 conventional *2,3	3
In the vicinity of the discharge outlet	T-1	Once a week*	<6.5	<6.4	<7.2	<6.8	<6.4	Being measured	<7.1	<7.9	<0.32	<6.0	0.35	<8.1
	T-2	Once a week*	<6.6	<6.3	<7.2	<6.8	<6.4	Being measured	<7.1	<7.9	<0.33	<8.3	0.36	<8.1
	T-0-1	Once a week*	<7.6	<7.8	<8.3	<7.8	—*1	—*1	—*1	<7.8	Being measured	<8.0	<0.36	<6.2
	T-0-1A	Once a week*	<7.7	<7.8	<8.3	<7.9	—*1	—*1	—*1	<7.8	Being measured	<8.0	6.9	7.1
	T-0-2	Once a week*	<7.6	<7.8	<8.3	<7.9	—*1	—*1	—*1	<7.8	<0.33	<8.1	<0.37	<6.2
	T-0-3A	Once a week*	<6.6	<6.3	<7.3	<6.9	—*1	—*1	—*1	<7.9	Being measured	<5.4	<0.26	<8.1
	T-0-3	Once a week*	<7.6	<7.8	<8.3	<7.9	—*1	—*1	—*1	<7.8	Being measured	<8.0	<0.36	<6.2
	T-A1	Once a week*	<6.2	<6.6	<6.6	<6.6	—*1	—*1	—*1	<6.6	<0.31	<8.2	<0.31	<5.7
	T-A2	Once a week*	<6.2	<6.5	<6.6	<6.6	—*1	—*1	—*1	<6.4	<0.31	<8.2	<0.30	<5.7
	T-A3	Once a week*	<6.2	<6.6	<6.6	<6.6	—*1	—*1	—*1	<6.6	<0.32	<8.2	<0.31	<5.7
In the vicinity of the discharge outlet	T-D5	Once a week	—	—	—	—	—	—	—	<7.9	Being measured	—	—	—
	T-S3	Once a month	—	—	—	—	—	—	—	—	—	—	—	—
	T-S4	Once a month	—	—	—	—	—	—	—	—	—	—	—	—
	T-S8	Once a month	—	—	—	—	—	—	—	—	—	—	—	—

※：A "less than" symbol (<) indicates that the analysis result was less than the detection limit.

（shaded）：Term of discharge of ALPS treated water (Group A)

*：Monitored daily for the time being after the commencement of discharge

*1：Sampling suspended due to bad weather condition

*2：Detection limit 0.4 Bq/L

*3：Sampled after the commencement of discharge at 2PM

1-3. Sea area monitoring history（9/11）

TEPCO

（Unit：Bq/L）

	Sampling location	Frequency	November											
			4	5	6	6 conventional *1	7	8	8 conventional *3	9	9 conventional *1	10	11	12
In the vicinity of the discharge outlet	T-1	Once a week*	<8.0	<7.6	<5.6	<0.34	<6.9	<5.5	−	<5.5	−	<6.9	<5.8	<7.0
	T-2	Once a week*	<8.2	<7.5	<5.5	0.38	<6.9	<5.5	−	<5.5	−	<7.0	<5.8	<6.9
	T-0-1	Once a week*	<6.3	<7.5	<7.2	0.36	−*2	<6.7	−	<6.4	−	<8.1	−*2	<4.7
	T-0-1A	Once a week*	<6.2	<7.6	9.0	9.5	−*2	<6.8	−	<6.4	−	11	−*2	<4.6
	T-0-2	Once a week*	<6.2	<7.5	<7.1	<0.31	−*2	<6.7	−	<8.4	−	<8.1	−*2	<4.7
	T-0-3A	Once a week*	<8.2	<7.6	<5.4	0.54	−*2	<5.5	−	<5.6	−	<7.0	−*2	<6.9
	T-0-3	Once a week*	<6.2	<7.5	<7.1	<0.31	−*2	<6.7	−	<6.4	−	<8.1	−*2	<5.1
	T-A1	Once a week*	<9.2	<5.7	<6.5	<0.39	−*2	<7.2	−	<7.5	−	<6.9	−*2	<7.8
	T-A2	Once a week*	<9.2	<5.7	<6.5	<0.38	−*2	<7.2	−	<7.5	−	<6.9	−*2	<7.8
	T-A3	Once a week*	<9.2	<5.7	<6.5	<0.39	−*2	<7.2	−	<7.6	−	<6.8	−*2	<7.8
In the vicinity of the discharge outlet	T-D5	Once a week	−	−	−	−	−	−	−	<7.5	Being measured	−	−	−
	T-S3	Once a month	−	−	−	−	−	<7.7	Being measured	−	−	−	−	−
	T-S4	Once a month	−	−	−	−	−	<7.7	Being measured	−	−	−	−	−
	T-S8	Once a month	−	−	−	−	−	<7.8	Being measured	−	−	−	−	−

※：A "less than" symbol (<) indicates that the analysis result was less than the detection limit.

[blue box]：Term of discharge of ALPS treated water (Group A)

*：Monitored daily for the time being after the commencement of discharge

*1：Detection limit 0.4 Bq/L
*2：Sampling suspended due to bad weather condition
*3：Detection limit 0.1 Bq/L

1-3. Sea area monitoring history（10/11）

TEPCO

(Unit : Bq/L)

