

# Sea Area Monitoring Plan for the Handling of ALPS Treated Water Fukushima Daiichi Nuclear Power Station

<Reference material>

March 24, 2022

Tokyo Electric Power Company Holdings, Inc.  
Fukushima Daiichi D&D Engineering Company

- TEPCO published TEPCO holding's action in response to the Japanese government's policy on the handling of ALPS treated water on April 16, 2021. The response includes strengthening and expansion of its sea area monitoring efforts to minimize adverse impact on reputation that may be sustained a result of discharging ALPS treated water into the sea.
- TEPCO, as the organization responsible for discharging ALPS treated water, evaluated how the treated water will disperse based using dispersion simulations at sea, and developed a sea area monitoring plan for measuring tritium levels to check on dispersion \*2 in seas off the coast of Fukushima near the station where tritium concentrations will likely increase after discharge.\*1. This was made public on August 25, 2021.

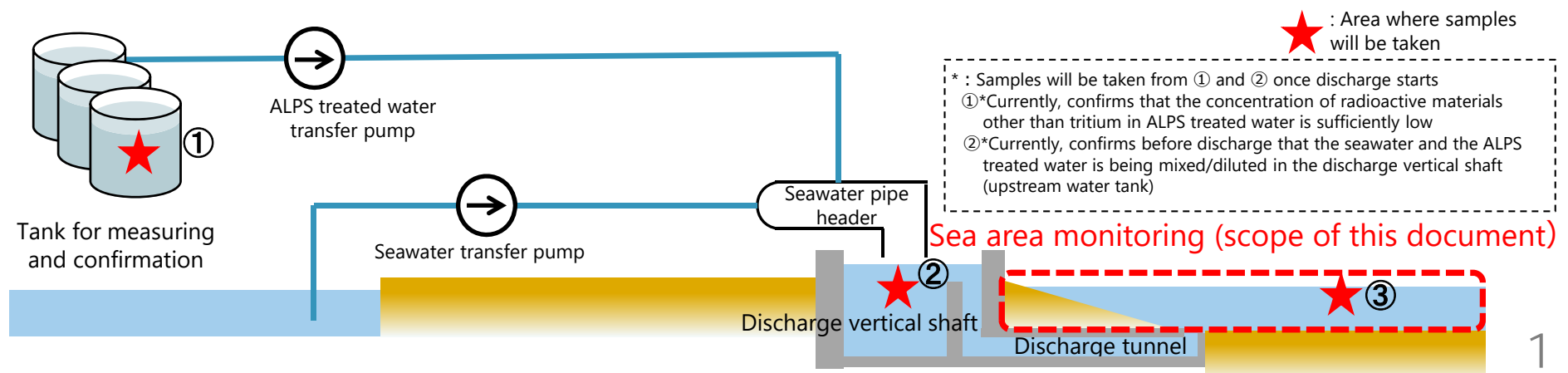
\*1 : Evaluated to be 1 to 2 Bq/L, 1/10000<sup>th</sup> to 1/5000<sup>th</sup> of the WHO drinking water guideline reference level of 10,000 Bq/L

\*2 : •Based on the dispersion simulations at sea, TEPCO has decided to take samples from more area and increase the frequency of sampling to ascertain the baseline before discharge.

•TEPCO also strengthened monitoring to assess how tritium was showing up in marine organisms

<Announced by August 25, 2021>

- In response to the Japanese government's Comprehensive Monitoring Plan which is being fortified to address concerns related to the discharge of ALPS treated water into the sea, TEPCO will reinforce the sea area monitoring plan based the results of the August 25, 2021 discussions (increase the number of sampling locations, measured organisms and sampling frequency) and set stricter detectable thresholds. The Plan will be put into effect in April 2022 to continuously confirm from before discharge how tritium and other nuclides are scattering, and how it is impacting marine organisms.
- To secure transparency and objectivity in the sea monitoring, we will ask local agriculture, forestry, fisheries producers and local government officials to participate in and observe sea area monitoring. The results of sea monitoring will be published on our website.
- The state of substances in the sea area will be disclosed, in cooperation with the Japanese government and related organizations, carefully and in an easy-to-understand manner to alleviate the concerns that the local community, parties concerned, and the society at large.



