Summary of opinions*	Our reply
The hypothetical source term assumes the effectiveness of secondary treatment by ALPS of radioactive contaminated water in storage tanks at Fukushima, which is not realistic.	It has been proven that the Multi-nuclide Removal Equipment (ALPS) has sufficient performance to remove the 62 nuclides subject to be removed. In the secondary treatment performance test conducted from November to December 2020, a tank was selected from each of the tank groups with relatively high and low concentrations of radioactive materials (J1-C and J1-G tank groups), and secondary treatment was conducted using the additional ALPS on 1,000 m3 of water from each tank (2,000 m3 in total). After secondary treatment, the water was measured and evaluated for the 62 nuclides, tritium, and carbon-14, which are the nuclides to be removed using the ALPS. As a result, it was confirmed that the system has the ability to sufficiently reduce the concentration of these 62 nuclides. Please refer to the following URL for the results. https://www.tepco.co.jp/en/decommission/progress/watertreatment/images/201224.pdf In the daily treatment of contaminated water, after the completion of treatment of water stored in flange tanks (end of FY2018), which structurally have a high risk of leakage, ALPS has been able to reduce the concentration of radioactive materials (other than tritium) contained in water stagnated in the buildings to a level where a single round of treatment is enough to fully meet the regulatory standards. Please refer to the following for information on the performance of ALPS in removing radioactive materials. https://www.tepco.co.jp/en/decommission/progress/watertreatment/images/exit_en.pdf About 70% of the water stored in the Fukushima Daiichi NPS is "Treated water to be re-purified" in which the sum of the ratios to regulatory concentrations limits of nuclides other than tritium do not meet the standards, and requires secondary treatment before discharge, but this is due to (1) equipment trouble immediately after the ALPS operation started, (2) operation prioritizing the activity rate rather than replacing the adsorbent in order to quickly process the high dose Reverse Osmosis Membrane (RO) concentrated salt water that was being stored on site to reduce the dose at the Fukushima Daiichi site boundary, and (3) prioritizing water stored in a flange tank with a high leak risk. Currently, all of the measures (1) above through (3) above have been completed or have met their targets.
The details of radiation in chapter 4-1 should be checked. There were some inaccurate descriptions of the upper limit for the amount of tritium that can be discharged.	We made an error in the English translation, writing 2.2 GBq instead of correct 22 trillion Bq. We will correct it to the accurate figure, 22 TBq.
I think we should seek opinions of foreign institutions.	As described in Reference E of this report, since the publication of this report on November 17, 2021, we have explained the discharge plan (including in online formats) to diplomatic missions in Tokyo and the media, in addition to domestic entities. We have provided individual explanations to interested countries and regions and carefully answered questions we received. We have also provided explanations and exchanged opinions through our overseas offices. In addition, as for the saftey of ALPS treated water, we have been receiving reviews from a team of international experts based on the request from the GOJ to the IAEA. Since the publication of this report on November 17, 2021, we have also visited embassies in Japan to provide explanations, have been explaining the report through our overseas offices, and have received a variety of opinions. We will respond to these opinions with sincerity.
I think it would be more appropriate to include in the optimization the risks associated with continuing to store treated water without implementing ocean discharge. I think it would be more accurate to clarify that this is not a measure to ensure little increase in risk, but rather a more proactive measure to reduce overall risk.	As you pointed out, the discharge of ALPS treated water needs to be understood in the context of optimizing the overall risk associated with decommissioning, so we have revised the description as such. Please see Chapter 1. in the revised REIA report.
Concerns have been expressed by foreign countries about this discharge into the sea. It says that the annual average tritium concentration is calculated for an area of 10 km x 10 km around the power station, but what about the impact on a wider area, even if it is diluted?	The average concentration of seawater in a 10 km square centered on the Fukushima Daiichi NPS was used for the exposure assessment, and the modeled area for the tritium dispersion simulation is 490 km x 270 km (see 6-1-2, (2) in the revised REIA report). In this simulation, the impact was evaluated to be very small even within the model range, and the result of the assessment at the model boundary (maximum 1.6E-04Bq/L) found that the maximum annual average concentration at the boundary of the calculation area of the simulation is sufficiently low(See Revision 6-1-3.(1) in the revised REIA report) compared to the tritium concentration in seawater around Japan (about 0.1 to 1 Bq/L), and the tritium concentration in the sea water outside the boundary is even lower by further dispersion. Therefore, we believe that the modeled area is sufficient for this assessment. In this assessment, the average concentration in a 10 km square area centered on the Fukushima Daiichi NPS was used for the calculation, mainly for the following reasons. ・The ”representative person”, a subject of this assessment, is assumed to be those being engaged in fishing industry. The nearest fishing port (Ukedo fishing port in Namie Town) is more than 5 km away from the power station. In addition, it is assumed that fishery operations will make extensive use of the sea area around the power station, including transportation. ・In addition, there is no fixed area where marine organisms inhabit the surrounding sea area, or where fishing takes place, and it is thought that they can move in various ways. Outside this 10 km square, there are areas where the concentration of radioactive materials in seawater is lower than that inside the square. One of the comments we received was that we should use a wider range. However, if we include a wider range than the range used in this report, the average concentration of radioactive materials will be lower than that used in this report, and the evaluation results will be smaller than those presented in this report. In the revised REIA report, in addition to 10 km x 10 km, we evaluated 5 km x 5 km as narrower area and 20 km x 10 km as wider area. The results were approximately 2 to 3 times lower at 5 km x 5 km than at 10 km x 10 km, and only slightly lower at 20 km x 10 km, both well below the dose limit for the general public of 1 mSv/year, as well as 0.05 mSv/year, which corresponds to the dose constraint. The results did not change.

Summary of opinions*	Our reply
Exposure to humans from seawater alone is being considered. However, water is constantly evaporating from the sea surface, which must also contain tritiated water. Will these impacts be considered?	Based on the results of this assessment, tritium concentrations at the sea surface were calculated to be in the range of 0.1 to 1 Bq/L, except for a small area around the Fukushima Daiichi NPS (see 6-1-3.(1) in the revised REIA report). According to the Fisheries Agency website, this concentration is equivalent to the tritium concentration (0.020~3.0 Bq/L) detected in seawater in Japan in the 10 years before the earthquake. Therefore, even taking into account the actual evaporation from the seawater surface, the tritium concentration in the surrounding atmosphere does not increase, and the effect of evaporation from the seawater surface is considered negligible. Fisheries Agency HP: https://www.jfa.maff.go.jp/j/kakou/Q_A/ (in Japanese only) As shown in Appendix VI "Migration routes and exposure routes other than those subject to assessment," the exposure routes that were not selected were reconfirmed with reference to IAEA-TECDOC-1759, etc. As a result, two exposure routes, accidental ingestion of sea water while swimming and internal exposure due to inhalation of sea splash, were added to the list of exposure routes, and other than that, no additional exposure routes were identified.
