

Information Circular

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Communication received from the Permanent Mission of Japan to the Agency

1. On 18 August 2023, the Secretariat received a Note Verbale from the Permanent Mission of Japan to the Agency.
2. As requested, the Note Verbale and its attachment are herewith circulated for the information of all Member States.

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The Permanent Mission of Japan to the International Organizations in Vienna presents its compliments to the Secretariat of the International Atomic Energy Agency and has the honour to convey, as attached, Japan's document in response to the feedback from the People's Republic of China and the Russian Federation with regard to the the ALPS-treated water at the Fukushima Daiichi Nuclear Power Station, which was contained in INFCIRC/1113.

In this regard, the Permanent Mission of Japan requests the Secretariat to circulate this Note with the enclosed attachment as an Information Circular (INFCIRC) to all Member States.

The attached document contains detailed technical information related to the aforementioned feedback by the People's Republic of China and the Russian Federation. The Permanent Mission of Japan believes that this document will help Member States to obtain clearer science-based understanding of the issue, as was the case with Japan's previous documents on the issue. The Permanent Mission of Japan would also like to draw Member States' attention to the background of the issue described in the introductory part of the attached document.

The Permanent Mission of Japan to the International Organizations in Vienna avails itself of this opportunity to renew to the International Atomic Energy Agency the assurances of its highest consideration.

18 August 2023
Vienna
Secretariat of the International Atomic Energy Agency



Japan's Response to the Feedback from the People's Republic of China and the Russian Federation

This is a document prepared in response to the feedback from the People's Republic of China and the Russian Federation contained in IAEA INFCIRC/1113 dated 27 July 2023.

In May 2022, the Government of Japan received joint questionnaires with 36 questions from the People's Republic of China and the Russian Federation concerning the planned discharge of ALPS treated water at the Fukushima Daiichi Nuclear Power Station (FDNPS). Japan replied with a 49-page document, which was sent directly to the People's Republic of China and the Russian Federation, and was also posted on the IAEA website available to the international community ([INFCIRC/1007 dated July 21, 2022](#)). In that response, Japan asked the People's Republic of China and the Russian Federation to provide information on their own measures in order to learn from practices of other countries, but Japan has yet to receive answers to these questions. **Japan hopes that the People's Republic of China and the Russian Federation will engage in interactive scientific discussions.**

In November 2022, the Government of Japan received feedback from the People's Republic of China and the Russian Federation. Japan gave serious consideration to it, prepared a detailed response, and provided it to the People's Republic of China and the Russian Federation in May 2023, which is also available on the IAEA website ([INFCIRC/1084 dated May 5, 2023](#)). Overall, the feedback from the People's Republic of China and the Russian Federation contained many ambiguous statements and questions unsupported by any scientific evidence, which seemingly ignored Japan's responses to the prior questionnaires.

Unfortunately, the People's Republic of China has continued to spread scientifically unfounded claims that take no account of the information and explanations provided by the Government of Japan on various occasions. The Government of Japan has repeatedly offered to hold bilateral meetings with Chinese experts as part of its continued effort to promote understanding of the safety of the discharge of ALPS treated water, but this meeting has not taken place.

It is against this background that Japan recently received further feedback from the People's Republic of China and the Russian Federation. Regrettably, it contains a number

of one-sided statements and questions that reflect an unwillingness to accept well-documented scientific fact, or authoritative analysis from independent international sources. Japan has nonetheless sought to engage constructively with the feedback in its detailed responses below, focusing on those aspects raising substantive scientific issues. The responses below contain Japan's answers to all the questions included in the feedback from the People's Republic of China and the Russian Federation (INFCIRC/1113) - Section I (Q1 to Q5, Q8 to Q10, and Q12 to Q16), and Section II (Q2, Q5 to Q6, Q8 to Q12, and Q19 to Q20).

As Japan has repeatedly made clear, including in its responses to the prior questionnaires, it will take all possible measures to ensure the safety of the discharge of the ALPS treated water, and it will not conduct any discharges that would endanger human health and the environment around the world.

Confirming this, **the IAEA published its Comprehensive Report on 4 July 2023, summarizing the outcomes of its rigorous two-year review to assess the safety of the planned discharge of ALPS treated water into the sea. The Comprehensive Report has concluded that (a) the approach to the discharge of ALPS treated water into the sea, and the associated activities by TEPCO, NRA, and the Government of Japan, are consistent with relevant international safety standards, and (b) the discharge of the ALPS treated water, as currently planned by TEPCO, will have a negligible radiological impact on people and the environment.**

This Comprehensive Report is the conclusion of the IAEA, which is authorized under its Statute to establish and apply international safety standards in the field of nuclear energy.

While undergoing the IAEA's rigorous review, Japan has been thoroughly explaining the safety of the ALPS treated water to the international community, based on scientific evidence in a transparent manner. Japan will continue to do so.

Joint Questionnaire's Section I. Concerning the Disposal of the ALPS Treated Water

[Japan's Answer to Question 1]

This question concerns 1) the suggestion from the People's Republic of China and the Russian Federation that water be stored at the FDNPS site indefinitely, 2) a claimed contradiction between Japan's statements that the ALPS treated water is "drinkable" and statements that there were risks in transporting ALPS treated water, and 3) the argument that discharge from FDNPS is different in kind compared to discharges from operating reactors.

With respect to point 1) above, the question about the need for disposal of the water in the ALPS treated water storage tanks has already been addressed in Japan's previous response. Our response in summary was as follows:

- There is insufficient additional storage capacity in existing tanks (97% full);
- Constructing more storage tanks is not feasible at the FDNPS, as all available space for tanks at the site is already occupied and the decommissioning process requires utilization of large sections of land for facilities for removal of fuels and debris;
- Expansion of the site is not possible, either, as the land surrounding FDNPS is already being used for storage of decontaminated soil from Fukushima Prefecture and cannot be used for any other purpose; and
- Use of storage tanks in the long term is dangerous, as the surrounding areas are prone to earthquakes, which would put tank integrity at risk.