	Sampling location	Frequency	November											
			13	13 conventional *1	14	15	15 conventional *1	16	17	18	19	20 *3	20 conventional *3,4	21
In the vicinity of the discharge outlet	T-1	Once a week*	<6.3	Being measured	<5.8	<6.9	—	<8.8	<7.8	<9.3	<6.3	<7.0	Being measured	<6.6
	T-2	Once a week*	<6.3	Being measured	<5.9	<6.9	—	<8.6	<7.7	<9.3	<6.2	<7.1	Being measured	<6.5
	T-0-1	Once a week*	<9.0	Being measured	<6.6	<6.2	—	<7.1	<7.9	—*2	<7.4	<8.1	Being measured	<7.0
	T-0-1A	Once a week*	<9.0	Being measured	7.2	10	—	<7.3	<7.9	—*2	<7.4	<8.1	Being measured	<7.0
	T-0-2	Once a week*	<8.9	Being measured	<6.5	<6.2	—	7.9	<7.8	—*2	<7.4	<8.1	Being measured	<7.1
	T-0-3A	Once a week*	<6.3	Being measured	<5.7	<6.9	—	<8.8	<8.0	—*2	<6.3	<7.0	Being measured	<6.7
	T-0-3	Once a week*	<9.0	Being measured	<6.6	<6.2	—	<7.3	<7.9	—*2	<7.3	<8.1	Being measured	<7.2
	T-A1	Once a week*	<7.6	Being measured	<6.8	<8.6	—	<8.8	<5.5	—*2	<8.6	<7.3	Being measured	<9.0
	T-A2	Once a week*	<7.6	Being measured	<6.8	<8.8	—	<8.6	<5.5	—*2	<8.8	<7.2	Being measured	<8.9
	T-A3	Once a week*	<7.6	Being measured	<7.0	<8.6	—	<8.8	<5.5	—*2	<8.8	<7.2	Being measured	<8.9
In the vicinity of the discharge outlet	T-D5	Once a week	—	—	—	<8.6	Being measured	—	—	—	—	—	—	<7.2
	T-S3	Once a month	—	—	—	—	—	—	—	—	—	—	—	—
	T-S4	Once a month	—	—	—	—	—	—	—	—	—	—	—	—
	T-S8	Once a month	—	—	—	—	—	—	—	—	—	—	—	—

※：A "less than" symbol (<) indicates that the analysis result was less than the detection limit.

[light blue box] ：Term of discharge of ALPS treated water (Group A)

*：Monitored daily for the time being after the commencement of discharge

*1： Detection limit 0.1 Bq/L
*2：Sampling suspended due to bad weather condition
*3： Sampled before 8AM, prior to the completion of the discharge
*4： Detection limit 0.4 Bq/L

1-3. Sea area monitoring history（11/11）

TEPCO

（Unit：Bq/L）

	Sampling location	Frequency	November							
			21 conventional *1	22	23	24	25	26	27	27 conventional *1
In the vicinity of the discharge outlet	T-1	Once a week*	–	<6.5	<5.5	<5.3	<6.3	<7.1	<5.7	Being measured
	T-2	Once a week*	–	<6.4	<5.5	<5.2	<6.3	<7.1	<5.8	Being measured
	T-0-1	Once a week*	–	<7.1	<6.4	<7.2	<7.3	<8.1	<6.4	Being measured
	T-0-1A	Once a week*	–	<7.0	<6.4	<7.2	<7.3	<8.2	<6.5	Being measured
	T-0-2	Once a week*	–	<7.0	<6.5	<7.3	<7.3	<8.1	<6.5	Being measured
	T-0-3A	Once a week*	–	<6.6	<5.5	<5.2	<6.3	<7.1	<5.7	Being measured
	T-0-3	Once a week*	–	<7.1	<6.5	<7.3	<7.3	<8.2	<6.4	Being measured
	T-A1	Once a week*	–	<7.4	<7.2	<5.7	<5.2	<5.7	<7.8	Being measured
	T-A2	Once a week*	–	<7.7	<7.2	<5.7	<5.2	<5.6	<7.8	Being measured
	T-A3	Once a week*	–	<7.6	<7.2	<5.6	<5.2	<5.7	<7.8	Being measured
In the vicinity of the discharge outlet	T-D5	Once a week	Being measured	–	–	–	–	–	<7.8	Being measured
	T-S3	Once a month	–	–	–	–	–	–	–	–
	T-S4	Once a month	–	–	–	–	–	–	–	–
	T-S8	Once a month	–	–	–	–	–	–	–	–

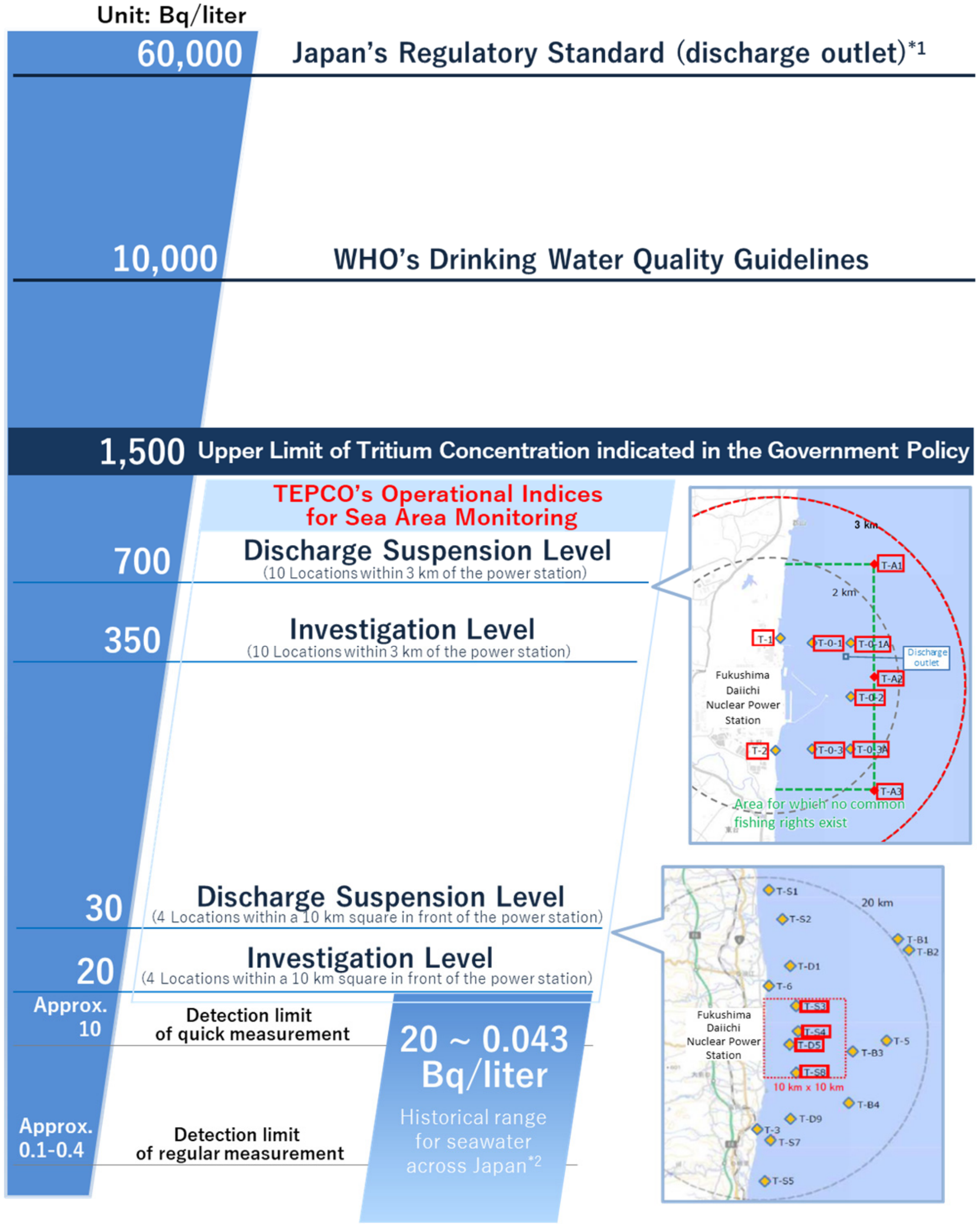
※：A "less than" symbol (<) indicates that the analysis result was less than the detection limit.