Shouldn't we analyze alpha emitting nuclides once since those are represented by total alpha?	In the current analysis of ALPS treated water, all alpha nuclides are below the detection limit, but in this assessment, the nuclides are evaluated as being present at concentrations of the detection limit. We are planning to analyze alpha nuclides in order to improve the uncertainty of the assessment.
The model range includes 30 layers in the vertical direction, but it is unclear how to set the water depth.	Water depth is divided into 30 layers using the sigma coordinate system, a type of polar coordinate system. Please refer to the figure attached to the revised REIA report.
The phrase "although the concentration near the discharge point on the seafloor is about 30 Bq/L" is misleading because it refers to the concentration at the resolution of the model shown, and in reality a value close to the discharged concentration is detected.	We have reviewed the description to avoid any misunderstanding.
In order to control reputational damage, measures should be taken to keep fish and shellfish away from the area around the discharge point and to prevent the tritium concentration in marine products from increasing. Since fish and shellfish can move, fish and shellfish with increased concentrations should not be caught in order to reduce reputational damage.	As for measures to prevent fish and shellfish from approaching the water discharge point, we believe that effective measures are difficult to implement. From the viewpoint of mitigating the adverse impact on reputation, according to the results of the dispersion simulation, the tritium concentration near the discharge point is expected to decrease quickly, but we will also formulate annually a discharge plan to reduce the concentration of released radioactive materials. We will work to reduce the adverse impact on reputation by strengthening environmental monitoring before the discharge of ALPS treated water, disclosing data to enable comparison before and after the discharge, and widely informing the public that the discharge of treated water will be being carried out safely.
It seems unreasonable to assume that the behavior of 63 nuclides is the same as that of tritium.	Since insoluble suspended particles are removed from ALPS treated water by the crossflow filter, which is a physical filter, the evaluation assumes that nuclides other than tritium are also water soluble. As you pointed out, some elements may be suspended in seawater or absorbed onto seabed soil. However, we do not consider the decrease in concentration in seawater due to absorption onto seabed soil in the radiological impact assessment, while we consider absorption onto seabed soil in equilibrium state in the evaluation of exposure to marine organisms, and thus we are conservative in our evaluation. The above has been added to 4.(3) and Appendix VII in the revised REIA report.
It is unclear where the "seawater in the current surrounding sea area" refers to. In the figure, there is a statement, "indistinguishable from the current surrounding sea area," but this is not clear unless a figure is shown with no discharge.	The tritium concentrations confirmed at the measurement points located approximately 10 km from the Fukushima Daiichi NPS are within that range. For details, please refer to Fig. II-3-4 in the "Investigation Report ②of the "Project for Commissioned Funds for Disaster Prevention Measures for Nuclear Facilities (Investigation and Comprehensive Assessment of Radioactivity in the Marine Environment) in 2020" of the Government of Japan. https://radioactivity.nsr.go.jp/ja/contents/16000/15909/27/rep2020_NRA_%E2%91%A2.pdf (in Japanese only)

Summary of opinions*	Our reply
I hear that tritium has already been released from nuclear power plants around the world, yet its health effects have not yet been clarified. Canadian-type nuclear facilities release large amounts of tritium, which has been reported to increase leukemia, childhood leukemia, Down's syndrome, and neonatal deaths in downstream of release point. Furthermore, the ALPS contaminated water generated by the severe accident at TEPCO's Fukushima Daiichi NPS was formed by contact with fuel debris that melted down in the severe accident at the station. The negative effects are immeasurable. It has been pointed out that tritium in storage tanks is organically bound compound. Tritium as an organically bound compound has a long half-life, and several papers have pointed out the danger of bioaccumulation. If tritium is released into the sea or into steam, all life forms will absorb tritium and be exposed to radiation, and life forms that eat that life form will also absorb tritium and be exposed to radiation. The amount of exposure to humans, who are at the top of the food chain, is immeasurable. In addition to tritium, radioactive materials such as iodine-129, strontium-90, carbon-14, and plutonium have been found to be contained in the contaminated water above the standard values. TEPCO should not trivialize and misrepresent the situation as "ALPS treated water".	Tritium is a radioactive substance that always exists naturally in the amount of 3.5 kg (1.2 x 10E+18 Bq), and a certain amount of tritium is always present in the bodies of living organisms, including humans. In the past, a large amount of tritium, about 650 kg (2.3 x 10E+20 Bq), was released into the environment between 1945 and 1963, when atmospheric nuclear tests were conducted by other countries. Of these, about 40 kg (1.4 x 10E+19 Bq) was estimated to remain as of 2007, with about 1% of this in the atmosphere, 90% in the ocean, and the rest in water on land. https://www.irsn.fr/EN/Research/publications-documentation/radionuclides-sheets/environment/Documents/Tritium_UK.pdf Especially in the 1960s, rainfall in Japan at one time contained tritium at concentrations exceeding 100 Bq/L. Since that time, epidemiological studies on the effects of tritium on the human body have been conducted in many parts of the world and also in the vicinity of nuclear power plants. As a result, the current radiation protection system has been developed with sufficient margin. Therefore, by complying with the current laws and regulations with sufficient leeway, we do not believe that radiation hazards such as those you are concerned about will occur. It is not believed that this could lead to bioaccumulation as you have pointed out. Note that when people say, "We don't know what the health effects of low radiation dose exposure are," this does not mean that we don't know what happens at all, but rather that the effects are too small to be observed without excluding effects from sources other than radiation. In addition, according to the results of various observations to date, no phenomenon called bioaccumulation of tritium has been observed in both plants and animals. https://www.irsn.fr/EN/Research/publications-documentation/radionuclides-sheets/environment/Documents/Tritium_UK.pdf
The quality of the translation of the English version is not good, and I cannot understand what they are trying to say.	We agree with your comments and will make every effort to provide English translations of higher quality.