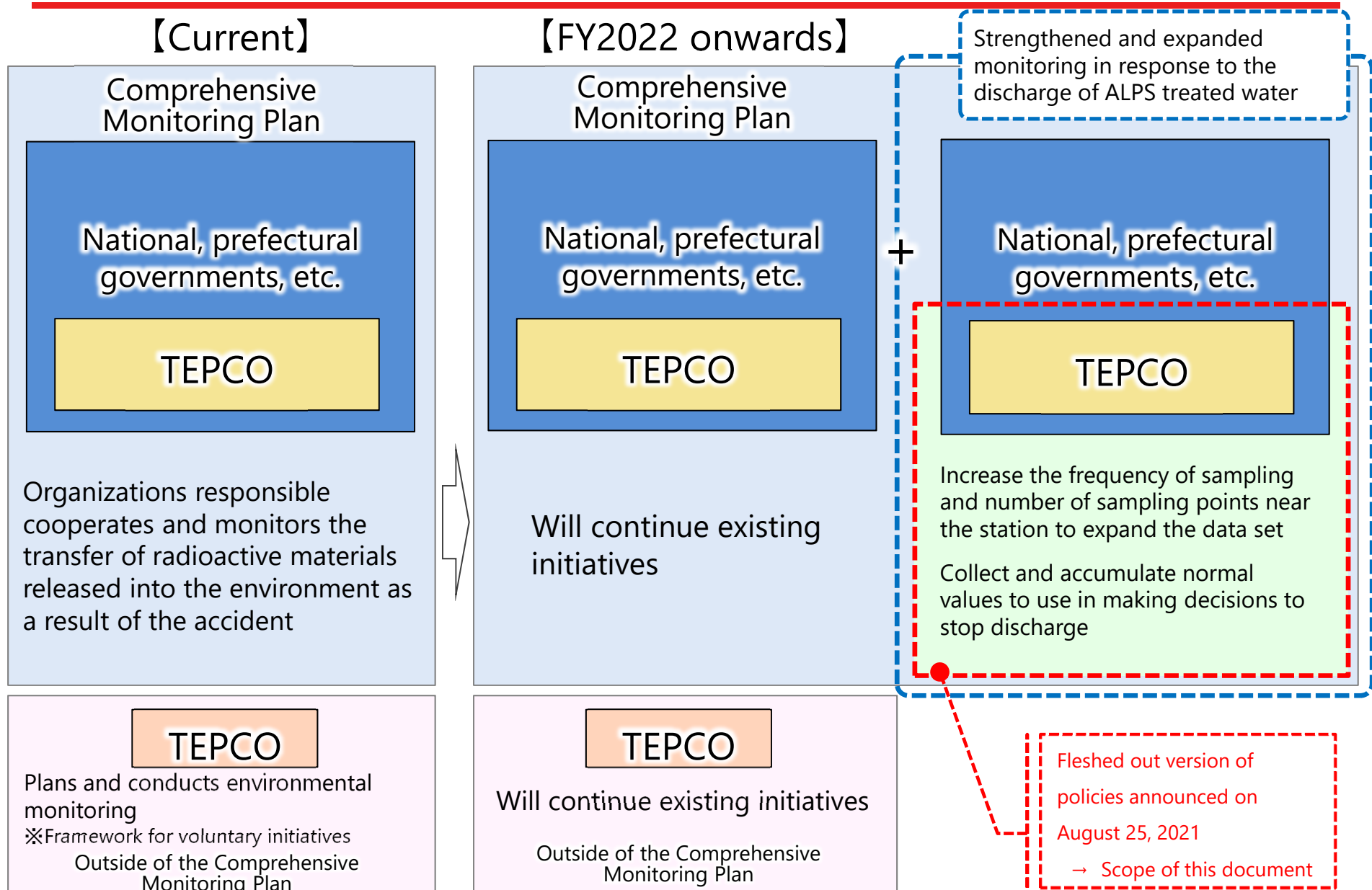
## 1-1. Government's Comprehensive Monitoring Plan

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### Current Comprehensive Monitoring Plan (sea area monitoring)

- The Government set up a Monitoring Coordination Committee under the Nuclear Disaster Response Headquarters to conduct radiation monitoring for the Fukushima Daiichi Nuclear Power Station accident in a planned manner and formulated a Comprehensive Monitoring Plan in August 2011.
- Based on this plan, ministries, local municipalities, nuclear operators, and other responsible organizations, have been conducting sea area monitoring focusing on cesium 134, cesium 137, strontium 90 to ascertain how the radioactive materials discharged into the environment scatters and transfers to different organisms.
  - Current Comprehensive Monitoring Plan (revised on April 1, 2021)  
See the Nuclear Regulation Authority (NRA) website (in Japanese)  
<https://radioactivity.nsr.go.jp/ja/list/511/list-1.html#chapter-1>
- Division of roles among responsible organizations (example)
  - NRA: Formulates and implements monitoring plan, analyzes and evaluates measurements including those taken by other organizations, summarizes analysis and evaluations results, and disseminates them to the public.
  - Nuclear operator (TEPCO): Conducts monitoring, summarizes and disseminates the results of analysis and assessment of measurements.

## 1-2. Strengthening of the Government's Comprehensive Monitoring Plan and the positioning of sea area monitoring conducted by various organizations



## 2-1. Key Points of TEPCO's efforts to strengthen sea monitoring (1/2)

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### ○ Increase the number of sampling locations, organisms monitored

- The Expert Sea Area Monitoring Committee established to advise the Government on the appropriateness of its efforts to strengthen sea area monitoring in the Comprehensive Monitoring Plan reviewed the updated plan created by the Ministry of the Environment and the NRA (hereinafter the Government)\*.

\*:Tritium is going to be measured near the outlet, near the shore of Fukushima, beaches, southern part of the sea area off the coast of Miyagi, and northern part of the sea area off the coast of Ibaraki, just in case. The seawater will be measured for nuclides other than tritium and fish for tritium and carbon 14, and seaweed for iodine 129 near the outlet.

- TEPCO as the party responsible for ALPS water discharge, will conduct monitoring, focusing on the area near the outlet, and will increase seawater and sampling locations near the station and at the shore of Fukushima for tritium, and will measure tritium and iodine 129 near the station.
- Flounder and flatfish that widely inhabit the sea area around the station have been chosen as fish to be monitored. These fish that inhabit the seabed are also targets of radiation impact assessments in the International Commission on Radiological Protection (ICRP) Recommendations.

## 2-1. Key Points of TEPCO's efforts to strengthen sea monitoring (2/2)

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### ○ Increase sampling frequency

- TEPCO will increase the frequency with which seawater is measured for tritium.
- The number of sampling locations will be increased **near the outlet where TEPCO will be focusing its monitoring efforts.** The detectable threshold will be set in line with the national government's target values. Sampling frequency will be set at numbers considered to be sufficient for ascertaining the situation based on past monitoring data.