Accordingly, the IAEA concluded that continued storage of the water in above-ground tanks "can only be a temporary measure while a more sustainable solution is needed."¹ In 2013, the IAEA began sounding an alarm about the lack of feasibility of above-ground storage and calling upon Japan to come to a decision on the most appropriate means of emptying the tanks and disposing of the stored water.² This advice was repeated in

¹ Mission Report, IAEA International Peer Review Mission on Mid-and-Long-Term Roadmap Towards Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station Units 1-4 (Fourth Mission) (5–13 November 2018), IAEA (31 January 2019) (hereinafter, "Fourth IAEA Mission Report"), available at: <https://www.iaea.org/sites/default/files/19/01/missionreport-310119.pdf>. See also Mission Report, IAEA International Peer Review Mission on Mid-and-Long-Term Roadmap Towards Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station Units 1-4 (Third Mission) (9–17 February 2015), IAEA (13 May 2015) (hereinafter, "Third IAEA Mission Report"), Advisory Point 13, available at: <https://www.iaea.org/sites/default/files/missionreport130515.pdf>.

² See Mission Report, IAEA International Peer Review Mission on Mid-and-Long-Term Roadmap Towards the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station Units 1-4 (First Mission)

subsequent IAEA reports, dated 31 January 2019 and 2 April 2020, which described as “urgent” the need for Japan to come to a decision on disposal of the water other than storage in tanks³. Japan agreed with the IAEA’s advice and decided against long-term storage of the water in tanks.

With respect to point 2) above, when discharged and diluted (for tritium), ALPS treated water will meet both Japanese regulatory standards based on relevant international standards. In other words, tritium levels in the treated water and diluted water will be below those considered safe for drinking. Meanwhile, it is not the practice of any country to drink the water discharged from nuclear facilities.

As a result of its comprehensive assessment, the IAEA has concluded in its Comprehensive Report that (a) the approach to the discharge of ALPS treated water into the sea, and the associated activities by TEPCO, NRA, and the Government of Japan, are consistent with relevant international safety standards, and (b) the discharge of the ALPS treated water, as currently planned by TEPCO, will have a negligible radiological impact on people and the environment.

To be more specific, the IAEA also concludes that the discharge permitted by the Nuclear Regulation Authority (NRA) would result in exposures more than 1,000 times lower than the relevant human health standards, and more than 1,000,000 times lower than internationally accepted reference standards for marine animals.⁴

In addition, there is no contradiction between the safety of ALPS treated water and the risks of transport. As described in Japan’s previous response, the risks associated with the transport are for water before treatment and dilution with seawater.

With respect to point 3) above, numerous operating nuclear facilities around the world, including nuclear reactors in the People’s Republic of China, discharge more tritium on

(15–22 April 2013), IAEA (22 May 2013) (hereinafter, “First IAEA Mission Report”), §§ 3.1.1, 3.2.2.3, Advice 9, available at: <https://www.iaea.org/sites/default/files/missionreport220513.pdf>. See also Third IAEA [Mission Report](#), p. 15, Advisory Point 13

³ [Fourth IAEA Mission Report](#), Advisory Point 1 See also IAEA April 2020 Review Report, Advisory Point 1

⁴ See “IAEA Comprehensive Report on the Safety Review of the ALPS-treated Water at the Fukushima Daiichi Nuclear Power Station” (hereinafter “Comprehensive IAEA Report”) at p. 83-84, available at https://www.iaea.org/sites/default/files/iaea_comprehensive_alps_report.pdf

an annual basis than the tritium contained in ALPS treated water from FDNPS. For instance, the amount of tritium to be released annually from FDNPS is approximately 1/10 (one-tenth) of the amount of tritium released from Qinshan Nuclear Power Plant in the People's Republic of China⁵.

Non-tritium nuclides will be discharged from FDNPS in concentrations below applicable domestic standard based on international standards and therefore also will not have an adverse effect on people or the environment.

The discharges of ALPS treated water thus share the same characteristics inherent in the discharges of nuclides from operating nuclear facilities around the world: All such discharges contain tritium, and other nuclides at levels below regulatory standards. The source of the nuclides - whether from an accident as at FDNPS or from normal operations - is irrelevant to the analysis of the safety impacts of the discharge of the nuclides. What matters is what nuclides are in the discharge, and in what concentrations, not where the nuclides came from.

Rigorous testing of the discharges from FDNPS will ensure that no nuclides will be discharged that have not been tested on a batch by batch basis, and found to be present, if at all, in concentrations below regulatory standards. As has been repeatedly explained in Japan's previous response, TEPCO's selection of nuclides to be measured and assessed was fully reviewed by the NRA and the IAEA, and was approved by the NRA after modifications were made to take into account their observations and recommendations. In light of the half-life effects for 12 years after the 2011 accident, the number of nuclides that possibly exist before treatment by ALPS is 29. As a result of its independent analysis and corroboration of ALPS treated water, the IAEA and third-county laboratories detected no nuclides in significant quantity other than those 29 nuclides (and tritium) subject to measurement and assessment. For these reasons, the IAEA's safety review has noted that the selection of the specified 29 nuclides to monitor in the tanks is appropriate.

Radioactive materials other than tritium are essentially removed by ALPS and other systems until the concentration level is below the regulatory standards. Tritium, which cannot be removed by ALPS, will be diluted with seawater until the concentration falls

⁵ China Nuclear Energy Yearbook 2022

below the regulatory standards.