*1：Detection limit 0.4 Bq/L

*：Monitored daily for the time being after the commencement of discharge

[Reference] Comparison of concentration of tritium in seawater

TEPCO

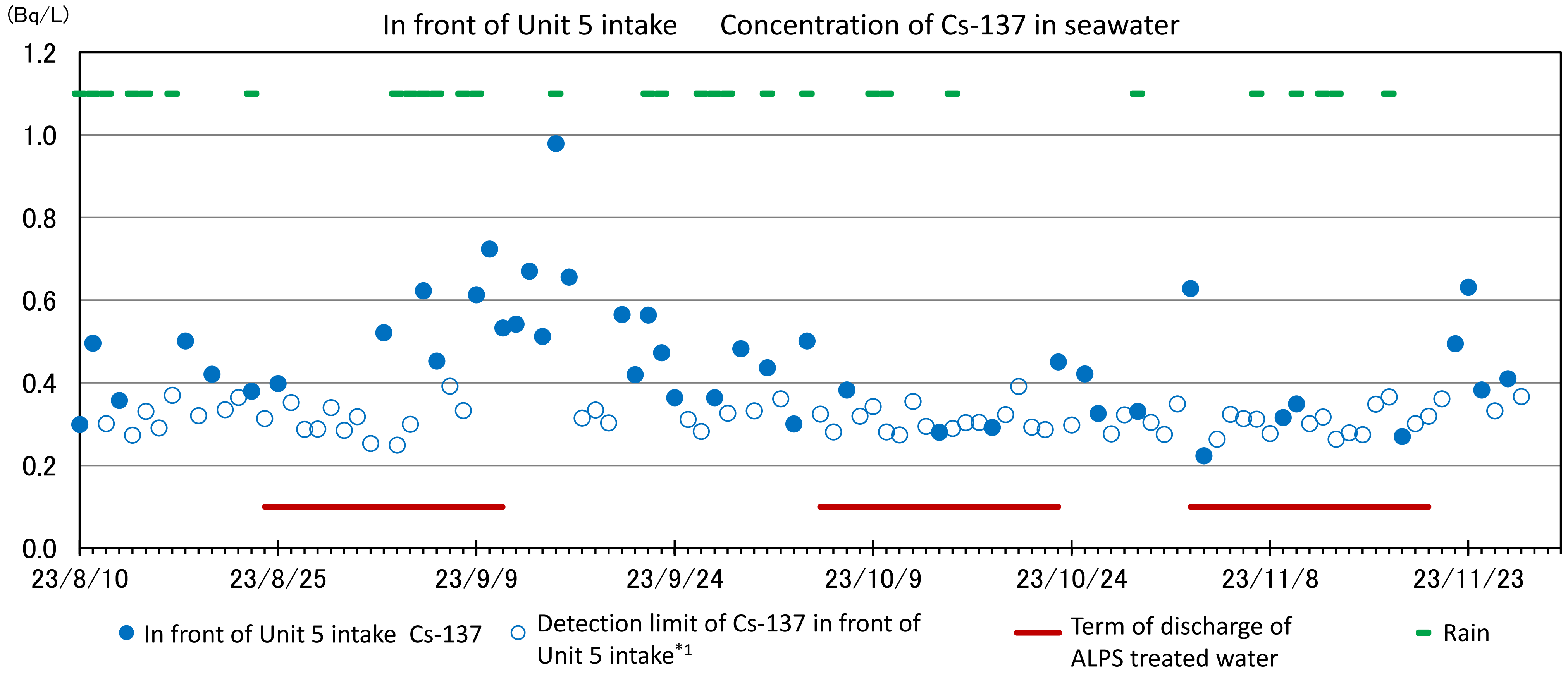


*1: This standard has been stipulated based on the calculation that if a person were to drink approximately 2L of the water coming out of the discharge outlet of a nuclear facility every day for one year, his/her exposure would be 1mSv.
*2: Source: Environmental Radioactivity and Radiation in Japan (Period: April 2019 to March 2022)

1-4. Unit 5 intake channel monitoring

TEPCO

- Monitoring results during the discharge of treated water have confirmed that values are similar to those prior to discharge and there were no fluctuations.



*1: Detection limit is displayed on the graph when the concentration is lower than detection limit.

※The location of seawater monitoring inside the Unit 5/6 intake open channel has been changed to the sampling location near the intake for seawater to be used for dilution (changed from "in front of the Unit 6 intake" to "in front of the Unit 5 intake").

2. Reviewing the first three discharges and future discharge plan

- The following pages review the first three discharges we have conducted so far, and inform you about future discharges with a focus on the issues noted below.

< Reviewing the first three discharges >

- 2.1 Events that occurred in conjunction with the discharge of ALPS treated water, and countermeasures to address them
- 2.2 Facility inspection results
- 2.3 Dispersion simulation

< Future discharge plan >

- 2.4 Information on the ALPS treated water for the 4th discharge

2-1. Events that occurred in conjunction with the discharge of ALPS treated water, and countermeasures to address them

TEPCO

- The following events occurred during the first three discharges of ALPS treated water into the sea. TEPCO has already implemented countermeasures to address these issues.