### ○ The detectable threshold will be set to be in line with the national government's target values.

- TEPCO has **set the detectable threshold for tritium and iodine 129 to be in line with the government's detectable threshold targets** to ascertain how the seawater is scattering and the state of marine organisms.

We will continue to measure the radioactive materials other than tritium and iodine 129—cesium 134, cesium 137, strontium 90, plutonium 238, plutonium 239, and plutonium 240—as we have in the past.

## 2-2. Strengthened sea area monitoring plan (1/2)

【seawater】

•TEPCO will increase the number of samples taken, frequency of measurement for tritium and set the detectable threshold to be in line with government targets.

Red : Strengthened compared to the current plan

Target	Sampling location (See 2-3. Diagram 1,2,3)	Number of samples taken	Subject of measurement	Frequency	Detectable threshold
Sea water	Inside the harbor	10	Cesium-134,137	Daily	0.4 Bq/L
			Tritium	Weekly	3 Bq/L
	Outside the harbor, within a 2km radius of the station	2	Cesium-134,137	Weekly	0.001 Bq/L
				Daily	1 Bq/L
		5 → 8	Cesium-134,137	Weekly	1 Bq/L
	7 → 10	Tritium	Weekly	1 → 0.4 Bq/L* <sup>1</sup>	
	Within 20 km of the coast	6	Cesium-134,137	Weekly	0.001 Bq/L
			Tritium	Twice a month → Weekly* <sup>2</sup>	0.4 → 0.1 Bq/L* <sup>3</sup>
	Within 20 km of the coast (Fish sampling location)	1	Tritium	Monthly	0.1 Bq/L
		0 → 10	Tritium	None → Monthly	0.1 Bq/L* <sup>3</sup>
20 km+ off the coast of Fukushima	9	Cesium-134,137	Monthly	0.001 Bq/L	
	0 → 9	Tritium	None → Monthly	0.1 Bq/L* <sup>3</sup>	

\*1 : Values will be measured using the electrolytic concentration method\* as needed.

\*2 : To be measured monthly when the detectable threshold is at 0.1Bq/L

\*3 : To be set at 0.4 Bq/L until the electrolytic concentration device is installed.

※ : Samples will be taken from the surface level of the sea

\* : Concentration method that uses the fact that tritium water is less easily electrolyzed. See reference for details on the electrolytic concentration device.

## 2-2. Strengthened sea area monitoring plan (2/2)

### 【Fish and seaweed】

- TEPCO will increase the number of samples taken, frequency of measurement and set the detectable threshold to be in line with government targets.

Red : Strengthened compared to the current plan

Target	Sampling location (See 2-3. Diagram 1,2)	Number of samples taken	Subject of measurement	Frequency	Detectable threshold
Fish	Within 20 km of the coast	11	Cesium134,137	Monthly	10 Bq/kg (live)
			Strontium 90 (5 samples with the highest concentrations of cesium)	Quarterly	0.02 Bq/kg (live)
		1	Tritium (tritiated water)	Monthly	0.1 Bq/L
			Tritium (organically bound)		0.5 Bq/L
		0 → 10	Tritium (tritiated water) *1	None → Monthly	0.1 Bq/L *3
			Tritium (organically bound) *2		0.5 Bq/L
Seaweed	Inside the harbor	1	Cesium134,137	Annually → Three times a year	0.2 Bq/kg (live)
	Outside the harbor, within a 2km radius of the station	0 → 2	Cesium134,137	None → Three times a year	0.2 Bq/kg (live)
			Iodine 129	None → Three times a year	0.1 Bq/kg (live)
			tritium (tritiated water) *1	None → Three times a year	0.1 Bq/L *3
			tritium (organically bound) *2		0.5 Bq/L

\*1 : Tritium that exists in water form and is excreted similarly to water. Half of the radiation is excreted in around 10 days.