The safety of the water discharged from nuclear facilities, including nuclear power stations, is judged on the basis of whether the aggregate amount or concentration of radionuclides contained in the water *to be discharged* is or is not below regulatory standards. The IAEA reviewed the safety of the ALPS treated water based on these standards, and found that the planned discharge of the ALPS treated water will not harm people or the environment, including the marine environment, as demonstrated in its Comprehensive Report.

[Japan's Answer to Question 2]

This question concerns 1) the reason why the option of vapor release was not selected as a method for disposal of treated water, and the claimed feasibility and desirability of vapor release as an alternative option, 2) the claim that “water released during the normal operation of a nuclear power plant and water from a nuclear accident are different”, and 3) the suggestion that there should be limits for the total amount and concentration of nuclides to be discharged other than tritium.

With respect to point 1) above, as has been explained in Japan's previous response, the discharge into the sea was selected because it can be implemented more reliably as it has a proven track record in domestic and overseas nuclear facilities, it is easy to forecast the diffusion behavior, and it is the easiest for monitoring of any potential impact on the environment. Japan's previous response fully explains the reasons why the option of discharge into the sea was selected and that of vapor release was not (page 5-6)⁶. The claim that “Japan's choice of ocean discharge is largely based on the consideration of economic cost” is totally unfounded, not based on evidence, and does not reflect the values that the Government of Japan cherishes when it comes to protecting human health and the environment. Through its extensive reviews, the IAEA has described Japan's analysis as “sufficiently comprehensive” and its decision as “technically feasible and in line with international practice”.

With respect to point 2) above, the claim that “water released during the normal operation of a nuclear power plant and water from a nuclear accident are different”, please see the responses to Part 1 Question 1. As demonstrated there, international safety standards do not distinguish between water released from normal operation, and water from a facility that has suffered an accident. This is because what matters is the content of the water to be discharged, not its source. The IAEA has confirmed in its Comprehensive Report that *the planned discharge of the ALPS treated water from FDNPS will not harm people or the environment, including the marine environment.*

⁶ Page 5 of Japan's previous response states with respect to vapor release:

- “part of the vapor is re-evaporated into the air after falling onto the land. Thus, it is difficult to forecast the diffusion behavior of vapor release, which poses difficulties in considering measures such as a monitoring system.”

- “Furthermore, it is expected that the variation in monitoring results, which depends on climate conditions such as rainfall and wind direction, is wider than that of discharge into the sea. Therefore, in light of adverse impacts on the reputation, careful consideration will be required for release conditions, such as diluting sufficiently to make the vapor's concentration lower than the regulatory standard.”

With respect to point 3) above, regarding the annual discharge limits for nuclides other than tritium, Japan does not consider it necessary to set such limits because Japan will ensure that the ALPS system reliably removes nuclides other than tritium below the regulatory standards before any individual batch of ALPS treated water is discharged. This will be ensured through comprehensively sampling each batch of ALPS treated water prior to beginning the dilution and discharge of that water.

In this respect, the IAEA states in its Comprehensive Report (pp. 25⁷) that “the total amount of tritium, Carbon-14 and Iodine-129 to be released each year in the discharge of ALPS treated water will be well below the amount of these radionuclides produced by natural processes each year, such as interaction of cosmic rays with gases in the upper atmosphere.” The IAEA also states that “The global inventory due to natural processes of Carbon-14 is estimated to be around 1 PBq (1,000 TBq). The amount of Carbon-14 in the ALPS treated water to be released each year is about 2 GBq (0.002 TBq), which is about 500,000 times lower than the global inventory due to natural processes” and that “(i)t is estimated that the global inventory of I-129 due to natural processes in the hydrosphere (primarily oceans) is about 1 TBq. The amount of I-129 to be released in the treated water each year is 30-300 MBq. This is about 3,000-30,000 times lower than the steady state inventory of naturally occurring I-129 in all of the oceans.” (pp. 26⁸)

Furthermore, the Government of Japan reiterates that should a problem be detected during the monitoring process such as detection of unusual value of concentration of the radioactive materials, Japan will take appropriate measures, including immediate suspension of the discharge, as stipulated in the implementation plan reviewed by the IAEA.

⁷ See pp.25 of the IAEA Comprehensive Report available at:
https://www.iaea.org/sites/default/files/iaea_comprehensive_alps_report.pdf#page=35

⁸ See pp.26 of the IAEA Comprehensive Report available at:
https://www.iaea.org/sites/default/files/iaea_comprehensive_alps_report.pdf#page=36

[Japan's Answer to Question 3]

This question concerns the claim that Japan's verification tests of the ALPS system are insufficient and that the reliability of the ALPS system to treat the large amount of water with many different nuclides is questionable.

The ALPS performance has been approved by the NRA, an independent regulator of Japan. Since 2019, the ALPS system has functioned stably and effectively enough to purify the water to meet the regulatory standards.

The IAEA report issued on 31 May 2023 concluded that neither the IAEA nor the participating third-country laboratories detected any additional radionuclides (i.e. radionuclides beyond 29 nuclides and tritium) at significant levels, and that Tokyo Electric Power Company (TEPCO) has demonstrated that it has a sustainable and robust analytical system in place to support the ongoing technical needs at FDNPS during the discharge of ALPS treated water⁹. These findings were presented again in the IAEA Comprehensive Report.

Finally, no discharges of ALPS treated water will be made from any tank to the sea unless the water from that tank meets the discharge standards instituted by the NRA and reviewed by the IAEA as part of its safety review. Because every batch will be tested, and actual concentration levels will be determined, there will be no need to estimate or project the nuclide concentrations in any batch before discharge. Thus, the ALPS system is more than sufficient to meet international and national safety standards.

