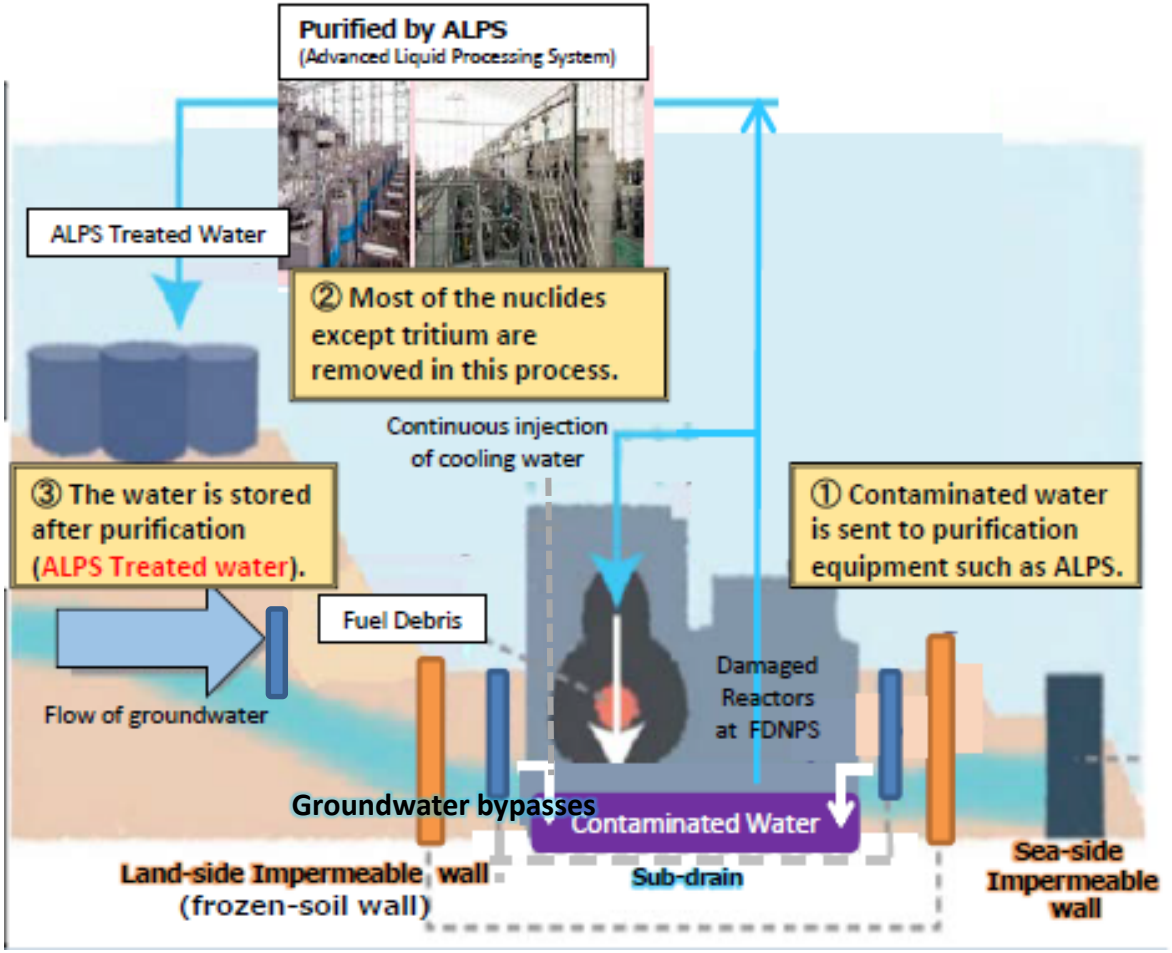
Current status of ALPS treated water (i)

◇The water for cooling fuel debris gets contaminated and stagnates in the buildings.

- ✓ **<u>The level of groundwater outside is controlled to be higher</u>** than that of water inside the buildings, to prevent the contaminated water from flowing out.
- ✓ As a result, **<u>groundwater keeps flowing into the buildings</u>** and **<u>contaminated water keeps generated in the buildings</u>** every day.