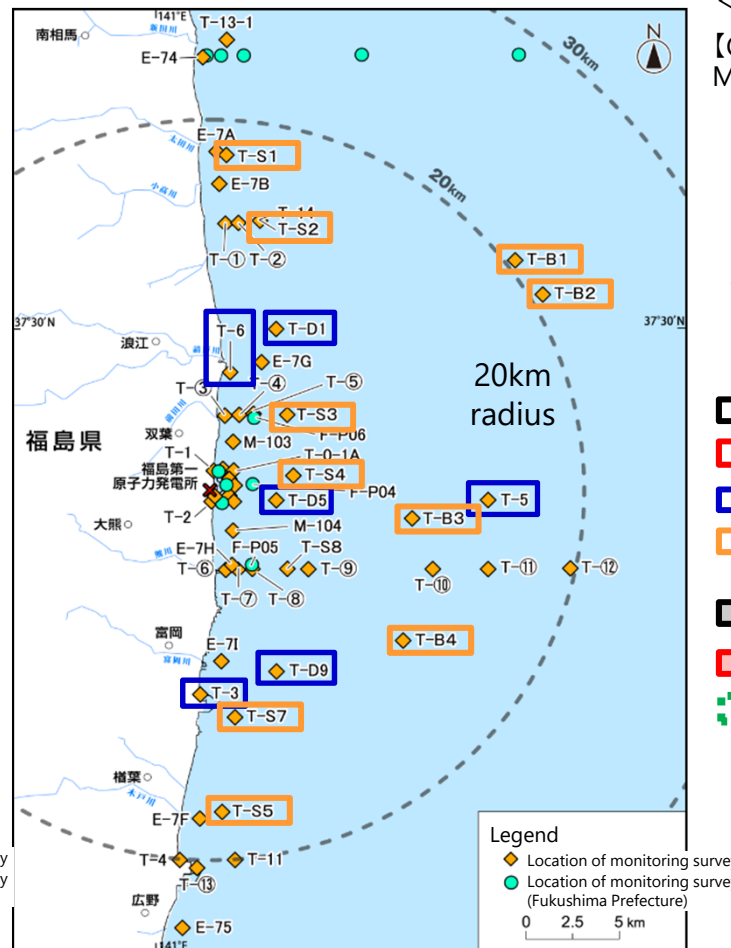
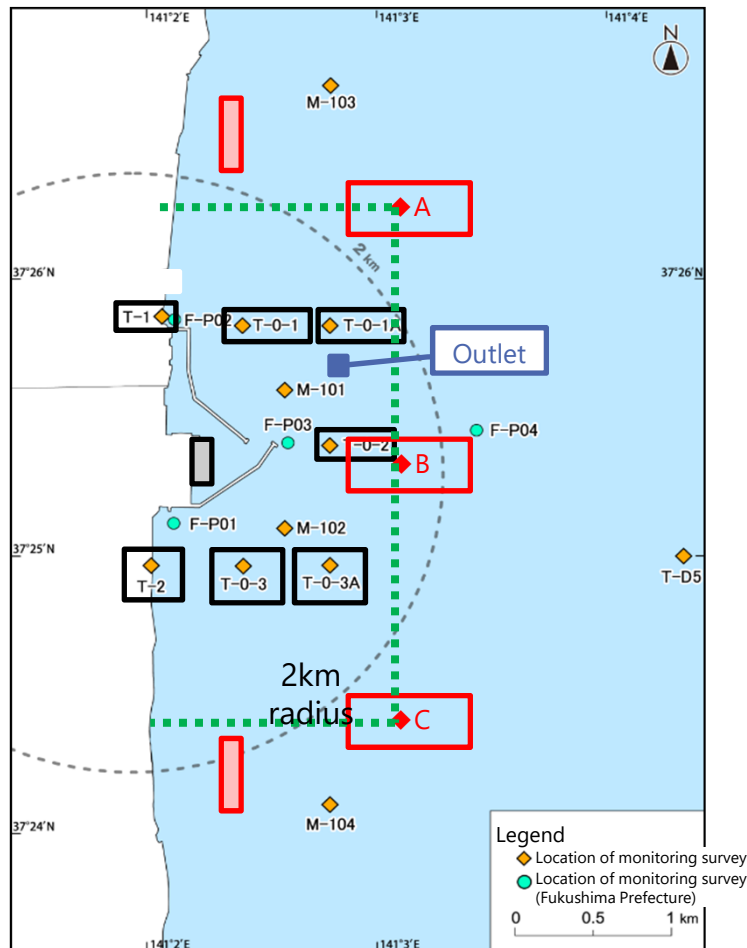
\*2 : Tritium ingested bound to organic material such as protein. Most of it is excreted in around 40 days while a portion may take up to a year to be excreted.

\*3 : Set at 0.4 Bq/L until the electrolytic concentration device is installed

## 2-3. TEPCO sampling locations to be strengthened by TEPCO's sea area monitoring (1/2)

[TEPCO's strengthening plan]

- TEPCO will increase the number of samples taken, frequency of measurement for seawater, fish, and seaweed and set the detectable threshold to be in line with government targets for seawater, fish and seaweed.



<Legend>

【Current Comprehensive Monitoring Plan】

- NRA M-○
- Ministry of Environment E-○
- Fisheries Agency (fisheries products) F-○
- Fukushima Prefecture F-○
- TEPCO T-○