In its response to the Fukushima Prefectural Fisheries Cooperative Association, the company states that "no action will be taken without the understanding of the parties concerned." Fishermen are not convinced by the discharge into the sea. TEPCO should keep the promise to the fishermen and not discharge it into the sea.	We have no intention of reversing our 2015 response to the Fisheries Federation in Fukushima Prefecture. We will continue to respond to their concerns and anxieties sincerely and carefully so that we gain deep understanding from as many people as possible.
The assumption that tritium discharged into the sea does not concentrate in the bodies of living organisms~~,~~ is incorrect.	In this assessment, including tritium, the values shown in IAEA-TRS-422, "Sediment Distribution Coefficients and Concentration Factors in the Marine Environment" were used, and we believe that these values are internationally recognized. In addition, according to the results of various observations to date, no phenomenon called bioaccumulation of tritium has been observed in both plants and animals. https://www.irsn.fr/EN/Research/publications-documentation/radionuclides-sheets/environment/Documents/Tritium_UK.pdf
It ignores the Kuroshio Current.	The Regional Ocean Modeling System (ROMS) in this assessment uses meteorological and oceanographic information including ocean currents such as the Kuroshio and Oyashio as input information, and its reproducibility has been confirmed in the calculation to reproduce the cesium concentration in seawater after the Fukushima Daiichi NPS accident in 2011. We are aware that there is currently no better model for the dispersion simulatinon in the sea area. We have added detailed input conditions, etc. in 6-1-2.(2) so that you can understand this point in the report.
If you are so sure that radioactively contaminated water is safe, "prove" its safety "with your own body" by holding a drinking tank water party on the 1F premises.	What we are planning to discharge into the sea this time is ALPS treated water, from which radioactive materials have been removed as much as possible, diluted with a large amount of seawater. In the following, we will answer your question by reading "contaminated water" as "ALPS treated water". For drinking water, even if the concentration of radioactive materials meets the regulatory standard for releasing radioactive materials into the environment, further treatment is required to make the water suitable for drinking water, such as sterilization and filtration. The ALPS treated water is planned to meet the regulatory standards for radioactive materials other than tritium, and then be diluted with a large amount of seawater so that it can be safely discharged into the environment. However, even after dilution, it is not suitable as drinking water because it is not treated as required for drinking water. In addition, we believe that the proposed "drinking water party" is not necessarily appropriate as a countermeasure against reputational damage, since it could be considered as an act that makes it seem as if there is a problem with something that originally had no problem.
(Regarding the dispersion situation) Could you please put a map of Tokyo Bay and dispersion similation result side by side so that we can get a sense of the scale of the situation?	To give you a sense of the scale, please refer to the contour map showing the concentration of radioactive materials on the map in colors, with the distance from the discharge location indicated horizontally and vertically.

Summary of opinions*	Our reply
In addition to direct exposure from seawater, external exposure is said to occur through contamination of ship hulls, beaches, and fishing nets. Since all nuclides adhere to and accumulate on these objects, the external exposure dose received from them should increase with each passing year. The same is true for internal exposure. The effects that accumulate in the organism over the years have not been evaluated.	Accumulation of radioactive materials in the environment is originally a slow process that takes a long time in the environment, but in this assessment, it is assumed that when seawater containing radioactive materials comes into contact with seabed soil, ship hulls, or fishing nets, it accumulates to the equilibrium concentration corresponding to the concentration of radioactive materials in the seawater, and no further accumulation is possible. This is a conservative assessment. In this case, the radioactive material concentration in seawater decreases due to the absorption of radioactive materials in seabed soil, etc. However, we have assumed that there is no decrease in the concentration of radioactive materials in seawater and have conducted a more conservative evaluation. Thus, although the evaluation periods are one year each in 2014 and 2019, we simulate from day 1 the conditions under which the discharge has been taken place over a long period of time. Based on the comment that this point is difficult to understand, we have reflected it in 4.(3) in the revised REIA report, so please refer to it.
Regarding the rearing test plan, the test will start in summer 2022, so it is very doubtful that any conclusion can be reached before spring 2023, when the discharge is scheduled to start.	The rearing test of fish, etc. that we are planning to conduct is not intended to investigate the effect of tritium newly given on the marine ecosystem. This assessment is conducted to indicate the existing knowledge that the tritium concentration in marine organisms is not different from that in seawater, as indicated by the figures in IAEA-TRS-422, "Sediment Distribution Coefficients and Concentration Factors in the Marine Environment", in a manner that is easy to understand for the public. The current plan will be presented in an easy-to-understand manner.
In the overall picture of the facility, the water flow to the discharge vertical shaft is pumped, but the system to transfer the fluid from the discharge vertical shaft to the undersea tunnel is not described.	The detailed design of the facilities is described in Chapter 5 of the revised report, including the results of studies that have progressed since the publication of the original report. Water is discharged from the water discharge vertical shaft (down-stream storage) through the tunnel to the tunnel outlet by the difference in water head. Explanation has been added to 5-3-5.
How do you plan to evaluate the added tritium concentration against the tritium concentration in the seawater before the discharge?	As already announced, we will strengthen the analysis of tritium by increasing the number of sampling points and sampling frequency and lowering the detection limit in sea area monitoring from April this year, about one year before the planned start of discharge into the sea. We intend to evaluate the value based on the range of variation obtained through this process.
The plan is to use seawater near the Fukushima Daiichi NPS as dilution water for discharging. However, I fear that the high water temperature during the summer months will cause the discharged water to be dispersed without mixing sufficiently from the seafloor to the ocean surface, resulting in the propagation of incorrect information. As a proposal, adding salt to the discharged water and discharging the treated water, which has a higher salt content than the nearby sea area, into the sea will help the water mass move toward deeper in the sea after discharge, thus reducing the impact on the coastal areas. Please consider it.	As you pointed out, the temperature of coastal seawater used as dilution water is considered higher than that of the offshore seabed where the water is discharged. However, the point where the water is discharged is shallow at a depth of about 12 m, and the temperature difference is considered to be less than 10°C at maximum. At this level, the density difference is less than 1%, and we believe that there will be no significant impact on dilution.