- ***<u>Sub-drains</u>*** *are wells located near the buildings, from which groundwater is pumped up to reduce the level of groundwater.*
- ***<u>Frozen-soil walls</u>*** *surround the buildings to redirect the groundwater's flow.*

Current status of ALPS treated water (ii)

◇At FDNPS, water used for cooling fuel debris (contaminated water) has been treated, and the **treated water is stored in tanks on site.**

- ✓ **Storage tanks are predicted to reach full capacity around summer of 2022.**

◇**Decommissioning of FDNPS is essential for reconstruction of Fukushima**.

- ✓ To secure reconstruction work such as retrieving fuel debris and storing waste temporarily, **installation of additional tanks on the site cannot be continued at this rate**.

◇Until the end of decommissioning, tanks are needed to be removed.

- ✓ Therefore, the issue on disposal of treated water cannot be left forever.

Tank groups storing treated water

Status of treated water in FDNPS (As of August 20, 2020)	
Tank storage volume	About 1.23 million ㎥
Tank capacity (at the end of 2020)	About 1.37million ㎥
Increase of treated water	About 50,000 to 60,000 ㎥/year

Characteristics of ALPS treated water

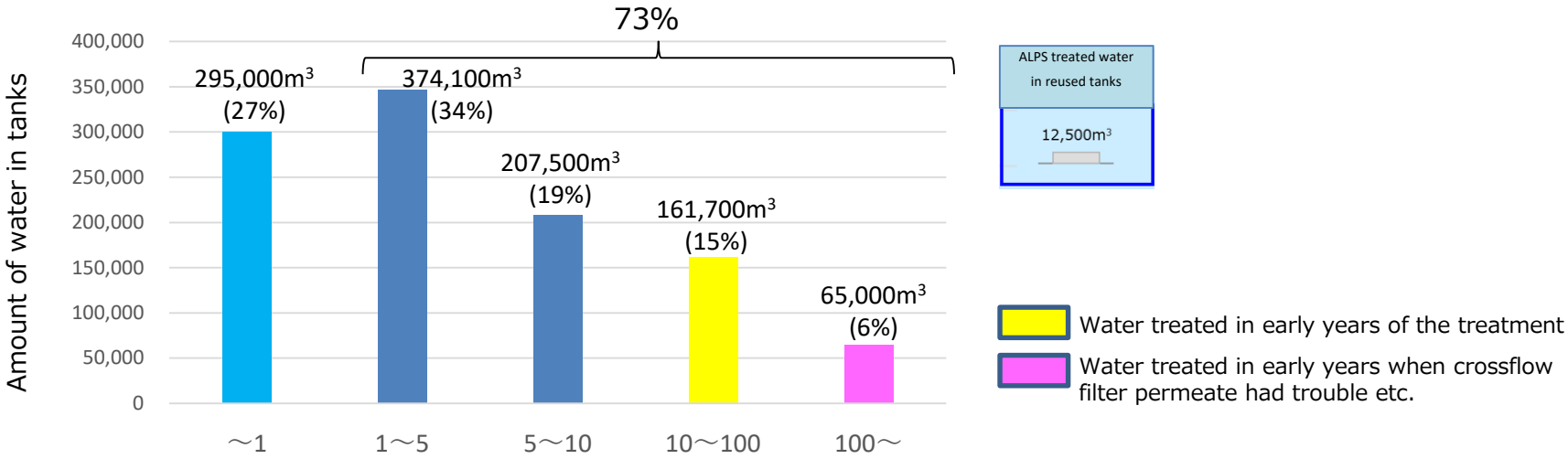
◇About 70 % of the treated water stored in tanks contains radionuclides other than tritium at the concentration which exceeds regulatory standards.

* In early years, the ALPS treatment has been carried out by prioritizing the volume of water treatment to quickly reduce the radiation impact to outside the site. There were also cross filter permeate troubles and other troubles.

◇Since FY2020, **re-purification** of the treated water will be commenced **to meet the regulatory standards other than tritium.**

◇In the case of releasing it to the environment, the treated water will be **sufficiently diluted also to meet the regulatory standard for tritium.**