⁹ See pp.iii of the IAEA Review of Safety Related Aspects of Handling ALPS-Treated Water at TEPCO's Fukushima Daiichi Nuclear Power Station, available at IAEA Website: https://www.iaea.org/sites/default/files/first_interlaboratory_comparison_on_the_determination_of_radio_nuclides_in_alps_treated_water.pdf#page=9

[Japan's Answer to Question 4]

This question concerns the request for additional information of early warning level for four different stages of the discharge process, namely inlet of ALPS, outlet of ALPS, the measurement/confirmation facility and the discharge vertical shaft, and the environment. This question also requests information on measurement methods and concentration ratios of seven major radionuclides to total α and β at the entrance and the exit of the ALPS facility.

The following is an answer to the question about the warning level at the measurement/confirmation facility. Answers to the questions about the warning level at the other points are unnecessary because (a) inlet and outlet of ALPS are not directly connected with the discharge point and therefore there is no need to set a warning level for them, and (b) the amount or concentrations of the nuclides in the discharge shaft cannot be more than what is found in the upstream measurement/confirmation facility. Information on the warning level for environmental monitoring is already provided in Japan's previous response.

After the treated water is transferred from the outlet of the ALPS to the facility for measurement and confirmation before the discharge into the sea, the pre-discharge monitoring (source monitoring) will confirm that the concentration of all nuclides to be measured and assessed except tritium are below regulatory standards. The water will not be discharged without this confirmation.

The target nuclides and their regulatory standards are as shown in the Table below, and the calculation method for the confirmation is shown in Equation 1-1.

Table: Target nuclides and their regulatory concentration limits

	Target nuclides (Physical half life)	Regulatory concentration limit (Bq/L)
1	C-14 (approx.5700Years)	2.0E+03
2	Mn-54 (approx.310Days)	1.0E+03
3	Fe-55 (approx.2.7Years)	2.0E+03
4	Co-60 (approx.5.3Years)	2.0E+02
5	Ni-63 (approx.100Years)	6.0E+03

6	Se-79 (approx.300,000Years)	2.0E+02
7	Sr-90 (approx.29Years)	3.0E+01
8	Y-90 (approx.64 Hours)	3.0E+02
9	Tc-99 (approx.210,000Years)	1.0E+03
10	Ru-106 (approx.370Days)	1.0E+02
11	Sb-125 (approx.2.8Years)	8.0E+02
12	Te-125m (approx.57 Days)	9.0E+02
13	I-129 (approx.16M Years)	9.0E+00
14	Cs-134 (approx.2.1Years)	6.0E+01
15	Cs-137 (approx.30Years)	9.0E+01
16	Ce-144 (approx.280Days)	2.0E+02
17	Pm-147 (approx.2.6Years)	3.0E+03
18	Sm-151 (approx.90Years)	8.0E+03
19	Eu-154 (approx.8.6Years)	4.0E+02
20	Eu-155 (approx.4.8Years)	3.0E+03
21	U-234 (approx.250,000Years)	2.0E+01
22	U-238 (approx.4.5B Years)	2.0E+01
23	Np-237(approx.2.1MYears)	9.0E+00
24	Pu-238 (approx.88Years)	4.0E+00
25	Pu-239 (approx.24000Years)	4.0E+00
26	Pu-240 (approx.6600Years)	4.0E+00
27	Pu-241 (approx.14Years)	2.0E+02
28	Am-241 (approx.430Years)	5.0E+00
29	Cm-244 (approx.18Years)	7.0E+00

※Half-life shows in 2 significant digits referring to ICRP Publication 107 “Nuclear Decay Data for Dosimetry Calculations”

$$\sum_i \frac{C_{i,ALPS}}{C_{i,limit}} < 1 \quad (1-1)$$

$C_{i,ALPS}$: Concentration of nuclide i in ALPS treated water

$C_{i,limit}$: Ratio of the concentration of each radionuclide to the regulatory concentration of nuclide i

With respect to the question about the concentration ratios of seven major radionuclides to total α and β at the entrance and the exit of the ALPS facility, the relevance of the

question is not clear to Japan. Japan would like to be briefed about the concerns in more detail and discuss the matter in an individual expert meeting that Japan has proposed to the People's Republic of China.

Regarding information about the mechanism for emergency shutdown, Japan provides the relevant information as follows:

- Radiation monitors are also installed in the transfer piping to connect the measurement/confirmation facility and the discharge vertical shaft. The radiation monitors are in place to ensure the emergency shutdown at approximately 60 cps (count per second), which is 10 times the background level of approximately 6 cps.
- The concentration in the discharge vertical shaft is determined on a real-time basis by calculation based on the tritium concentration before the dilution in the measurement and confirmation facility and the flow rate of ALPS treated water and seawater for dilution. If an event occurs that may cause the tritium concentration to exceed the pre-determined value, such as seawater pump shutdown, failure of ALPS treated water or seawater for dilution flow meter, or ALPS treated water flow rate exceeding the planned level, the emergency isolation valve will be closed, and the discharge will be stopped.
- The ALPS treated water flow rate set for emergency shutdown depends on the tritium concentration before dilution, as shown in Equation 1-2.

$$F_{ALPS,HL} = \frac{F_{SW} \times C_{H3,diluted}}{C_{H3,ALPS} - C_{H3,diluted}} \quad (1-2)$$

$F_{ALPS,HL}$: The ALPS treated water flow rate set for emergency shutdown

F_{SW} : Actual seawater flow rate measured value (continuous measurement)

$C_{H3,diluted}$: Tritium concentration after seawater dilution (1,400 Bq/L as a management value)

$C_{H3,ALPS}$: Tritium concentration in ALPS treated water (differs between the tank groups)

[Japan's Answer to Question 5]

This question concerns the claimed inadequacy of homogenization tests of the treated water in the tanks and the need to select more than one reagent to verify the homogenizations.