You say that you are taking measures to deal with contaminated water based on three basic policies, but if this is part of the basic policies, you should investigate the underground water veins and shield them with conventional concrete or other means. If we stop cooling (the damaged reactor core) with water and cool it with air, contaminated water will not be generated.	As shown in the Mid-and-Long-Term Roadmap ("Mid-and-Long-Term Roadmap towards the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station"), we are taking various measures to reduce the amount of contaminated water to less than 100m3 per day by 2025. Currently, the groundwater level around the building is controlled to be a certain level higher than the contaminated water level inside the building to prevent contaminated water inside the building from leaking out of the building, and as a result, groundwater is flowing into the building. Therefore, concrete shielding of upstream of groundwater cannot completely prevent the generation of contaminated water. As stated in the report, contaminated water is purified and reused in the water to cool the reactor core, and contaminated water is also generated by groundwater infiltrating the building. Therefore, it is difficult to completely prevent contaminated water from being newly generated even if the damaged core is cooled with air.
Frozen soil wall do not stop the inflow of groundwater and are not a long-term measure.	Currently, the groundwater level around the building is controlled to be a certain level higher than the contaminated water level inside the building to prevent contaminated water inside the building from leaking out of the building, and as a result, groundwater is flowing into the building. Under these circumstances, we believe that the land-side impermeable wall (frozen soil wall) has succeeded in stabilizing the groundwater level as low as possible and controlling the amount of inflow into the building as much as possible. Therefore, the generation of contaminated water cannot be completely prevented. We will continue to pave site and repair damaged areas of the building roofs, and take multilayered measures such as installing a large cover over the Unit 1 reactor building where debris is being removed, in order to reduce the amount of contaminated water generated to less than 100 m3 per day by 2025.
I don't know how the operational control values will actually be applied, but it would be better to evaluate the amount of discharge (average value) throughout a year, instead of controlling each discharge (badge). It is better to be flexible rather than to stop discharge immediately at the moment they exceed operational control values, even if only a little. This is to advance the decommissioning of the station as quickly as possible.	The annual discharge amount of each nuclide is summarized in a table for each source term. Please see 6-1-2.(1) in the revised REIA report. We are currently discussing how we will actually manage the system, and we will also take your comments into consideration.

Summary of opinions*	Our reply
As long as the number of years for continued discharge has not been clarified, wouldn't it be necessary to stop the inflow of groundwater and the increase in contaminated water before asking the local residents for understanding of discharging the water itself?	First of all, it is difficult to immediately stop the inflow of groundwater completely because it is necessary to work inside the building where the radiation dose level and contamination level are high. However, the efforts to reduce the amount of newly generated contaminated water by reducing the inflow of groundwater through landside impermeable walls (frozen soil walls) and other measures are steadily producing results, and the amount of newly contaminated water generated per day is about 1/4 of what it was before the measures were implemented (about 140 m3/day in March 2020, compared to about 540 m3/day in May 2014). In addition, as a prerequisite, the discharge of ALPS treated water must be completed when the decommissioning of the Fukushima Daiichi NPS is completed. In the revised REIA report, please refer to Appendix II, which shows the results of the estimation assuming that the discharge of ALPS treated water will be carried out until 2051.
There is a possibility of direct leakage to the sea, for some reason, from sample tanks or treated water transfer piping. It could be a leakage due to aging over the years, or a human error. Aging is a worrisome problem if it is going to continue for decades.	Considering the situation that the facilities will be used for long time, we will thoroughly select materials for them, and install and maintain them. In addition, the equipment will be designed to automatically stop discharge if any abnormality is detected to prevent problems caused by human error, as you have pointed out. We will properly design, construct, operate, and maintain our facilities to avoid such a situation. The impact of such a problem, should it occur, has been evaluated for the following cases: "a pipe rupture and 10,000 m3 of water is discharged from the tank over a period of 20 days without dilution", "all the tanks of the measurement/confirmation facilities are damaged simultaneously due to a huge earthquake and 30,000 m3 of water is discharged in one day without dilution", in Section 6-2. "Potential Exposure". The results of the assessment of in both cases were found to be minimal.
When diluting with seawater, the method seems to be not to stir sufficiently the water in a tank but to simply pour it into the seawater piping. In other words, there are areas of high concentration and areas of low concentration, and the calculations are not accurate. Shouldn't there be a more reliable dilution?	As you pointed out, the ALPS treated water is mixed with seawater for dilution in the seawater piping. This mixing effect has been verified by computer simulation, and as shown in the results of the monitoring at the water discharge vertical shaft (upper-stream storage) in 9-2-2., an intended result of dilution was confirmed. In addition, at the start of discharge, the tritium concentration in seawater after dilution is confirmed to be less than 1,500 Bq/L (less than 1/40th of the national regulatory standard for discharge) at the discharge vertical shaft (upper-stream storage) before continuous discharge. Also, during the continuous discharge, sampling will be conducted daily at the water discharge vertical shaft (down-stream storage), and the results will be promptly announced so that everyone can confirm the results.
If the water is still to be discharged, shouldn't efforts be made to support the development of tritium separation technology?	Public solicitation for tritium separation technology began in May 2021, and as of April 2022, there are 11 projects that may meet the requirements for practical application in the future. None of these 11 cases were immediately applicable to the Fukushima Daiichi NPS at this time. Applicants who pass the second round of evaluation will be asked to conduct a feasibility study on the conceptual design of the actual plant and a small-scale demonstration test at an off-site location. Through this feasibility study, we hope to identify issues that need to be resolved and technologies that require breakthroughs for practical application, and accelerate development of the technology. Even if the tritium separation technology is put to practical use, discharge of low-concentration tritiated water after separation will be necessary in any case, because it is essentially a technology to separate high concentration tritiated water and low concentration tritiated water. Therefore, it is necessary to steadily implement the discharge of the water by discharge into the sea, which was recently indicated in the government's Basic Policy.