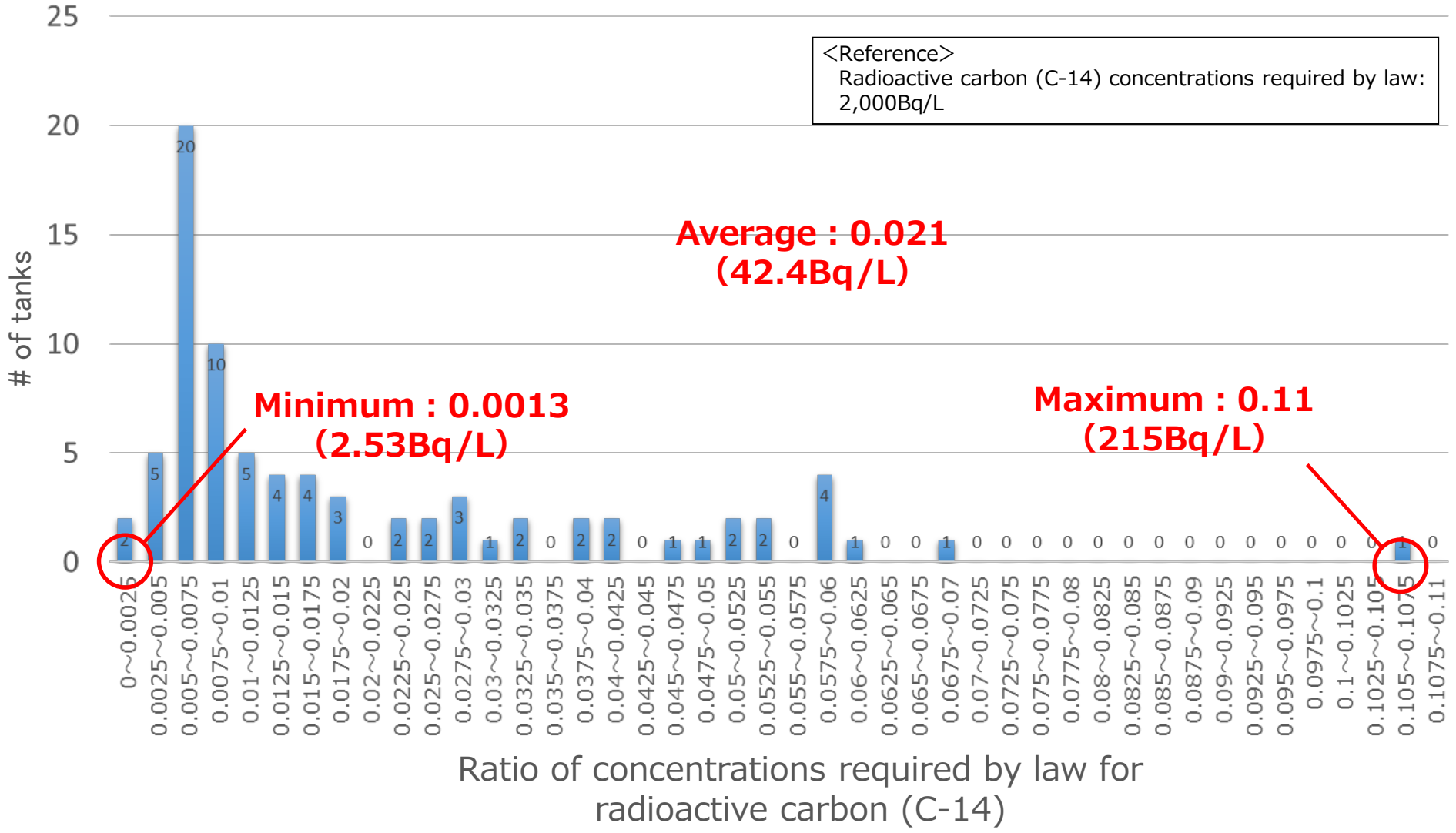
Sum of the ratios of actual concentrations to regulatory standards for 62 nuclides* (as of August, 2020) * other than tritium



*73% of the total volume of ALPS treated water stored in tanks contains radionuclides other than tritium at the concentration that exceeds the regulatory standards for discharge. This will be further re-purified to meet the regulatory standards other than tritium.

(Ref.) C-14 concentration in tanks

Distribution of the legally required concentration ratios of radioactive carbon (C-14) in tanks* for storing water treated with ALPS



*Tanks for which analysis of radioactive carbon (C-14) has been conducted (as of the end of June, 2020, 80 tanks in total)
TEPCO Treated Water Portal Site: https://www.tepco.co.jp/en/decommission/progress/watertreatment/index-e.html

[Ref.] What are the regulatory standards for discharge？ (i)

- Japan's regulatory standards for discharge is set in compliance with the international standards known as publications of International Commission for Radiological Protection (ICRP), keeping additional public radiation dose not exceeding 1mSv/year.
  (*In the case of Fukushima Daiichi NPS, the dose should not exceed 1mSv/year.)