【TEPCO's strengthening plan】

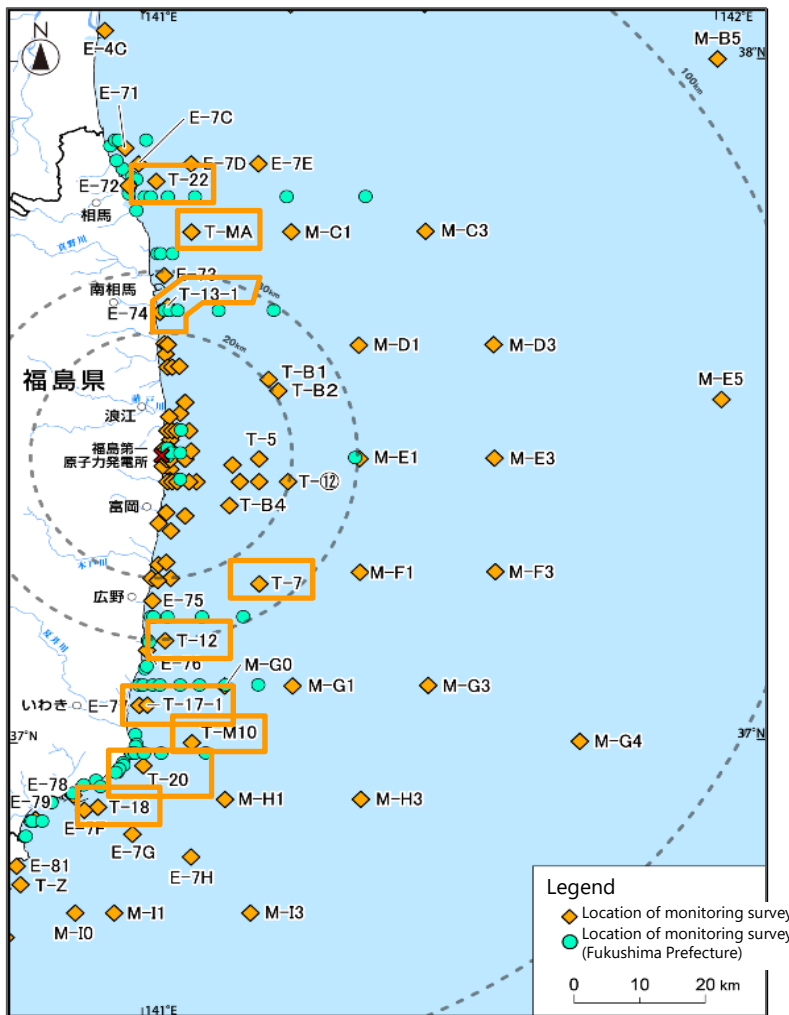
- : Locations where the detectable threshold is being revised (seawater)
- : New sampling locations (seawater)
- : Locations at which sampling frequency will be increased (seawater)
- : Locations at which tritium will be measured in addition to cesium (fish, seaweed)
- : Locations with no change (Seaweed)
- : New sampling locations (Seaweed)
- : Areas where no fishing is being conducted on a daily basis ※  
1.5km (East to West), 3.5km (South to North)  
※ : Area where common fishery rights are not set



## 2-3. TEPCO sampling locations to be strengthened by TEPCO's sea area monitoring (2/2)

【TEPCO's strengthening plan】

- TEPCO will increase the number of samples taken for tritium in regards to seawater.



<Legend>

【Current Comprehensive Monitoring Plan】

NRA M-○

Ministry of Environment E-○

Fisheries Agency (fisheries products) F-○

Fukushima Prefecture F-○

TEPCO T-○

【TEPCO's strengthening plan】

◻ : Locations at which tritium will be measured in addition to cesium (seawater)

Diagram 3. 20km+ off the coast of Fukushima

## 2-4. Evaluation of sea area monitoring results

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### ○ Sea area monitoring results will be evaluated as follows.

#### 【Evaluations before discharge】

- Monitoring data will be gathered starting in April 2022 establish a baseline before discharge (concentrations of tritium and other nuclides in the subdrain and groundwater drain treated water, groundwater bypass water, and seawater in site discharge channels).

#### 【Evaluations after discharge】

- We will ascertain how the seawater dispersed and the impact on marine organisms.
- We will compare the results against sea dispersion simulation results and concentrations used in radiation impact assessments to confirm that seawater dispersion behavior and material concentrations are within the expected range.
- If measurements exceed the fluctuation range observed in pre-discharge baseline values, we will investigate the cause after checking our measurements with other monitoring organizations.
- If measurements grossly exceed the fluctuation range observed in pre-discharge baseline values \*, then sea discharge will be stopped. Measurements will be taken again from the relevant location and the state of scope and frequency of monitoring will be temporarily expanded to ascertain the state of the surrounding sea area.

\* : To be set based on data collected starting in April 2022

#### 【Evaluations to be conducted before and after discharge】

- If measurements differ among the various monitoring organizations, we will cooperate with organization to determine what is causing the discrepancy.
- If TEPCO's processes or facilities is determined to be the cause of the discrepancy, we will check our processes and improve them as needed.

### 3. Securing transparency and objectivity in sea area monitoring results

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- **We will confirm the appropriateness of our monitoring results by comparing our measurements with the monitoring results of other organizations conducted according to the Comprehensive Monitoring Plan.**
  
- **We will implement the following to secure transparency and objectivity in measurements.**
  - We will continue to have our staff take analytical skill tests and participate in intercomparative analyses conducted by domestic and overseas laboratories so that we can objectively confirm our analytical skills from a third-party perspective.  
  
[E.g., participate in the international intercomparison analysis program for radioactivity analysis (hosted by the International Atomic Energy Agency (IAEA)), conduct intercomparison analysis with the Radioactivity Measurement and Analysis Technology Committee, Japan Chemical Analysis Center, and other organizations]
  
  - We will ask local agriculture, forestry, fisheries producers and local government officials to participate in and observe sea area monitoring (e.g., radioactivity measurement, sample collection).
  
  - We will establish a system to objectively confirm our measurement values by having a company certified by the International Organization for Standardization (ISO) for environmental radioactivity analysis (ISO/IEC 17025) participate in sea area monitoring and measure the same samples as our company as a third party. For the time being, we will have them start with measuring cesium, and as soon as we are ready, will gradually expand the scope include the measurement of tritium, which we are aware is of great interest in the discharge of ALPS treated water.

## 4. Policy for disclosing the results of sea area monitoring

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- **We will disclose information as follows to further foster understanding internationally and domestically.**
  - As soon as the results are ready, we will disclose them on our website in an accurate and timely manner.
  - Data will be disclosed in a form that is easy-to-understand for local residents and domestic consumers.
  - We will also explain what the values mean and how it confirms the safety of the discharged ALPS treated water.
  