No.	Event	Overview	Main countermeasures
1	Vent valve flange leak detector alarm	On September 6, 2023, during the first discharge, the alarm on a leak detector installed on a vent valve flange of ALPS treated water transfer pipe sounded. It has been deemed that the alarm sounded due to rainwater or condensation since there was no leak from the flange .	Cover the entire waterproof cover installed around the vent valve flange. (Temporary plastic covering is currently being installed ,but will be replaced with weatherproof covering in the future)
2	Bubbles of the waterproof coating inside the discharge vertical shaft(upper-stream storage)	Six bubbles more than 10 cm in width were discovered during the inspection conducted after the first two discharges. No abnormalities were found in the waterproof function of the coating. It is assumed that waterproof coating swelled due to hydraulic head pressure on the concrete surface of the bottom plate, caused by rainwater flowing from the top plate due to peeling off of the waterproof caulking, caused by frequent walking of workers and visitors on the top plate.	Waterproof caulking and waterproof coating to the top plate were applied as countermeasures. The bubbles in the waterproof coating that are more than 10cm wide have been deemed to not have impacted the integrity of the coating since there is no crack in the membrane of the coating, however they will be repaired in order to engage in preventative maintenance. After repairs, waterproof functionality will be confirmed through pressure resistance and leak tests, equivalent to those performed during the pre-use inspection.

2-2. Facility inspection results

TEPCO

■ During and after the 1st , 2nd and 3rd discharge, we have performed inspections as follows:

Black：No abnormalities has confirmed
Gray：Inspections are performing

Facility name	Patrol inspection details	Inspection after the discharge		
	During the 1st, 2nd and 3rd discharge	After the 1st discharge	After the 2nd discharge	After the 3rd discharge
Measurement/ confirmation facility	**External inspection (measurement/confirmation tanks)** - Visual check for abnormalities	**Inspections implemented in accordance with the long-term inspection plan (agitators/MO valves)** - Insulation resistance measurement - Check for leakage thorough MO valve seat	**Inspections implemented in accordance with the long-term inspection plan（agitators）** -Insulation resistance measurement **Others** -Measures to reduce clogging of ALPS treated water transfer pump inlet strainer by circulating/agitating water in tank group A	**Inspections implemented in accordance with the long-term inspection plan （agitators/MO valves）** - Insulation resistance measurement - Check for leakage through MO valve seat
Transfer facility	**External inspection (ALPS treated water transfer pump/transfer pipes)** - Visual check for abnormalities - Check for abnormal sounds using tool	**External inspection (ALPS treated water transfer pump/transfer pipes)** - Visual check for abnormalities **Others** - Strainer cleaning - Check for leakage through MO valve seat - Check for leaks from the vent valve flange	**External inspection (ALPS treated water transfer pump/transfer pipes)** - Visual check for abnormalities **Others** - Strainer cleaning, - Check for leakage through MO valve seat	**External inspection (ALPS treated water transfer pump/transfer pipes)** - Visual check for abnormalities **Others** - Strainer cleaning, - Check for leakage through MO valve seat
Dilution facility	**External inspection (seawater transfer pipes/seawater pipe header, etc.)** - Visual check for abnormalities - Check for abnormal sounds using tool **External inspection (discharge vertical shaft (upper-stream storage))** - Visual check for abnormalities	**External inspection (seawater transfer pipes/seawater pipe header, etc.)** - Visual check for abnormalities **External inspection (discharge vertical shaft (upper-stream storage))** - Check for abnormalities in the concrete surface - Check for abnormalities with the surface of the waterproof coating (cracks/flaking, etc.) - Check for sediment inside the upper-stream storage	**External inspection (seawater transfer pipes/seawater pipe header, etc.)** - Visual check for abnormalities **External inspection (discharge vertical shaft (upper-stream storage))** -Follow-up observation of condition inside the storage	**External inspection (seawater transfer pipes/seawater pipe header, etc.)** - Visual check for abnormalities **External inspection (discharge vertical shaft (upper-stream storage))** -Draining of the storage, follow-up observation and repair※ **Others** -Replacement of seawater transfer pumps gland packings and flow meter inspection
Discharge facility	**External inspection (discharge vertical shaft (down-stream storage))** - Visual check for abnormalities	**External inspection (discharge vertical shaft (down-stream storage))** - Visual check for abnormalities ※Underwater areas such as discharge tunnel, etc. will be inspected at a different time.		
Seawater intake facility	**External inspection (partitioning weirs)** - Visual check for abnormalities	**External inspection (partitioning weirs)** - Visual check for abnormalities		

※：Refer to the following pages for details

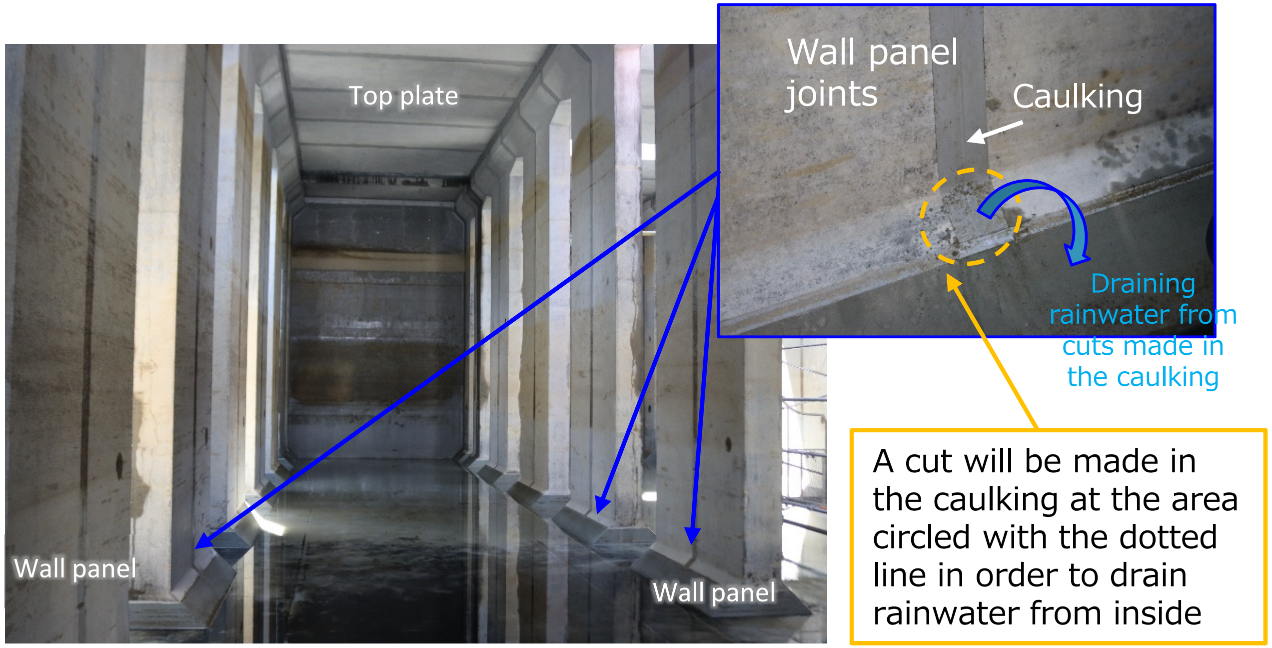
2-2. Dilution facility (discharge vertical shaft (upper-stream storage)) repairs

- To address the bubbling of the waterproof coating inside the storage, the following repairs will be implemented in order to engage in preventative maintenance.