<Case 1> water which contains one kind of radionuclide

EXAMPLE

Sr-90 (@12Bq/L) < 30 Bq/L

This case meets the standard.

Regulatory standard

"The regulatory standards for discharge" is the limit of concentration* applicable to the discharge of radioactive waste to the environment, which is stipulated in **the ordinance of the Reactor Regulation Act.**

* The concentration should be less than the stipulated limit (Bq/liter-water).

(Ref.) Regulatory standards for discharge in each major radionuclide in Japan (in the case of discharge into the sea)

Nuclide	(Bq/Liter-water)
Tritium (H-3)	60,000
Cesium-137 (Cs-137)	90
Cesium-134 (Cs-134)	60
Cobalt-60 (Co-60)	200
Antimon-125 (Sb-125)	800

Nuclide	(Bq/Liter-water)
Ruthenium-106 (Ru-106)	100
Strontium-90 (Sr-90)	30
Iodine-129 (I-129)	9
Carbon-14 (C-14)	2000
Technetium-99 (Tc-99)	1,000

＜Actual data＞ Actual radiation concentration measurements for each tank group
https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/pdf/ref.pdf

[Ref.] What are the regulatory standards for discharge？ (ii)

<Case 2> water which contains multiple kinds of radionuclides

If the radioactive waste contains multiple radionuclides, **the sum of the ratios of each radionuclide concentration to the regulatory standards for them should be less than 1** (please see the equation below).

$$\frac{\text{concentration of A}}{\text{standard for A}} + \frac{\text{concentration of B}}{\text{standard for B}} + \frac{\text{concentration C}}{\text{standard for C}} \cdots < 1$$

EXAMPLES

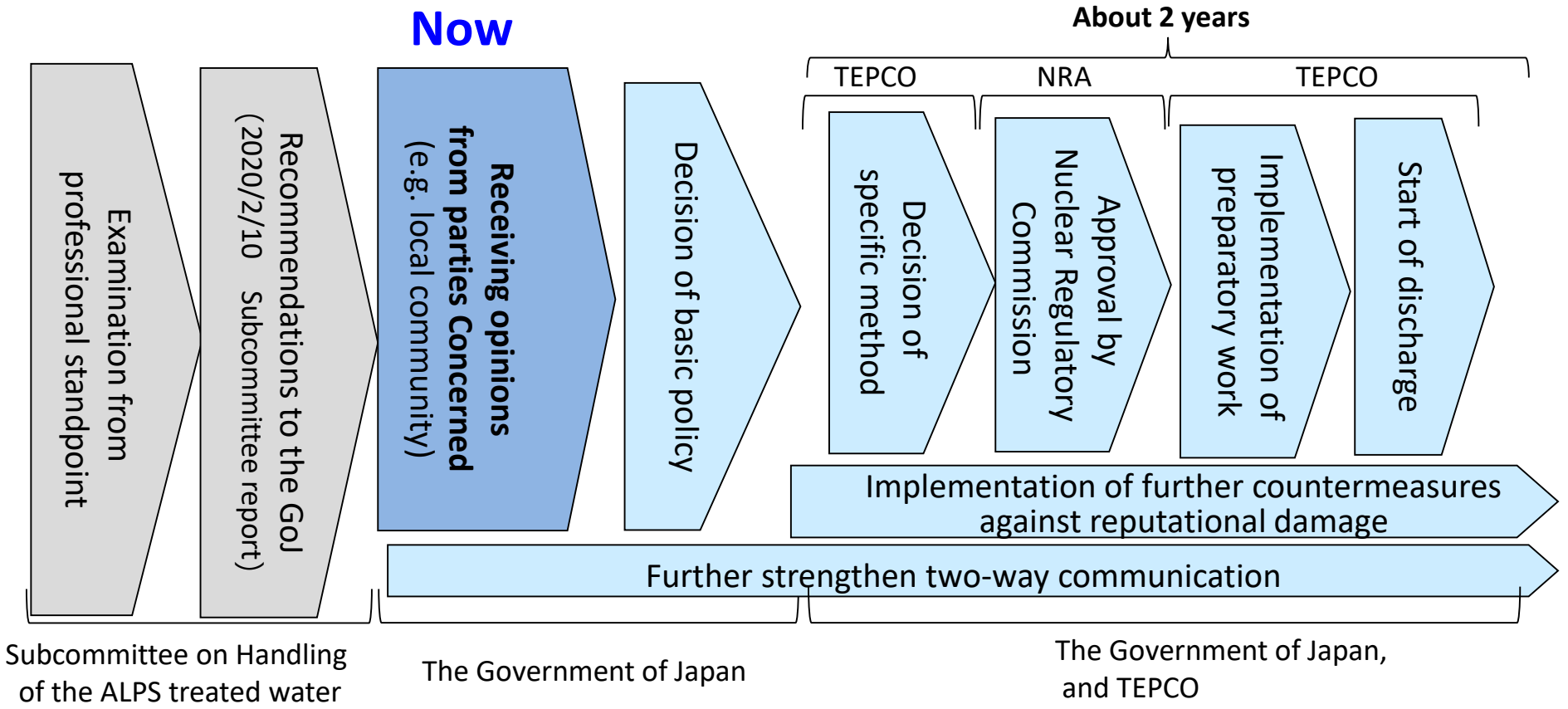
Radionuclides (@concentration in the water (Bq/L)) [standard value (Bq/L)]