- **The report on the sea area monitoring results will be as follows.**
  - We will summarize the results of our sea area monitoring and the evaluation results in a report on our website. A new report will be published every quarter.
  - In the evaluation, we will check whether the measurement results are within the range predicted in the sea dispersion simulation results and whether the concentrations are equivalent to those in the radiation impact assessment. The results of the evaluation will be expressed in an easy-to-understand manner.
  - The report will be presented at a meeting where people from the local government and academic experts will confirm and evaluate the results.

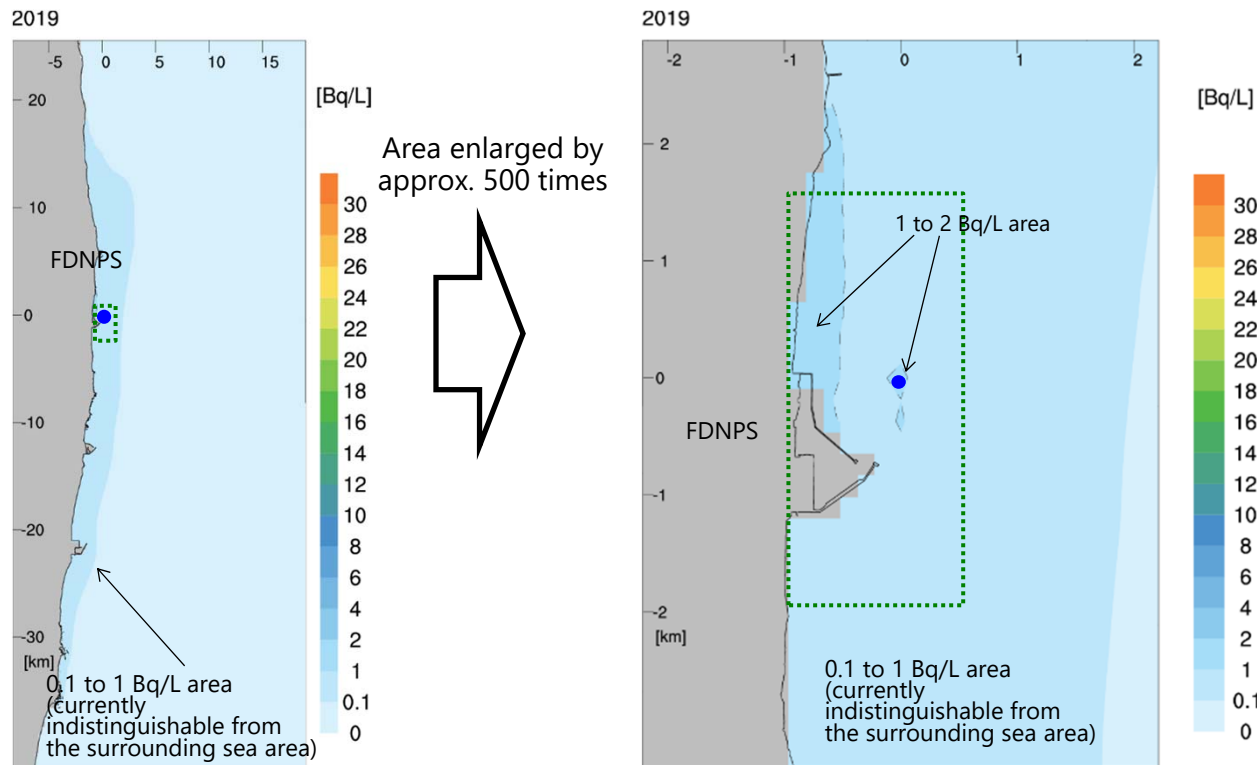
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# Reference

## (Reference) Results of dispersion simulation at sea

Simulations using the meteorological and sea conditions data from 2019 found that the area 2 to 3 km from the station may have higher tritium concentrations than concentrations observed in the current surrounding area (0.1-1 Bq/L\*) of 1 to 2 Bq/L, which is 1/100,000<sup>th</sup> to 1/10,000<sup>th</sup> of the criteria in the WHO Guidelines for drinking-water quality (10,000 Bq/L).

⇒ Monitoring efforts will be strengthened to confirm the status of dispersion.