Locations to be repaired	Repair method
Bubbles over 10cm in width*	①Cut the bubbles to drain the rainwater underneath the waterproof coating that caused the bubbles ②Install a temporary weir around the cut area, treat the surface and apply waterproof coating(Polyurea)
Wall panel joints	①Cut through the caulking between joints where rainwater is expected to accumulate to drain rainwater ②Caulk the cut area after the drainage is completed (Highly weather resistant one-component polyurethane)

*As a result of the inspection, bubbles that are either narrow or wider than 10cm but are deemed not to require repairs, will be subject to follow-up observations.

Waterproof coating bubbles



Draining rainwater from wall panel joints

2-3. Information about the dispersion simulation that uses weather and sea condition data during discharge

TEPCO

- To validate the sea area dispersion simulation used for the radiological environmental impact assessment, we are performing tritium dispersion calculations using actual tritium discharge records and meteorological/marine meteorological data.
- We are currently calculating/assessing the data for the first discharge period (August 22-September 11).
- Going forward, we will perform dispersion calculations for the second and third discharges and compare/review them to sea area monitoring results.

Calculation conditions for the first discharge period. (The model is the same as that used for the radiological environmental impact assessment report)

Amount of tritium discharged

・8/24 13:03 – 9/10 14:52 (Constant)

Discharge rate＝2.66E+09Bq/h （＝140,000Bq/L×456m3/day×1000L/m3÷24h/day）

・9/11 10:33 - 12:15

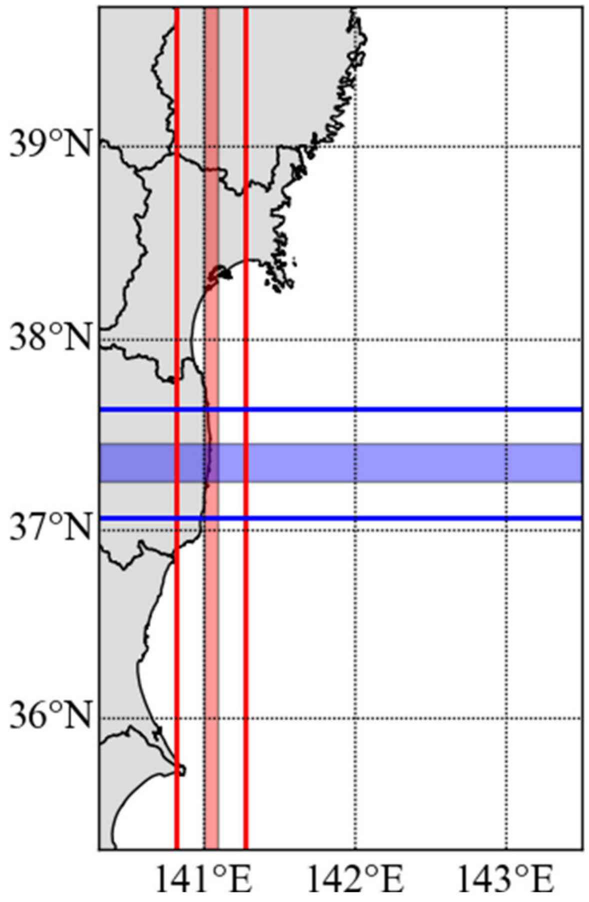
Discharge rate＝1.32E+09Bq/h （＝140,000Bq/L×16m3×1000L/m3÷102/60h）

Environmental conditions

・ Actual meteorological/marine meteorological data from the discharge period (Meteorological Agency, JAMSTEC, etc.)

[Reference]　Overview of dispersion simulation (Regional Ocean Modeling System)

- We use a model that has been validated through dispersion calculations for cesium concentration in seawater after the Fukushima Daiichi Nuclear Accident.
- Furthermore, we calculate at a higher resolution to enable a highly detailed simulation of the sea area in the vicinity of the power station.



- The Regional Ocean Modeling System (ROMS） is applied to the area off the coast of Fukushima
- Sea area flow data
  - Use data [1] which interpolated Metrological Agency's short-term weather forecast data to the driving force of the sea surface
  - Use reanalyzed data of the sea （JCOPE2M[2][3]） as the source data for boundary conditions and data assimilation* for open ocean
- Model scope: North latitude: 35.30～39.71 degrees、 East longitude: 140.30-143.50 degrees（490km×270km); gradually improve resolutions of sea area approx. 22.5km north-south x approx. 8.4km east-west around the power station
  - Resolution (all area): Approx. 925m north-south x approx. 735m (approx. 1km) east-west, vertical direction: 30 layers
  - Resolution (vicinity): Approx. 185m north-south x approx. 147m (approx. 200m) east-west, vertical direction: 30 layers (sea area where the red and blue hatching intersect)
- Actual meteorological /marine meteorological data
  - Use meteorological/marine meteorological data from the discharge period

*Data assimilation: Method for incorporating actual data into numerical simulations. Also referred to as "nudging."