As explained in Japan's previous response, the K4 tank group circulation/agitation demonstration test by TEPCO in February 2022 used sodium tertiary phosphate as the reagent, and TEPCO confirmed the tank group as a whole was well supplied with phosphoric acid. In addition, TEPCO conducted another K4 tank group circulation/agitation demonstration test in July 2022, confirming the behavior of seven major nuclides as a precaution. Although TEPCO conducted this test with sodium tertiary phosphate as the reagent, TEPCO confirmed that concentration discrepancies and the water quality throughout all the tanks was homogeneous.

The IAEA's Comprehensive Report states that "IAEA has concluded that the activities and approach taken by TEPCO and NRA are consistent with the relevant international safety standards" and "IAEA has found TEPCO's methodology to achieve homogeneity and thus representative samples to be appropriate"¹⁰.

¹⁰ See p. 94 of the IAEA Comprehensive Report available at:
https://www.iaea.org/sites/default/files/iaea_comprehensive_alps_report.pdf#page=104

[Japan's Answer to Questions 8 & 9]

The questions concern 1) the quality assurance and credibility of the monitoring results, and 2) the need for external supervision in regard to monitoring.

With regard to point 1) above, Japan's previous response fully explains the quality assurance of monitoring by TEPCO, the Government of Japan, and domestic third-party laboratories. In addition, Japan would like to provide the following information:

The IAEA and several third-country laboratories selected by the IAEA analyzed the samples of treated water taken in March 2022 from the K4-B tank group, and compared them with, and thereby corroborated, the results of analysis of the same samples by TEPCO and the domestic third-party organizations (Inter-Laboratory Comparison: ILC). As a result, the IAEA concluded in its First Report on the ILC published dated 31 May 2023 and in its Comprehensive Report that "(t)hese findings provide confidence in TEPCO's capability for undertaking accurate and precise measurements related to the discharge of ALPS treated water. Furthermore, based on the observations of the IAEA, TEPCO has demonstrated that it has a sustainable and robust analytical system in place to support the ongoing technical needs at FDNPS during the discharge of ALPS treated water".

With regard to point 2) above, the Government of Japan is of the view that the independent analysis and corroboration activities by the IAEA and third-country laboratories will assure the quality of, and provide confidence in, the results of Japan's source monitoring and environmental monitoring. As clearly mentioned in the IAEA Comprehensive Report, the IAEA review and monitoring will continue after the start of the ALPS treated water discharge. As part of the review, ILCs of the ALPS treated water prior to discharge and of the samples in the marine environment after the discharge will be conducted involving third-country laboratories.

The Government of Japan is of the view that the participation of the third-country laboratories as part of the IAEA review will ensure the credibility and transparency of Japan's monitoring. Japan is confident that the IAEA will make its own independent and professional decision on the selection of capable third-country laboratories for these corroboration activities based on a well established procedure of the IAEA. Japan respects the IAEA's decision in this regard, and therefore is of the view that Japan's individual invitation of stakeholders for monitoring is unnecessary.

[Japan's Answer to Question 10]

This question states that 1) the participation of Chinese and Russian experts in the IAEA Task Force is not sufficient and that 2) the People's Republic of China and the Russian Federation should be able to participate directly in third-party monitoring in accordance with relevant provisions of the United Nations Convention on the Law of the Sea (UNCLOS) and of IAEA Safety Standards.

With respect to point 1) above, as stated in Japan's answer to Questions 8 & 9 above, the Government of Japan is of the view that the independent analysis and corroboration activities by the IAEA and third-country laboratories will assure the quality of, and provide confidence in, the results of Japan's source monitoring and environmental monitoring.

As has been explained in Japan's previous response, every discharge of ALPS treated water into the sea will be tested to verify that no nuclides will be discharged in concentrations greater than the regulatory standards.

Japan would also like to reiterate that the IAEA concluded after its rigorous two-year review, which involved independent international experts and third-country laboratories, "that its findings provide confidence in TEPCO's capability for undertaking accurate and precise measurements related to the discharge of ALPS treated water. The IAEA also finds that TEPCO has demonstrated that it has a sustainable and robust analytical system in place to support the ongoing technical needs at FDNPS during the discharge of ALPS treated water." (Comprehensive Report p. 114.)

Furthermore, as the Comprehensive Report clearly demonstrates, the IAEA will continuously review procedures and results of Japan's relevant measurements including monitoring after the discharge starts (pp. 111-116). The review by the IAEA will include periodic review missions to Japan (pp. 112), and real time monitoring and display of data for the public to ensure the ongoing reliability of the discharge facilities (pp. 115). Should a problem be detected during the monitoring process such as detection of unusual value of concentration of the radioactive materials, Japan will take appropriate measures, including immediate suspension of the discharge, as stipulated in the discharge plan reviewed by the IAEA.

That said, as stated in Japan's answer to Questions 8 and 9 above, the Government of

Japan is of the view that the participation of the third-country laboratories as part of the IAEA review will ensure the credibility and transparency of Japan's monitoring. Japan is confident that the IAEA will make its own independent and professional decision on the selection of capable third-country laboratories for these corroboration activities.

With regard to point 2) above, Japan has taken all measures necessary to comply with Article 194 of UNCLOS and international safety standards (GSR 3.124). The discharges will not cause damage by pollution to other States or the marine environment. As the IAEA found in its Comprehensive Report "the REIA produced by TEPCO and reviewed by NRA has demonstrated that the dose to representative persons in neighbouring countries will be undetectable and negligible." (Comprehensive Report, p. 25.) Similarly, "radiological impact on animals and plants in the sea by the discharge of ALPS treated water under normal operations is negligible." (Comprehensive Report, p. 28.) Finally, the IAEA concluded that "activity concentrations in international waters will not be influenced by the discharge of ALPS treated water into the sea and the transboundary impacts are therefore negligible." (Comprehensive Report, p. 80.)