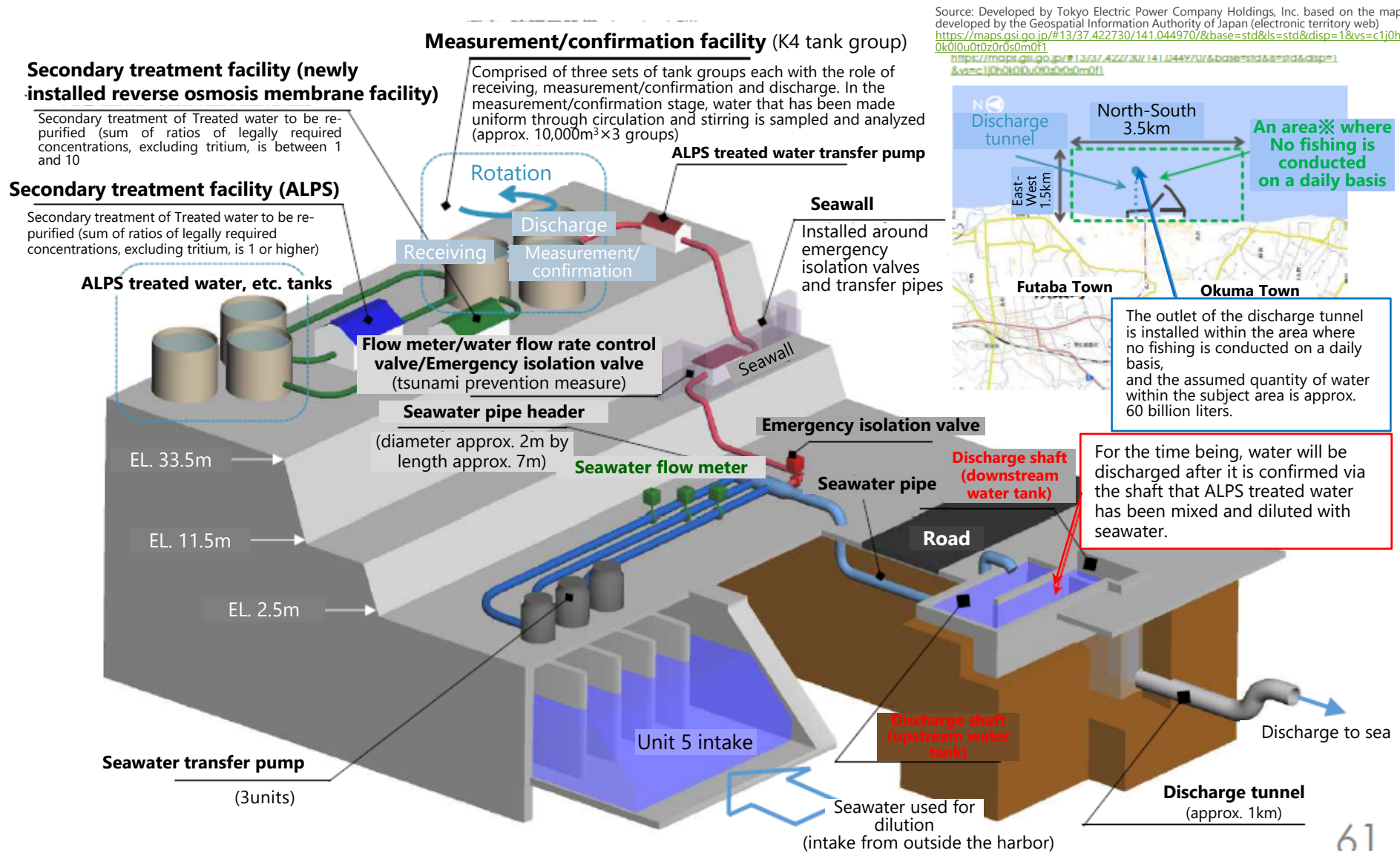


※ : The simulation was conducted using a program based on sea scattering model (ROMS) originally developed by a US university and widely used by universities and research institutes, and further improved by CRIEPI

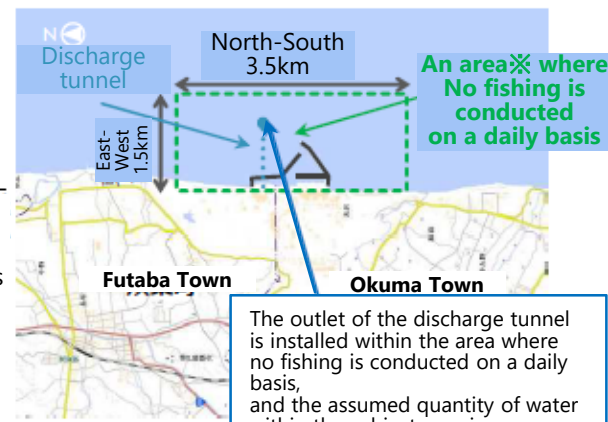
Enlarged view of the area off the coast of Fukushima  
(Largest value in scale at 30 Bq/L)

Enlarged view of the area around the station  
( Largest value in scale at 30 Bq/L )

# (Reference) Overview of facilities for securing safety



Source: Developed by Tokyo Electric Power Company Holdings, Inc. based on the map developed by the Geospatial Information Authority of Japan (electronic territory web) <https://maps.gsi.go.jp/#13/37.422730/141.044970/&base=std&ls=std&disp=1&vs=c1j0h0k0l0u0t0z0r0s0m0f1>  
<https://maps.gsi.go.jp/#13/37.422730/141.044970/&base=std&ls=std&disp=1&vs=c1j0h0k0l0u0t0z0r0s0m0f1>



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

For the time being, water will be discharged after it is confirmed via the shaft that ALPS treated water has been mixed and diluted with seawater.

## (Reference) Sea area monitoring plan published on August 25, 2021

○This plan will confirm the status of tritium dispersion to the sea and the status of the transfer of radionuclides to fish and seaweed.