I-129 (@0.9Bq/L) [9Bq/L*]	I-129 (@4.5Bq/L) [9Bq/L*]
+ Sr-90 (@3Bq/L) [30Bq/L*]	+ Sr-90 (@12Bq/L) [30Bq/L*]
+ Cs-137 (@54Bq/L) [90Bq/L*]	+ Cs-137 (@54Bq/L) [90Bq/L*]
Sum of the ratio	**Sum of the ratio**
0.9/9 + 3/30 + 54/90	4.5/9 + 12/30 + 54/90
= 0.1+ 0.1 + 0.6	= 0.5 + 0.4 + 0.6
= 0.8 **< 1**	= 1.5 **≧ 1**
This case **meets** the standard	This case **exceeds** the standard

Process towards decision on the handling of the ALPS treated water

◇Considering the opinions received, **the GOJ will decide its basic policy including measures against possible reputational damage.**

◇Based on the governmental basic policy, TEPCO will determine the specific method and will obtain an approval from the Nuclear Regulatory Commission, and then will start discharge.

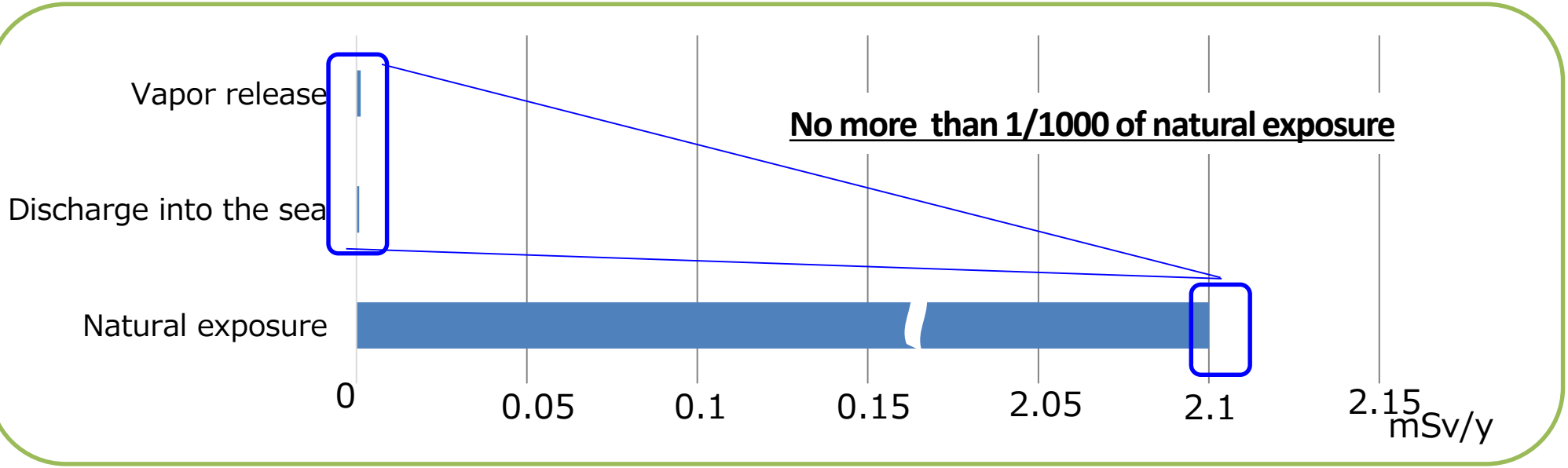


(Ref.) The radiation impact of treated water release

◇**The impact of the radiation to human health as a result of the discharge is considerably small.**