TEPCO's mid-and-long-term roadmap and strategic plan, which are the basis for the necessity of ALPS treated water discharge, are not reliable.	In the Mid-and-Long-Term Roadmap ("Mid-and-Long-Term Roadmap towards the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station"), the government sets basic approach and major target processes for decommissioning of the Fukushima Daiichi NPS. In addition, with the aim of providing a technical basis for the the Mid-and-Long-Term Roadmap and contributing to its smooth and steady implementation and consideration on revision, a Technical Strategy Plan ("Tokyo Electric Power Holdings Co., Ltd. Technical Strategic Plan for Decommissioning of the Fukushima Daiichi NPS") has been formulated by Nuclear Damage Compensation and Decommissioning Facilitation Corporation. Looking back on our past achievements, we have generally followed these guidelines and have been carrying out decommissioning work safely and steadily. We will continue to make steady progress toward the achievement of our Mid-and-Long-Term Roadmap, placing the highest priority on safety, in the coming 10 years where removal of fuel debris, which is even more difficult task, is planned. To achieve this, we will need a site on higher ground that is currently being used as a tank site. Therefore, we will make firm efforts to handle ALPS treated water, realize the Mid-and-Long-Term Roadmap, and fulfill our responsibility to decommission the Fukushima Daiichi NPS, which is our mission.
This report is not an environmental impact assessment as required by Article 206 of the 1982 United Nations Convention on the Law of the Sea, which states that "When States have reasonable grounds for believing that planned activities under their jurisdiction or control may cause substantial pollution of or significant and harmful changes to the marine environment, they shall, as far as practicable, assess the potential effects of such activities on the marine environment and shall communicate reports of the results of such assessments in the manner provided in article 205."	Article 206 of the UN Convention on the Law of the Sea, which you pointed out, says "may cause substantial pollution of or significant and harmful changes to the marine environment". In addition to the environmental effects of radioactive materials contained in the ALPS treated water as described in the main body of the report, we have also assessed the environmental effects other than radiation related to the discharge of ALPS treated water into the sea, and has assessed that there is no risk of significant pollution or significant and harmful changes to the marine environment with respect to any of these factors. Please refer to Reference D "Results of Evaluation of Environmental Impact related to ALPS treated Water Discharge including Non-radiological Impact, " for details.

Summary of opinions*	Our reply
When releases of many radioactive materials continue, there is no assessment of the eco-systemic or cumulative effects of the releases over a period of 30 years or longer.	In this evaluation, the accumulation process of radioactive materials, which takes time in the actual environment, was simplified to simulate the situation after a long period of time under more severe conditions than actual conditions, such as always being in equilibrium with the concentration in seawater, and not simulating the decrease in concentration in seawater that occurs in the actual accumulation process. Even under these conditions, the results show that the impact on the environment is minimal. Please refer to the 4.(3) in the revised REIA report, which describes our views based on the comments we have received.
The impact of organically bound tritium (OBT) has not been evaluated.	The water stored is filtered by the physical filter that is installed in the ALPS, and the results of previous investigations indicate that the amount of organic matter in the water is small and negligible. In addition, tritium does not concentrate in the environment (the IAEA document we referred to this time states that the concentration factor is 1), and the beta rays which emits have low energy, so we did not consider OBT as of November 2021. In the effective dose conversion coefficient for tritium in ICRP Publ.72, OBT is about three times that of free water tritium (FWT), and considering that OBT is less than 1% of the total internal exposure in this assessment, even if OBT is contained, there is no impact on the conclusions based on the assessment results. However, in this assessment, it was assumed that 10% of the tritium in marine products is OBT. Please refer to Appendix III of the revised version for the handling of this matter.
TEPCO has not evaluated alternatives to the proposed discharge, such as applying tritium removal technology or continuing on-site storage in tanks. TEPCO could have acquired more land, built more tanks, kept tritium is a half-life of 12 years in the tanks, and made it be more decayed.	In the revised REIA report, we have added some explanations to help you understand the circumstances leading up to the discharge into the sea and the rationale behind it, based on the comments we received. See chapter 2 and reference B in the revised REIA report.
Disposal of radioactive liquid waste is illegal. Under Article 192 of the United Nations Convention on the Law of the Sea, nations have an obligation to protect and preserve the marine environment.	As stated in the government's Basic Policy, we will ensure the safety of the public, the surrounding environment, and agricultural, forestry, and fishery products by ensuring that the discharged water is safe by taking appropriate measures based on international practices in accordance with relevant international laws, in addition to complying with legal and regulatory standards, etc., for the discharge of ALPS treated water into the sea. In the revised RIA report, we have added some explanation to help you understand the circumstances leading up to the discharge into the sea and the rationale behind it, based on your comments. Please refer to the revised REIA report.
TEPCO's Radiological Impact Assessment Report does not indicate that there is any substantial benefit, either within Japan or to the international community, in discharging radioactive liquid waste into the Pacific Ocean.	The decommissioning of the Fukushima Daiichi NPS is different from the operation of a typical nuclear power plant on a point that it is a continuous risk reduction activity to protect people and the environment from the risks of radioactive materials that have already become apparent as a result of the accident. In the long-term process toward the decommissioning of nuclear power station over the next several decades, it is essential to deal with issues that it pose greater radiation risks, such as the removal of fuel debris and the safe storage of spent fuel, etc. In order to accurately respond to these issues, it is necessary to steadily reduce overall risks from a medium- to long-term perspective. The discharge of ALPS treated water that we are now planning is part of such risk reduction activities. After removing as much radioactive materials as possible by ALPS, etc., we will steadily dispose of the waste in a safe manner that will have no substantial impact on people or the environment. We have added such information to the revised REIA report. Please refer to it.
IAEA GSG-9 states that the following points should be considered (a)The possibility of additional radionuclides being discharged that were not present in routine discharges during normal operation. (b)The need for a survey of these additional radionuclides in the environment to determine pre-existing levels. (c)The possibility that any contamination on the site that resulted from incidents during operation may affect the discharges during ecommissioning. We see no evidence that any of the above has been considered, including the enormous risks posed by the spent fuel debris and the exposure effects it continues to pose to the environment.	(a) In the planned discharge of ALPS treated water into the sea, the nuclides to be removed by ALPS are selected based on information on nuclides contained in the fuel damaged by the accident, including nuclides that were not discharged at the power station before the accident, and nuclides other than tritium are removed so that the concentration is lower than the legal effluent standard. This point is appropriately reflected in our evaluation in the original REIA report. (b) As we have been announcing sequentially since last April, the pre-discharge monitoring will start approximately one year before the scheduled start of the discharge. In the revised REIA report, please refer to chapter 9. for a summary of the sea area monitoring to be conducted before and after the start of the discharge. (c) We also evaluated how radioactive materials already discharged into the environment as a result of the accident would be affected by the discharge of ALPS treated water into the sea, and confirmed that the impact would be small. Please refer to Appendix V in the revised REIA report for the details of the evaluation.