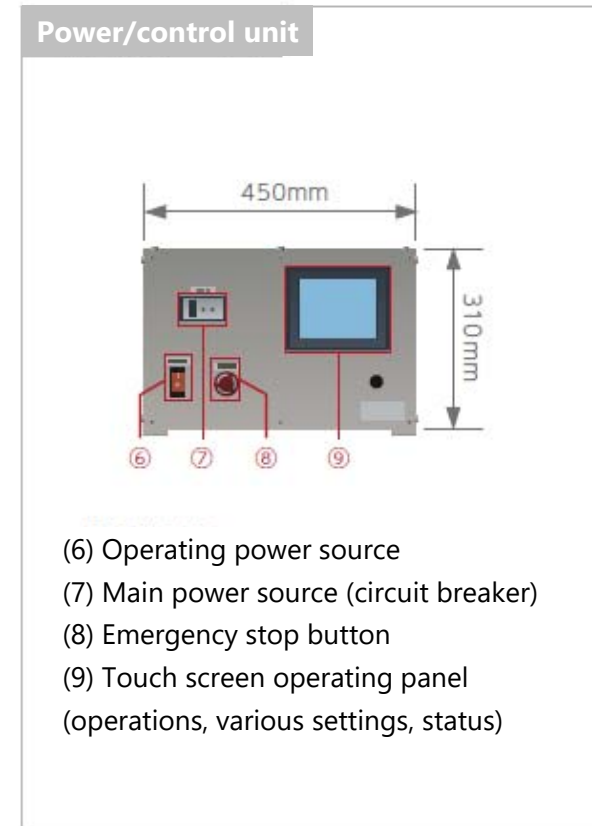
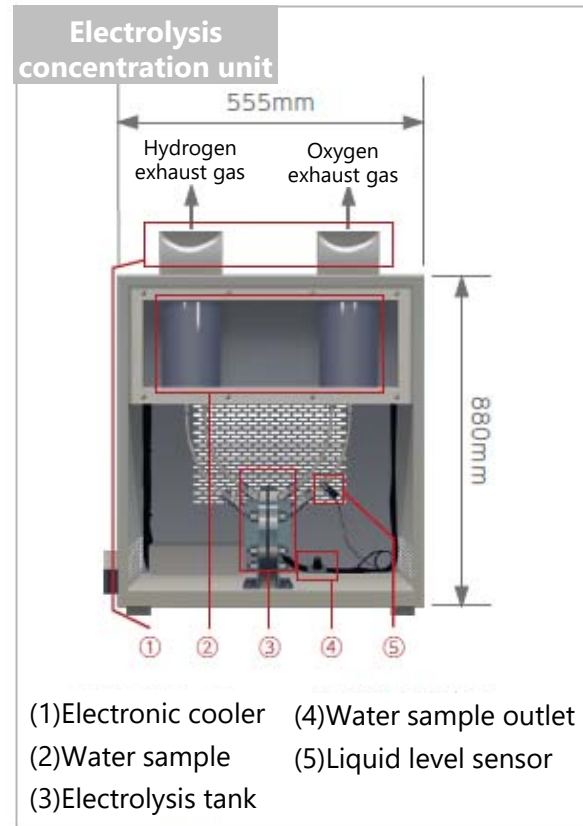
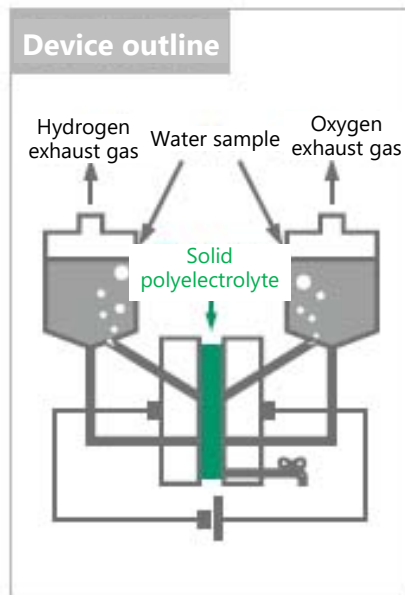
Subject	Area sampled	Subject of measurement	Current frequency	After change (draft)	Remarks
Seawater	Inside the harbor	10 locations	Cesium : Daily Tritium : Weekly	Cesium : Daily Tritium : Weekly	<b>Perform daily for discharge vertical shaft (discharge end)</b>
	Within 2km (and the vicinity)	7 locations	Cesium : Weekly Tritium : Weekly	Cesium : Weekly Tritium : Weekly	<b>Added three sampling areas (total of ten areas)</b>
	Within 20km	6 locations	Cesium : Weekly Tritium : Every two weeks	Cesium : Weekly <b>Tritium : Weekly</b>	<b>Doubled the analysis frequency of tritium</b>
	Outside 20km (off the coast of Fukushima)	9 locations	Cesium : Monthly Tritium : 0 times	Cesium : Monthly <b>Tritium : Monthly</b>	<b>Added tritium</b>
Fish	Within 20km	Cesium134,137 Strontium Tritium	Cesium : Monthly (11 locations) Strontium : Quarterly (Top five samples for cesium concentration) Tritium : Monthly (one location)	Cesium : Monthly (11 locations) Strontium : Quarterly (Top five samples for cesium concentration) <b>Tritium : Monthly (one location)</b>	Fish are currently sampled at 11 locations to analyze cesium and tritium is analyzed in one of those locations. After the change, <b>tritium analysis is conducted in the remaining ten locations</b>
Seaweed	Inside the harbor	Cesium134,137	Cesium : Three times annually (one location)	<b>Cesium : Three times annually (one location)</b>	Conducted three times annually in March, May and July
	Outside the harbor	Cesium134,137 Iodine 129 Tritium	Cesium : 0 times Iodine : 0 times Tritium : 0 times	<b>Cesium : Three times annually (two locations)</b> <b>Iodine : Three times annually (two locations)</b> <b>Tritium : Three times annually (two locations)</b>	<b>Added two locations outside the harbor</b> Conducted three times annually in March, May and July (based on survey of habitats to be determined at a later date)



# (Reference) Tritium electrolysis concentration device

## 【Specifications】

- Can concentrate 1000 mL of distilled water sample to 50 mL in 60 hours.
- Tritium is generated and released once hydrogen and oxygen are separated through electrolysis.



※From the website of De Nora Permelec