- ✓ Even if the entire amount of the ALPS treated water containing tritium and other radioactive material were to be disposed of in one year*, the impact would be **no more than 1/1000 of the exposure impact of natural radiation** in Japan.

Comparison of radiation impacts from natural exposure and discharge of whole treated water in one year*



- Based on a UNSCEAR-specified method.
- All volume of the ALPS treated water stored in tanks is discharged in one year, and similar amounts are discharged during following 100 years.
- The treated water contains 860 trillion Bq of tritium and the other radionuclides

(Ref.) Simulation of diffusion (TEPCO's draft study report March 24, 2020)

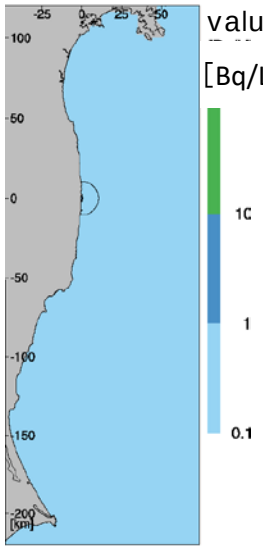
Vapor release

- There is no diffusion simulation model available for vapor.
  - i. Simple evaluation is difficult: It requires consideration of morphological changes in vapor due to weather conditions, advection caused by groundwater or rivers, re-release, and transpiration from plants
  - ii. Knowledge of continuous simulation is not available

Discharge into the sea

22 Trillion Becquerel / year

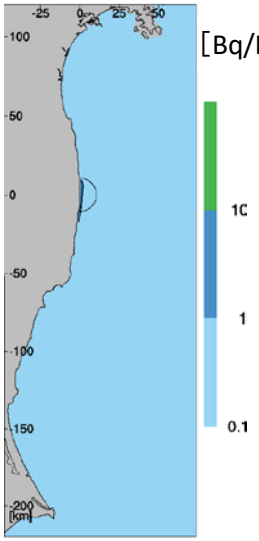
* The same amount as the operational standard value set before the accident



Area above 1 Bq/L

- To about 1.5 km to the north
- To about 1.5 km to the south
- To about 0.7 km to offshore

100 Trillion Becquerel / year



Area above 1 Bq/L

- To about 10 km to the north
- To about 20 km to the south
- To about 2 km to offshore

– Areas where the tritium concentration exceeds its background level (0,1 to 1 Becquerel/Litre) are limited around the Fukushima Daiichi NPS

– The level of tritium concentration around the NPS is far lower than that set by WHO drinking water guideline (10,000 Bq/L)

(Ref.) What are the IAEA's findings on the disposal options of the ALPS treated water ?

Statements made by IAEA Director General Rafael Grossi in February 2020:

"The IAEA considers the disposal options (discharge into the sea and vapor release) as technically feasible and in line with international practice."

"Once a decision is taken on the way forward, the IAEA would be ready to assist in its implementation, for example in radiation monitoring. It could help provide reassurance to the public – in Japan and elsewhere – that any releases of water would be within international standards."

IAEA Review Report on the ALPS Subcommittee Report etc. (2 April 2020)

- The two options selected (discharge into the sea and vapor release) are technically feasible and would allow the timeline objective to be achieved. *(Acknowledgement 4)*
- The IAEA Review Team also notes that the ALPS treated water will be further purified as necessary to meet the regulatory standards for discharge before dilution. *(Acknowledgement 4)*
- The IAEA Review Team is not aware of a solution currently available for the separation of tritium commensurate with the concentration and the volume of ALPS treated water. *(Acknowledgement 3)*
- The IAEA Review Team holds the view that a decision on the disposition path for the stored ALPS treated water must be taken urgently, considering safety aspects and engaging all stakeholders. *(Advisory Point 1)*

Photo Credit: Dean Calma / IAEA

Fukushima Status Update at IAEA website https://www.iaea.org/newscenter/focus/fukushima/status-update