The current TEPCO plan is to reduce additional groundwater contamination from 150 m3/day at the end of 2020 to 100 m3/day by 2025. Even if this were achieved, an additional 273,750 m3 of water would be generated between 2020 and 2025, and another 182,500 m3 between 2025 and 2030, for a total of 456,250 m3. Thus, in addition to the 1,284,000 m3 currently stored in tanks, approximately half of that amount of contaminated water must be treated by ALPS. A statement on this point is not included in this report.	In the REIA report, the discharge of newly generated ALPS treated water is also included in the study. Currently, approximately 140m3 of contaminated water is generated per day, and as indicated in the Mid-and-Long-term Roadmap ("Mid-and-Long-term Roadmap for Decommissioning of Fukushima Daiichi Nuclear Power Station, TEPCO Holdings Co). Furthermore, although detailed simulations are required, we will consider increasing the reduction in the amount of stored ALPS treated water without increasing the amount of tritium to be discharged by discharging the ALPS treated water with low tritium concentration at first. In addition, with the current design of the treated water transfer pump, if ALPS treated water with the lowest tritium concentration (about 150,000 Bq/L) is discharged at the upper limit of the annual tritium release amount of 22 trillion Bq, it is possible to dispose of about 500 m3 of treated water per day, and compared to the amount of contaminated water currently being generated, it is possible to reduce the storage volume in a planned manner. Please refer to Appendix IV in the revised REIA report for the results of simulations based on several assumptions.

Summary of opinions*	Our reply
When contaminated water is discharged into the Pacific Ocean, the entire amount of carbon-14 with a half-life of 5,730 years is released into the environment. Carbon-14 is the primary contributor to collective doses of humans around the world. METI seems to be saying that carbon-14 is 32 times more dangerous to living organisms than tritium. TEPCO decided not to apply the technology to remove carbon-14, even though it is possible. This report by TEPCO fails to evaluate and explain to the public what the implications of the long-trem release of carbon-14 into the environment are.	Since we do not discharge contaminated water into the sea, and what we are planning to discharge~~do~~ is ALPS treated water, from which radioactive materials have been removed as much as possible, and will be properly diluted with a large amount of seawater, I will answer your question by reading "contaminated water" as "ALPS treated water". First, the concentration of carbon 14 in ALPS treated water has been measured to date to be about a few hundredths of the regulatory concentrations limits, or at most 1/10 of the limit. The contribution of each nuclide to the evaluation results is also shown in Appendix X. The character of the carbon-14 is as you have suggested, but carbon 14 is a naturally exsisting nuclide and is always present in the human body in certain quantities. Many people live in such an environment without being affected by radiation because humans and other living organisms have the ability to protect themselves from radiation. The internationally recognized standards are set with sufficient leeway to include the ability to protect oneself from radiation and risks from non-radiation sources. In this assessment, which is related to our planned discharge of ALPS treated water into the sea, we compared against the dose limits or dose targets established in Japan in accordance with such international standards, and concluded that the impact would be very small. The contribution of each nuclide to the evaluation results is shown in Appendix X in the revised REIA report.
From the numbers provided indicating that the nuclides still need dilution, it seems unsafe to proceed with this project without more stringent guidance and international support at this time. A report regarding the contents of each tank to be discharged in the future should be provided for review by UN scientific experts.	We will continue to fully cooperate with the IAEA so that it can conduct a strict review to enhance the transparency of ALPS treated water discharge.
Regarding the Regional Ocean Modeling System, "ROMS" used to calculate the dispersion in the sea area, "We have conducted calculations to reproduce the cesium concentration in seawater leaked by the Fukushima Daiichi NPS accident, and have confirmed that the reproducibility is high through comparison with actual measurement data. (Tsumune et al.,2020)[9]", but this reference [9] does not state "highly reproducible". As pointed out below, it is admitted that the calculated values are underestimated in the offshore area where the radioactivity concentration is lower than near the coast of the site, and we request correction of the factually incorrect statements.	In the reference [9] you pointed out, the reproducibility of the data is described as "The simulated annual averaged distributions of surface 137Cs activity were in good agreement with observations conducted from 2013 to 2016 and were similar among the years; therefore the distribution should be predictable by the simulation provided that information on the release rate is available." The results are evaluated as follows: "The cause of this underestimation is not underestimation of the direct discharge, but inflow across the domain boundary due to recirculation in the North Pacific may have been underestimated." The discharge of ALPS treated water does not fall under the above category, but is a direct discharge from the power station, so we believe that it is highly reproducible and can be applied to the impact assessment of the discharge of ALPS treated water. These are summarized in Appendix VII in the revised REIA report.
Regarding carbon-14, METI has long been concerned about the difficulty of handling it and its impact through resarch on TRU-containing wastes. Can we really discharge the water into the sea without recovering carbon 14?	The concentration of carbon 14 in ALPS treated water, etc., has been measured to date to be about a few hundredths of the regulatory concentration limits, or 1/10 of the limit at the highest. The contribution of each nuclide to the evaluation results is also shown in Appendix X.
Even if tritiated water is discharged 10 times more than the pre-accident level, it will take more than 30 years from the start of the discharge, which means that the discharge will not even be completed in 40 years after the accident. If this is the case, then the discussions on contaminated water treatment and decommissioning, which have been conducted based on the assumption of 40 years of operation, should be redone.	As shown on page 55 of Exhibit 2 published in August 25, 2021, we conducted simulations of the total amount of tritium to be discharged in two cases: (1) the case in which all tritium existed at the time of the accident remain, and (2) the case in which the total amount of tritium is the lowest based on current information. In each case, the annual tritium discharge was varied so that the release would be completed by 2051, the 40th year of decommissioning, and the results showed that the discharge could be completed by 40 years after the accident in each case. The simulation results are also included in the revised REIA report as Appendix II.