With regard to Paragraph 5.99 of IAEA Safety Standards GSG-9, Japan has systematically tried to address the concerns expressed by third States, including through bilateral exchanges of information, and through frequent briefings to broad groups of Embassy officials in Tokyo. In addition, the Government of Japan has provided individual briefing sessions to countries and regions which have expressed particularly keen interest, and currently maintains dialogues with interested parties such as the Republic of Korea and Pacific Island countries.

With regard to the People's Republic of China, Japan repeatedly proposed individual briefing sessions to Chinese nuclear experts as well as government officials with a view to engaging in scientific discussion and promoting China's understanding of the matter. These offers are in line with Japan's commitment to ensuring maximum transparency with regard to the safety of the planned discharge. It is regrettable that such meetings have yet to be realized.

[Japan's Answer to Question 12]

This question concerns the radiation monitors installed in the multinuclides transfer facility building for the dilution of ALPS treated water, and the request for information on detection limits for nuclides and ways to prevent accidental discharge. This question also complains that Japan's previous answer only depicts the limit of Cs-137 detected by radiation monitor.

First, Japan would like to make it clear that the radiation monitors installed in the relevant facilities are designed to ensure that, if alarm value is detected, an emergency shutoff signal is sent and the emergency isolation valve is activated. For this reason, limits for individual nuclides are not established.

As shown in Japan's answer to Question 4 above, the system is designed for emergency shutdown in multiple steps, and the water will not be discharged unless it is confirmed that the nuclides other than tritium are below the regulatory standards prior to the dilution. In other words, the water that exceeds a regulatory standard cannot proceed to the transfer facility. However, in the unlikely event that high concentration radioactive materials flow into the transfer piping, the radiation monitors will detect it, and the system will stop the discharge to the ocean in an emergency. The distance from the radiation monitor to the emergency isolation valve is about 1 km. The emergency isolation valve will close before it reaches the emergency isolation valve, and no discharge will be made into the sea.

[Japan's Answer to Question 13]

This question concerns four matters related to the environmental monitoring, i.e., 1) supervising department of the implementation of the government's monitoring programme, 2) the types of nuclides monitored for seawater, sediments and aquatic organisms, 3) the request for specific information on monitoring I-129 and C-14, and 4) the role of Japan's experts meeting established for sea area monitoring.

With respect to point 1) above, the NRA, the Ministry of the Environment, the Fisheries Agency, and Fukushima Prefecture have been conducting and will continue to conduct monitoring as supervision departments under the government's Comprehensive Radiation Monitoring Plan (CRMP). In this connection, it should be noted that should a problem be detected during the monitoring process such as detection of unusual value of concentration of the radioactive materials, Japan will take appropriate measures, including immediate suspension of the discharge, regardless of which government/local government entity is primarily responsible for the monitoring. The IAEA has reviewed this mechanism and concluded in its Comprehensive Report that: "A clearly defined plan for enhanced environmental monitoring by TEPCO and the Government of Japan to address the discharges of ALPS treated water is in place". (page 94)

As has been repeatedly explained, the Inter-Laboratory Comparison (ILC) has been conducted by the IAEA to confirm the adequacy of radioactivity measurements by analytical laboratories since 2014. Another ILC called "the corroboration of environmental monitoring" has been conducted to corroborate the results of GOJ's sea area monitoring as part of the IAEA's Review since 2022. Third-country institutes, including neighbouring countries, are also participating in these ILCs.

With regard to point 2) above, Japan would like to reiterate that the government's website¹¹ describes the entire scope of the government's sea area monitoring programme including the types of nuclides covered in the monitoring. Regarding the target species of marine organisms, the Ministry of the Environment selects the marine organisms that can be collected, and benthic fish for fish species. The Fisheries Agency has selected Olive flounder as a common fish species, as well as fish species that are important in each region, such as those with large catches.

¹¹ See the government's Monitoring Plan:
https://radioactivity.nra.go.jp/en/contents/17000/16273/24/274_20230412.pdf

With respect to point 3) above, the government's monitoring program covers both nuclides for seawater, C-14 for fish, and I-129 for seaweed.

With respect to point 4) above, the members of the expert meeting for sea area monitoring are selected from among Japanese experts with necessary expertise in environmental engineering, and radiation effects, who are well qualified to provide advice and recommendations to the government in accordance with the terms of reference of the meeting. Furthermore, the IAEA and third-country laboratories will be involved in the corroboration of environmental monitoring data, which further broadens the range of expertise involved in environmental monitoring activities. The Government of Japan does not see any problem in relation to the composition of Japan's expert meeting for sea area monitoring.

[Japan's Answer to Question 14]

This question concerns whether key monitoring samples will be retained after the completion of Japan's measurements in order for stakeholders and neighbouring countries to re-measure the samples.

Japan has fully answered this question in its previous response dated 5 May 2023 (see Japan's Answer 14). Japan's view on the participation of stakeholders and neighbouring countries in monitoring is given in its Answer to Questions 8, 9, and 10 above.

[Japan's Answer to Question 15]

This question concerns 1) how to ensure the safe storage and management of the “waste”, and 2) how to prevent leakage and ensure the disposal of the “waste” in line with international standards. We understand this question to refer to nuclear wastes and not the discharge of ALPS treated water.

With regard to point 1) above, the melted fuel debris from the accident is currently being cooled and managed in the reactor containment vessel, and will be removed and stored in a planned manner in the future. To reduce the risk to the off-site, the extracted fuel debris needs to be stored in a facility that could appropriately contain it. To secure a site to build such a facility, the currently stored ALPS treated water must be discharged into the sea in line with international safety standards so that the storage tanks can be removed and new storage facilities for the melted fuel debris can be built in their place.