[1] Atsushi HASHIMOTO, Hiromaru HIRAGUCHI, Yasushi TOYODA, Kou NAKAYA, "Predicting Japan's Climate Changes in conjunction with Global Warming (Vol.1), -Application to Weather Forecast/Analysis System NuWFAS's Long-Term Climate Forecasts-", Central Research Institute of Electric Power Industry Report, 2010

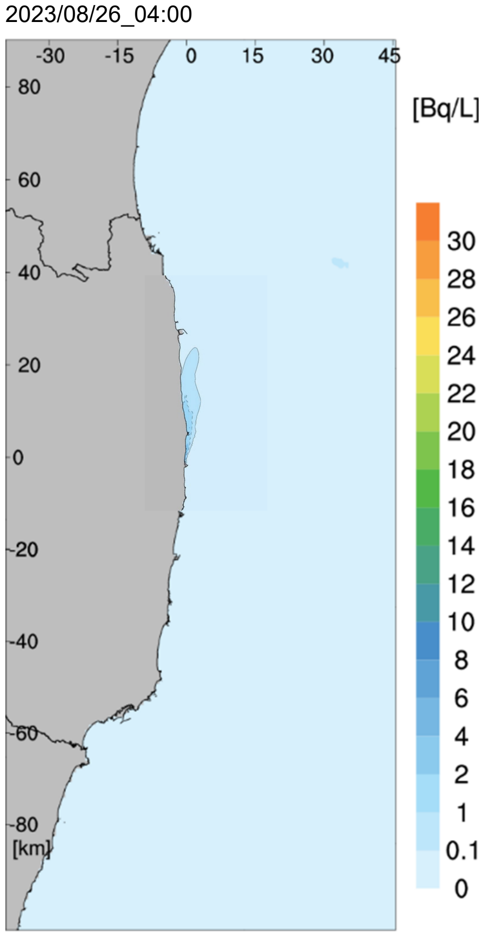
[2] Miyazawa, Y., A. Kuwano-Yoshida, T. Doi, H. Nishikawa, T. Narazaki, T. Fukuoka, and K. Sato, 2019: Temperature profiling measurements by sea turtles improve ocean state estimation in the Kuroshio-Oyashio Confluence region, Ocean Dynamics, 69, 267-282.

[3] Miyazawa, Y., S. M. Varlamov, T. Miyama, X. Guo, T. Hihara, K. Kiyomatsu, M. Kachi, Y. Kurihara, and H. Murakami, 2017: Assimilation of high-resolution sea surface temperature data into an operational nowcast/forecast system around Japan using a multi-scale three dimensional variational scheme, Ocean Dynamics, 67, 713-728.

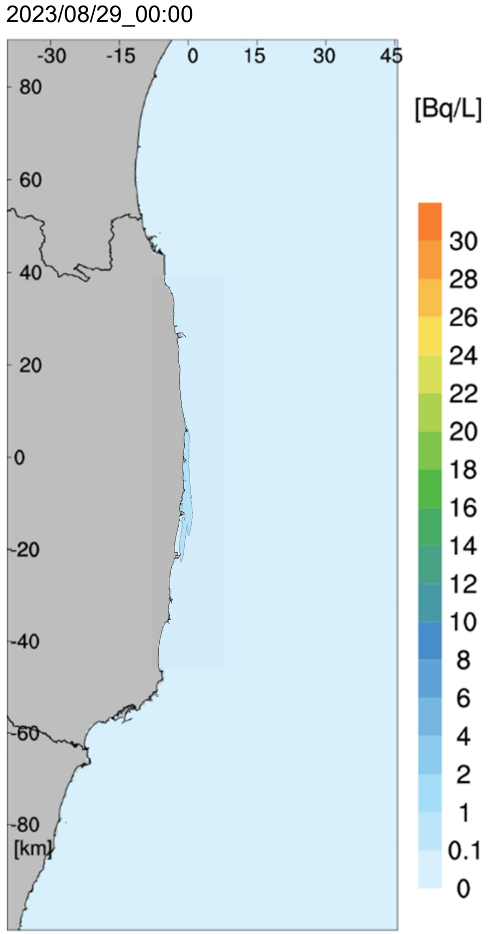
2-3. Results of dispersion calculations based on meteorological and marine meteorological data during the discharge (Calculation example)

TEPCO

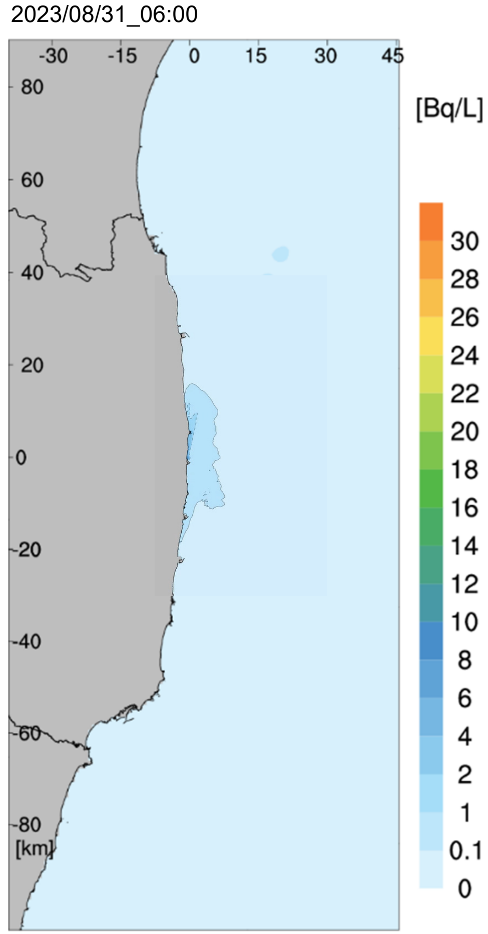
- The following is an example of a dispersion calculation performed using the amount of tritium discharged during the discharge period as well as on meteorological and marine meteorological data. Going forward these calculations will be compared with sea area monitoring results.



August 26 4:00A.M.
(Flow in the northern direction)



August 12:00A.M.
(Flow in the southern direction)