According to ICRP 146, which is incomplete revisions of 109 and 111, "authorities should invite key representative stakeholders to participate in the preparedness process, and in the management of the successive phases of the accident." (ICRP Publication 146 "RADIOLOGICAL PROTECTION OF PEOPLE AND THE ENVIRONMENT IN THE EVENT OF A LARGE NUCLEAR ACCIDENT: UPDATE OF ICRP PUBLICATIONS 109 AND 111" This implies that the disposal will not be made without regard to the will of the stakeholders.	We have been taking every opportunity to explain the project to many parties concerned, including local governments and people engaged in the fishing industry, and have been listening to their opinions. We will do our best to resolve each and every one of their concerns and anxieties and to gain the understanding of as many people as possible by explaining our considerations and actions regarding the handling of ALPS treated water as part of decommissioning work and by carefully listening to their opinions.
This plan assumes that 10 times the amount of tritium discharged before the accident will be discharged, which is unacceptable. Even if discharge should be done, the annual amount of tritium to be discharged should be kept lower than the pre-accident annual level (actual result). If this is set as the upper limit, this means that it would take more than 100 years to reduce the amount of the annual tritium discharge to 1/10 of the design level, which is also unrealistic.	The pre-accident annual tritium release control value of 22 trillion Bq was set at the time of the establishment of the nuclear power station as a guideline value for normal operation, and in actual operation the value is much lower than the regulatory standard set in terms of concentration. The government's Basic Policy is to discharge tritium at a level below 22 trillion Bq per year, and we formulate a discharge plan at the end of each fiscal year based on the latest data available at that time to reduce the concentration and amount of tritium to be discharged as much as possible. In the assessment in the original REIA report published in November 2021, the most severe conditions were assumed and the assessment was based on the assumption of full discharge at the upper limit, but the impact on humans and the environment was evaluated to be extremely small. Considering the delay in decommissioning and the risks involved in tank storage in the case that the waste is stored on site, even if limiting an annual discharge amount as indicated in the current plan, it is expected that discharge can be completed without difficulty according to the discharge plan.

Summary of opinions*	Our reply
The current sea area monitoring is done only once a month, and even if the frequency is increased, it is impossible to estimate how much contaminated water will be discharged before an abnormality is noticed. The radioactivity concentration of contaminated water should be monitored in real time before discharge.	Since we do not discharge contaminated water into the sea, and what we are planning to discharge is ALPS treated water, from which radioactive materials have been removed as much as possible, and will be properly diluted with a large amount of seawater. Therefore, we will answer your question by reading "contaminated water" as "ALPS treated water". The radiation emitted from tritium is so weak that continuous measurement is difficult, and it takes about one day from the time a sample is taken until the results are available. Therefore, the current plan is to control the concentration of tritium in the water to be discharged by measuring the tritium in the "measurement/confirmation facility" and confirming that the dilution ratio determined by the measurement results is being observed by flow meters installed both on the treated water side and the seawater side. In addition, we will confirm that the tritium concentration is correctly diluted by sampling once a day in the "seawater piping" and measuring the tritium concentration. We have decided to increase the frequency and locations of the sea area monitoring in the vicinity of the power station. For details, please refer to Chapter 9. of the revised REIA report.
The legal basis for TEPCO's access to underground areas up to 1 km offshore is unclear.	We plans to carry out this work in accordance with the government Basic Policy , but as with similar cases of other companies, we will proceed with the necessary procedures in accordance with domestic laws and regulations regarding the use of land under the seafloor.
The ROMS (Regional Ocean Modeling System) only considers the area (490 km x 270 km) from the Fukushima nuclear power station, and there is no way that the discharged contaminated water will remain in this area. The ocean is connected, and dispersion throughout the ocean region should be considered. A better alternative, permanent tanks on land, should be adopted.	Since we do not discharge contaminated water into the sea, and what we are planning to discharge is ALPS treated water, from which radioactive materials have been removed as much as possible, and will be properly diluted with a large amount of seawater, we will answer your question by reading "contaminated water" as "ALPS treated water". According to the Fisheries Agency's website, the tritium concentration detected in seawater in Japan during the 10 years before the earthquake ranged from 0.020 to 3.0 Bq/L. Tritium is present everywhere in the environment. Therefore, in this simulation, in principle, the range where the annual average concentration exceeds 0.1 Bq/L is shown as the dispersion range. In order to confirm the influence outside the calculation domain, the annual average concentration at the boundary of the calculation domain was confirmed from the simulation results, and the maximum concentration was 1.6E-04Bq/L. The maximum annual average tritium concentration at the boundary of the calculation domain in the simulation is low enough compared to the tritium concentration in seawater around Japan (0.020~3.0 Bq/L) (See 6-1-3.(1) of the revised REIA report), and the concentration outside the domain is even lower due to further dispersion. Therefore, we believe that the modeled range is sufficient without the need to calculate the concentration outside the area. Fisheries Agency Website : https://www.jfa.maff.go.jp/j/kakou/Q_A/ (in Japanese only) The feasibility of permanent storage in tanks was also discussed by the subcommittee on the Handling of ALPS Treated Water, etc., and the subcommittee concluded that discharge into the sea would be appropriate. For details of the process of study, please refer to Reference B, "Process of Study on Each Discharge Method for ALPS Treated Water".
A search for "Dose assessment for the general public in the safety review of light water reactor facilities for power generation" reveals that this is a document dated June, 1977, which states that "1. The standard for the dose to the general public specified in the current laws and regulations is based on the recommendations of the ICRP, and for nuclear facilities, 500 millirems per year is set as the allowable exposure dose for persons outside the perimeter monitoring area", which is a more lenient standard than the current situation. For representative person, "the probability that a random sample of the population exposed a relatively large dose is approximately 5% or less," but this is not considered in the plan. The dose coefficients are supposed to be given as the committed dose from the yearly intake, but internal exposure results are also shown in mSv/year, for example in Table H-1, and it is not clear what is conducted. Thus, it is difficult to say that this evaluation method even follows the ICRP procedures.	The "Dose Limit for the General Public in the Safety Assessment of Light Water Reactor Facilities for Power Generation" was approved by the Nuclear Safety Commission in 1989, after the dose limit for the general public was set at 1 mSv. In this document, the dose limit for persons outside the perimeter monitoring area is 1 mSv (= 100 millirems) per year in terms of effective dose. In light of the current situation around the Fukushima Daiichi NPS, where the general public cannot reside and the fishing industry is still in the process of recovery, we have referred to the same document for the attributes of representative persons, such as the number of days per year they are engaged in the fishing industry. On the other hand, for a representative person, the food intake, which is considered to have the greatest impact on exposure among lifestyle habits, is set to include the intake of 97.5% of the randomly selected individuals by evaluating using the value that is the mean value + 2σ, based on the results of the latest National Health and Nutrition Survey. As you pointed out, there are uncertainties in these representative persons characteristics, but even if the uncertainties are taken into account, the evaluation results are sufficiently low, and thus the dose constraint (dose target) of 0.05 mSv/year is not likely to be exceeded. The age groups of adults, infants, and children, which had been assumed to be 20 years or older for adults, 5 years for infants, and 1 year for children, but were not stated in the original REIA report, have been added in the revised REIA report. When making comparisons with dose limits, the ICRP recommendation (e.g., ICRP Publ. 103 "The 2007 Recommendations of the International Commission on Radiological Protection," Paragraph No. 141) indicates that internal exposure should be evaluated as if all doses received during the 50 years after the intake in the relevant intake period were received in the first year of the intake. The ICRP recommendation (e.g., ICRP Publ. 103 "The 2007 Recommendations of the International Commission on Radiological Protection", Paragraph No. 141, etc.) recommends to use this "committed dose", and this is also the method used in this evaluation.