With regard to point 2) above, in order to reduce the risk of leakage, flanged tanks have been replaced with welded tanks. In addition, weirs are also constructed around the tanks to prevent leaked water from spilling into the environment. This weir is double, so that even if leaked water overflows the inner weir, it can be contained in the outer weir. Furthermore, radiation detectors are also installed in the drainage channels to detect any leakage.

[Japan's Answer to Question 16]

This question concerns the request for further details of the test methods and quality assurance measures for the impervious performance of the frozen soil wall. While this question is also not related to the discharge of ALPS treated water, Japan's answer is provided below.

The construction of the frozen soil wall has ensured that the water level difference between inside and outside of the frozen soil wall is maintained and at the same time, the redundant measures of sub-drainage and others have progressed to enable stable management of the groundwater level. The results have been evaluated by experts at the Contaminated Water Treatment Committee in March 2018. Specifically, the water level difference between the ground water level inside and outside of the frozen soil wall has increased to 4–5 meters and the contaminated amount was reduced from 520 m³/day before the closure of the frozen soil wall (average of December 2015 - February 2016) to 140 m³/day after the closure of the frozen soil wall (average of December 2017 - February 2018). Since then, there has been progress on various measures and production of contaminated water has been reduced from 540 m³/day in May 2014 before the measures were taken to 90 m³/day in 2022 fiscal year. This track record quantitatively proves the effectiveness of the measures taken by the frozen soil wall.

Joint Questionnaire's Section II. Concerning Radiological Impact Assessment Report Regarding the Discharge of ALPS Treated Water into the Ocean

[Japan's Answer to Question 2]

This question concerns 1) the comment that neighbouring countries such as the People's Republic of China and the Russian Federation should be able to participate in the decision-making process regarding the planned discharge of ALPS treated water into the sea, and 2) the claim that the term "ALPS treated water" is not an "internationally recognized term".

With respect to point 1) above, Japan has fully addressed this question in its previous response dated 5 May 2023 (Japan's Answer II-2) as well as Japan's Answer to Questions 8, 9, and 10 above.

Further, the IAEA in its Comprehensive Report positively noted the efforts that Japan has made to provide information to and engage in consultations with the interested parties including both international and domestic ones, and to conduct significant outreach activities to ensure transparency. (page 97)

With respect to point 2) above, as mentioned in II-2 of Japan's previous response dated 5 May 2023, the ALPS treated water is not "contaminated water" as the concentration of radioactive materials is far below the regulatory standards.-These two terms should not be mixed up. The IAEA too has pointed out that in order to avoid public confusion, there must be a proper understanding of the terminology, and that there is a need to distinguish these terms. The IAEA uses the term "ALPS treated water" in its Comprehensive Report.

[Japan's Answer to Question 5]

This question concerns the request for additional information on the results of the diffusion of adsorbed nuclides and their impact on seafood, especially migratory marine organisms.

The assessment of radiological environmental impacts conducted by TEPCO carefully considered such elements as ocean dispersion, the effect of bioaccumulation and long-term accumulation. Having considered these elements, it concluded that the impact on humans and the environment would be negligible. The IAEA's Comprehensive Report includes an extensive review of TEPCO's REIA, and associated assumptions and technical analyses.

Regarding accumulation in sediments, TEPCO conservatively assumed a direct and immediate equilibrium with seawater and considered the possibility of build-up of radionuclides in the sediment layer. As determined by the IAEA Comprehensive Report at pp. 69, "the approach taken by TEPCO results in a highly conservative approach that is likely to overestimate the annual doses from both the consumption of seafood and external doses for marine sediments". Further, as determined by the IAEA Comprehensive Report at pp. 70, TEPCO has conservatively used concentration factors in their assessment of transfer to marine foods in the aquatic environment. The concentration factors were derived from data compiled by the IAEA, using an approach commonly used to assess activity concentrations in marine foods from discharges of radionuclides to the environment.

Furthermore, the REIA was conducted by setting "the most affected person" who frequents the sea area around the discharge point (10 km×10 km) and consumes marine products which are caught within the area (10 km×10 km). The IAEA has found that "(s)ince the assessment was conducted based on conservative assumptions, there is no significant risk of underestimation. Any person living in the wider area would be far less affected by exposure than the representative person identified in the REIA" (the IAEA Comprehensive Report at pp. 21). And the IAEA has also concluded that "(t)he results of the radiological environmental impact assessment show that the estimated dose to populations in neighboring countries will be negligible." (the IAEA Comprehensive Report at pp. 28)

[Japan's Answer to Question 6]

This question concerns how a representative individual is defined in the assumption of the REIA, and the need for quantitative explanation of the assumption.

As stated in 6-1-2(4) of the REIA, the nearest fish port is 5km north-south from the FDNPS. Since fishery is conducted in the large area centering around the fish port, it is reasonable to assess that a representative person would conduct fishery within a 10 km square area centering around the fish port and consume seafood caught in the area, but the REIA conservatively assumes that the representative person conducts fishery in a 10 km square area centering around the FDNPS and consumes seafood caught in that area. Moreover, although people consume seafood caught both within and outside Japan in normal cases, the REIA assumes that the representative person consumes seafood only caught within the 10km square centering around the FDNPS to make conservative assessments.

In addition, attachment XII of the REIA shows several results of the impact by changing the assessment area of seawater concentration used in the exposure assessment. Although the assessment area is a 10km square around the FDNPS in the main text of the REIA, attachment XII shows that if the assessment area is changed to a smaller 5km square area, exposure assessment value would be $5E-06$ to $9E-05$ mSv/year. These values are higher than in the main text of the REIA, but are significantly below the public dose limit (1mSv/year) as well as dose constraints (0.05mSv/year).