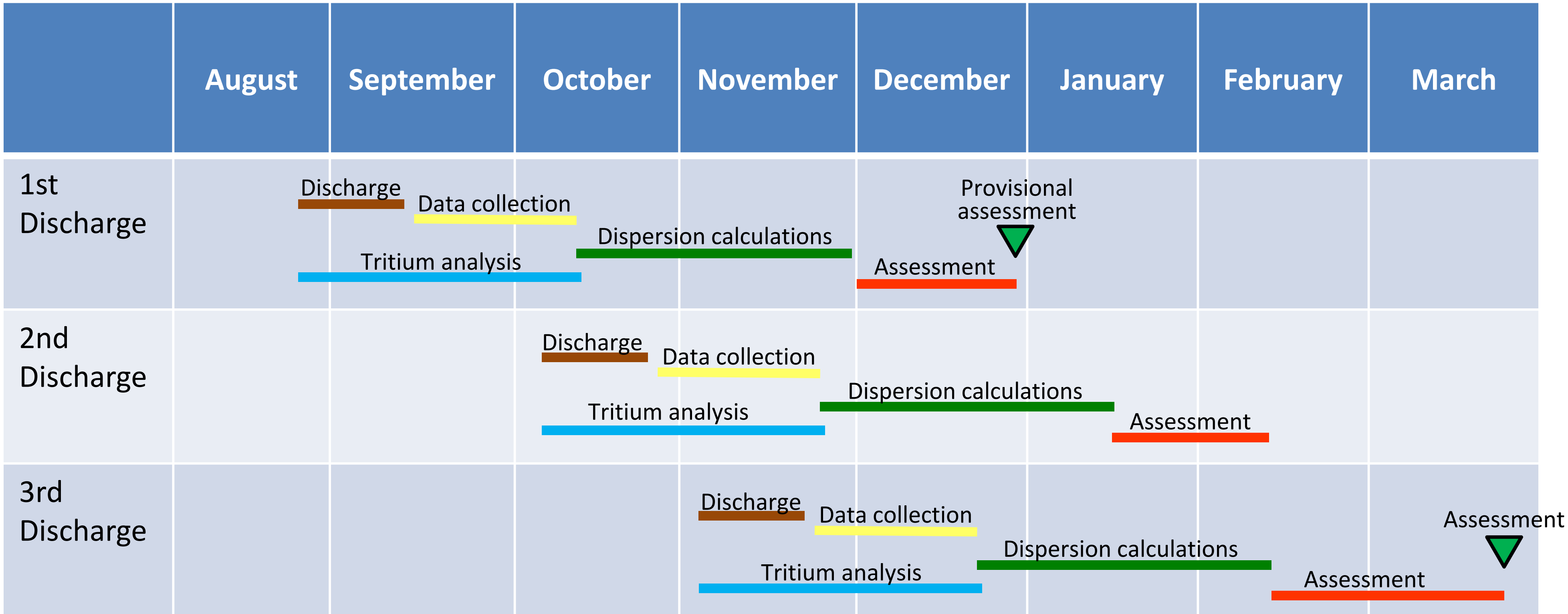
August 31 6:00A.M.
(In the case of slow flow speeds)

Figure. Dispersion calculation result (average concentration distribution on the sea surface per hour)

2-3. Dispersion simulation review schedule

TEPCO

- Analyzing the tritium concentrations in seawater sampled during the discharge takes approximately one month.
- And, it takes approximately one month after that to obtain the meteorological/marine meteorological data because reanalysis needs to be conducted.
- Dispersion calculations and assessment will be conducted thereafter, so the total process from the completion of discharge until assessment will take approximately three months.
- A provisional assessment of the 1st discharge will be released in December, and an assessment of all three discharges will be released at the end of March next year.



2-4. FY2023 Discharge Plan

TEPCO

- Currently, ALPS treated water from tanks of K4 area Group E and K3 area Group A is being transferred to the measurement/confirmation facility tank Group B in preparation for the fourth discharge.

1st discharge	Measurement/confirmation facility (K4 area) Group B:	Approx. 7,800m^3	Secondary treatment: No Tritium concentration: 140,000Bq/liter Total amount of tritium: 1.1 trillion Bq	Completed
2nd discharge	Measurement/confirmation facility (K4 area) Group C:	Approx. 7,800m^3	Secondary treatment: No Tritium concentration: 140,000Bq/liter Total amount of tritium: 1.1 trillion Bq	Completed
3rd discharge	Measurement/confirmation facility (K4 area) Group A:	Approx. 7,800m^3	Secondary treatment: No Tritium concentration: 130,000Bq/liter Total amount of tritium: 1.0 trillion Bq	Completed
4th discharge	K4 area Group E (Transferred to Measurement/confirmation facility group B ※2): K3 area Group A (Transferred to Measurement/confirmation facility group B ※2):	Approx. 4,500m^3 Approx. 3,300m^3	Secondary treatment: No Tritium concentration : 170,000～210,000Bq/liter ※1 Total amount of tritium: 1.4 trillion Bq ※1	Currently being transferred

➡ Total amount of tritium discharged during FY2023: Approx. 5 trillion Bq

※1 Average value of the tank group that was assessed taking into account the radioactive decay until July 1, 2023

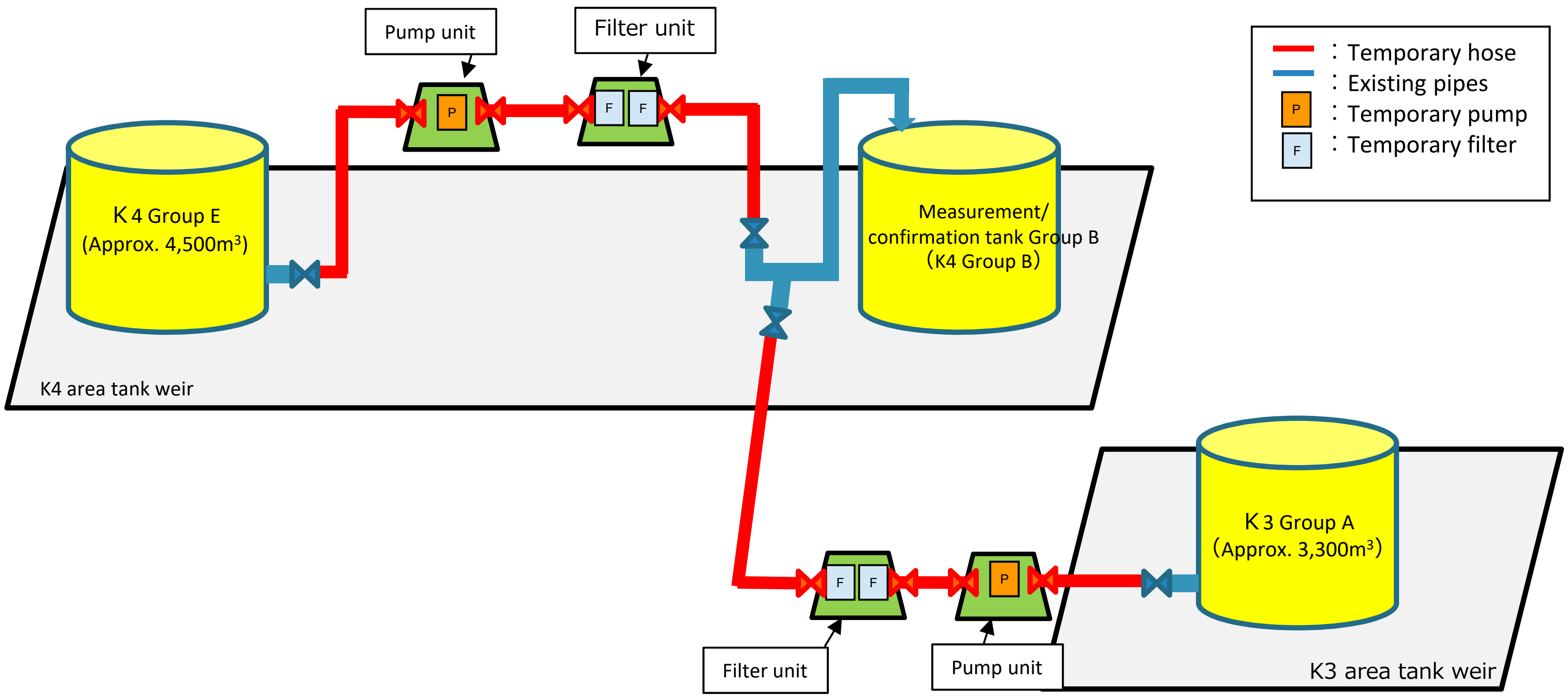
※2 Being transferred to K4 area tank group B that was empty after the 1st discharge was completed