[Japan's Answer to Question 8]

This question concerns the selection of nuclides to be measured and assessed in monitoring and the claim that the water discharged into the ocean by Japan contains the radionuclides not found in conventional nuclear power plants, especially long-lived radionuclides.

Please see Japan's response to Part I, Question 1 above. As demonstrated there, TEPCO's selection of nuclides to be measured and assessed (29 nuclides and tritium) took into account the observations and recommendations of the NRA and the IAEA, and was fully reviewed by both of them.

[Japan's Answer to Questions 9, 10, 11]

The questions concern risk assessment 1) on the combined exposure toxicity of radionuclides and other contaminants, and 2) on the long-term health effects caused by Auger electrons of tritium and carbon-14, and 3) the methodology and results of the assessment on the enrichment of radionuclides in certain foods and their long-term health effects caused by biological chain transfer following the discharge of nuclear contaminated water.

With regard to point 1) above, the relevance is not clear to the Government of Japan. In Japan's previous responses, dated 21 July 2022 and 5 May 2023, Japan requested further clarification from the People's Republic of China and the Russian Federation regarding their questions on the combined exposure toxicity of radionuclides and other contaminants. However, Japan has not received any response.

TEPCO's REIA revealed that to the extent that any chemical substances persisted in the ALPS-treated water, these substances were far below the Japanese regulatory limits set in the Water Pollution Control Law."¹²

With regard to point 2) above, according to the decay diagram shown in ICRP Publication 38 "Radionuclide Transformations - Energy and Intensity of Emissions", neither tritium nor carbon-14 emits Auger electrons, and neither the ICRP nor the IAEA has provided an assessment method to date.

In TEPCO's REIA, the risk from Auger electrons is considered to be one of the uncertainties. In any case, however, the results of the exposure assessments are much smaller than dose limits and dose constraints, and thereby confirm the conclusion of the REIA that the risk from exposure is sufficiently small, even with this uncertainty taken into account.

Significantly, the REIA has been reviewed by the IAEA and the IAEA concluded in its Comprehensive Report that "a REIA has been produced and is compliant with the

¹² See "Radiological Impact Assessment Report Regarding the Discharge of ALPS Treated Water into the Sea (Design stage / Revised version), TEPCO (28 April 2022) (hereinafter, "Revised Second REIA Report"), Attachment II, Section 6, available at:

<https://www.tepco.co.jp/en/hd/newsroom/press/archives/2022/pdf/220513e0101.pdf>

international safety standards” and “the REIA includes the sensitivity of the doses estimated to the representative person and to reference animals and plants for relevant assumptions made by TEPCO. Taking account of uncertainties, the annual doses to the representative person (adult, children and infants) will be far below the dose constraint of 0.05 μmSv per year”.

With regard to point 3) above, this question is a repetition of Question II-5 above. Japan’s answer is provided in response to that question.

[Japan's Answer to Question 12]

This question concerns the process that Japan has followed to invite public comment on TEPCO's REIA and the contents of the comments received.

As indicated in Japan's previous response, TEPCO published in April 2022 the results of the public comments procedures it followed. The details of the public comment procedures and the responses received are available at TEPCO's website.¹³

¹³ TEPCO, "Radiological Environmental Impact Assessment Report Regarding the Discharge of ALPS Treated Water into the Sea (Construction stage / Revised version) ", February 2023, available at <https://www.tepco.co.jp/en/hd/newsroom/press/archives/2023/pdf/230220e0101.pdf#page=264> and <https://www.tepco.co.jp/en/decommission/progress/watertreatment/images/20220428.pdf>.

[Japan's Answer to Question 19]

This question concerns a request for additional information on whether there are water masses with locally elevated level of radionuclides (non-adsorbed and adsorbed nuclides).

As shown in the dispersion simulation of the ALPS treated water into the sea in the REIA, the concentration level of nuclides immediately decreases after the discharge with distance from the FDNPS. There are no water masses where the concentrations of radioactive materials increase. The result of the 7 years concentration calculation used in the simulation does not show that radioactive materials tend to accumulate.

Although the simulation clearly shows that water masses will never remain, Japan is fully committed to suspending the discharge in the event of detecting unusual values of nuclides, and in particular when 700 Bq/L of tritium is detected within 3 km from the FDNPS or 30 Bq/L of tritium is detected within 10 km square in front of the FDNPS in the sea area monitoring.

The IAEA concludes in its Comprehensive Report that “(t)he results of the radiological environmental impact assessment show that the estimated dose to populations in neighbouring countries will be negligible.” (Comprehensive Report at pp. 28) and finds that “(b)ased on the results of the marine dispersion model used by TEPCO, activity concentrations in international waters will not be influenced by the discharge of ALPS treated water into the sea and the transboundary effects are therefore negligible.” (Comprehensive Report at pp. 80)

[Japan's Answer to Question 20]

This question concerns the comment that the People's Republic of China and the Russian Federation should be able to participate directly in third-party monitoring, to which Japan has responded in its Answers to Questions 8, 9, and 10 above. This question also refers to the assessment of the People's Republic of China and the Russian Federation that "TEPCO has had many cases of dishonesty in falsifying data".

Japan strongly disagrees with the questionnaire's characterization of TEPCO, its actions and its reputation. In regard to the discharge of ALPS-treated water into the sea, TEPCO's application to the NRA and REIA underwent strict scrutiny, including by the IAEA, and underwent multiple revisions in response to NRA requirements and IAEA comments, eventually satisfying both the NRA and the IAEA.

Moreover, Japan reiterates that all discharges into the sea will be closely monitored by both the NRA and the IAEA, such that, should a problem be detected during the monitoring process such as detection of unusual value of concentration of the radioactive materials, Japan will take appropriate measures, including immediate suspension of the discharge.