[Reference] Information on the water transfer to measurement/confirmation facility in preparation for the 4th discharge

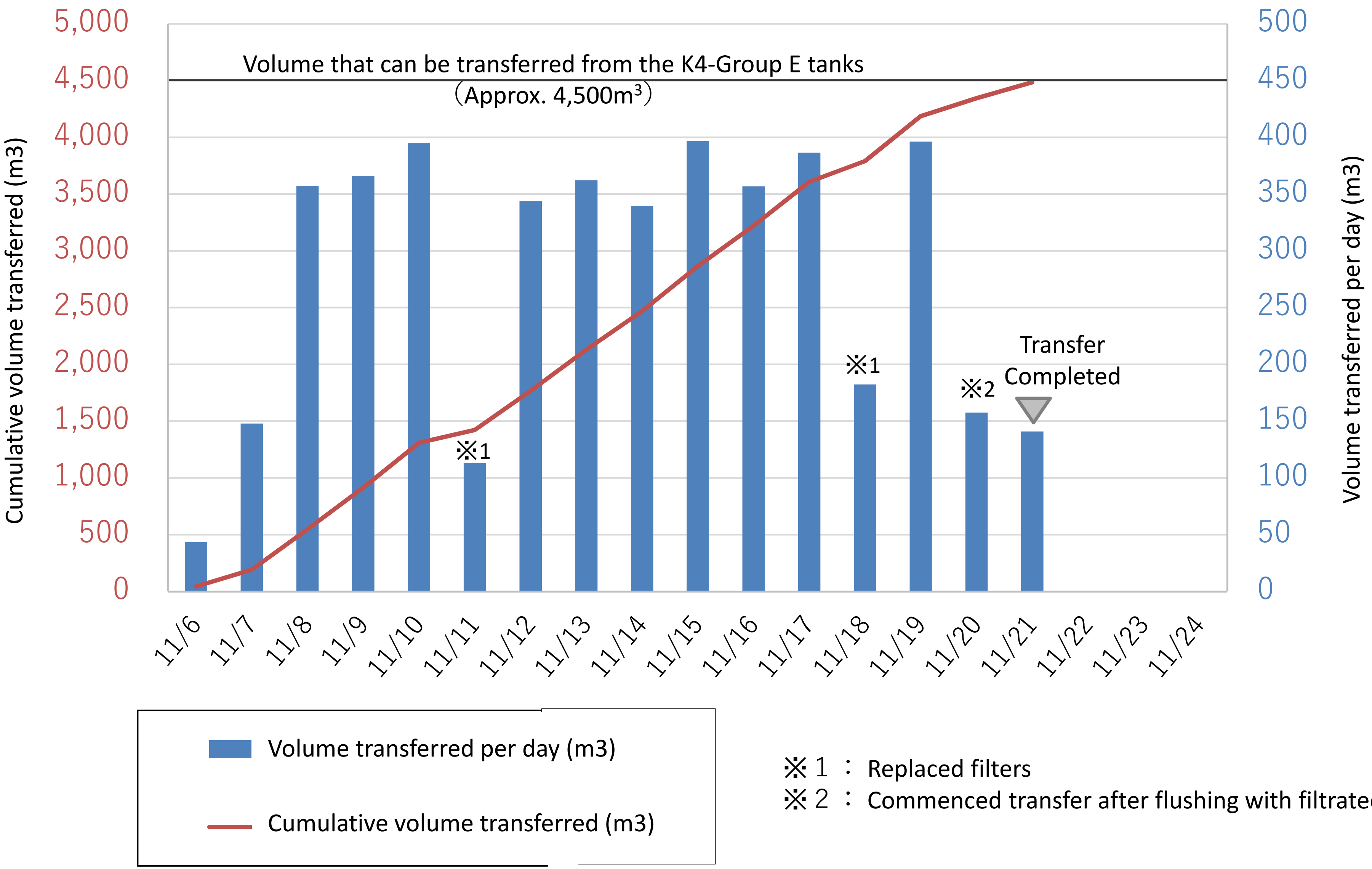
Partially edited excerpts from 118th meeting of the Secretariat of the Team for Countermeasures for Decommissioning, Contaminated Water and Treated Water

- In preparation for the 4th discharge of ALPS treated water into the sea, ALPS treated water will be transferred from tank group E in K4 area and tank group A in K3 area to measurement/confirmation tank group B.
- To transfer the water, temporary equipment including hoses, pumps and filters will be installed as shown in the following diagram. This water transfer will be conducted upon implementing leak countermeasures, such as using dual-layered hoses, etc.

  (Water transfer from tank group E in K4 area to the measurement/confirmation tank group B was completed on November 21. Water transfer from tank group A in K3 area is scheduled to start tomorrow (December 1.))



[Reference] Water transfer record for K4 tank group E in preparation for the fourth discharge



※1 ： Replaced filters
※2 ： Commenced transfer after flushing with filtrated water