Summary of opinions*	Our reply
Although the average concentration within a 10 km x 10 km is used, as shown in Figures 5-3 and 5-4, the concentration varies greatly depending on the distance and depth from the discharge point; for fishermen, the concentration at sea surface; for citizens, near the coast; and for saltwater organisms, at the proper depth should have a significant impact. The original simulation was done for 30 layers, and the analysis should take into account the possibility that the 95% tile = exposure dose may be larger based on the ICRP's concept of representative persons.	In the original REIA report published in November 2021, as described in 6-1-2(3)"setting of exposure pathways", the concentration in the surface layer is used for exposure in offshore work, the average value for all layers is used for exposure in swimming and diving work because it is not possible to specify in which layer the work is performed, and the concentration in the lowest layer is used for the assessment of effects on standard plants and animals because all organisms are benthic organisms. In the evaluation of the effects on standard plants and animals, the concentration in the lowest layer is used, as all organisms are benthic organisms. In addition, benthic plants and animals are also considered to be exposed to external radiation from radioactive materials that have migrated to the seabed soil and reached equilibrium. From the viewpoint of more appropriate evaluation, in the revised REIA report, the nearest beach was used as the evaluation point, and sandy beach, swimming, accidental ingestion of seawater, and splash inhalation were evaluated according to the seawater concentration near the evaluation point. The IAEA GSG-9 indicates that the 95th percentile for representative persons should be evaluated for lifestyle data on specific exposure routes for representative persons, and milk and grain consumption is cited as an example. In this report, the exposure routes via food (internal exposure), for which statistical data are available, are evaluated by adding twice the standard deviation, which corresponds to the 95th percentile value.
The 1500 Bq/L is compared with the World Health Organization (WHO) drinking water quality guideline of "10,000 Bq/L for tritium" This may be intended to give the impression that it is lower than this standard, however, the EU has set a lower value of 100 Bq/L (exposure dose of 0.001 mSv/year) and the U.S. a lower value of 740 Bq/L (0.01 mSv/year). The contaminated water to be discharged contains nuclides other than tritium, and the comparison based on tritium alone is inappropriate.	Since we do not discharge contaminated water into the sea, and what we are planning to discharge is ALPS treated water, from which radioactive materials have been removed as much as possible, properly diluted with a large amount of seawater, we will answer your question by reading "contaminated water" as "ALPS treated water". As you have pointed out, various drinking water standards have been set around the world, depending on national circumstances and other factors. In this REIA report, the WHO drinking water standard, which is an international standard, is used as a comparison for the tritium concentration of 1500 Bq/L, rather than a specific standard value, to provide a standard that is easy to understand for the general public around the world. The drinking water standard stipulated in the World Health Organization's (WHO) Guidelines for drinking-water quality (GDWQ) is 0.1 mSv per year for exposure from drinking water, which is considered to represent a low risk level that does not cause any detectable adverse health effects. Each country set a different value based on its circumstance. In this discharge of ALPS treated water into the sea, nuclides other than tritium that exceed the regulatory concentration limit before dilution are subjected to secondary treatment by ALPS, etc. to reduce the amount of radioactive materials to below the regulatory concentration limit, and furthermore, in order to keep the tritium concentration below 1500 Bq/L, the ALPS treated water discharged into the sea will be diluted to more than 100 times. Therefore, even if the concentrations of all nuclides other than tritium at the discharge point are taken into account, the concentration will still be less than about 1/30 of the regulatory concentration limit (specifically, less than 0.035). The evaluation was conducted based on the dose limit (1 mSv/year) set for exposure doses including other nuclides and the target dose value (0.05 mSv/year) at the site boundary of domestic nuclear power stations, which the Nuclear Regulation Authority (NRA) has deemed equivalent to a dose constraint value, and the impact was evaluated to be extremely small.
The tritium concentration in seawater should be about 0.1Bq/L. However, your survey puts it at 0.1Bq/L to 1Bq/L. This indicates that there are already cases of high concentrations due to the influence of sub-drainage water and other factors. The current situation is full to the brim, and we do not want to see it increased any further.	The tritium concentration in seawater in the surrounding area has fluctuated in the range of 0.1 to 1 Bq/L according to our company's measurement results, and in the range of 0.020 to 3.0 Bq/L according to the Fisheries Agency website for the 10 years prior to the earthquake. For details, please refer to page 22 of "Review draft on the discharge methods of the ALPS treated water and measures to respond to adverse impact on reputation" released in March 2020. Even if the concentration is a few Bq/L, it is extremely low compared to the regulatory standard value of 60,000 Bq/L. Please note that the tritium concentration in seawater fluctuates due to the effects of past nuclear tests conducted by other countries, rain, land water, and other factors. Fisheries Agency Website : https://www.jfa.maff.go.jp/j/kakou/Q_A/
The evaluation should be based on the assumption of the maximum case of the released amount, taking into account the future decay and the expected generation of contaminated water.	Regarding the maximum amount of tritium which may remain in the plant, the relevance between its natural decay and the amount to be released have been studied before, and the results are shown on the page 55 to 59 of the attachment 2 published on August 25, 2021 (https://www.tepco.co.jp/en/hd/newsroom/press/archives/2021/pdf/210825e0102.pdf). As you indicated, there is a possibility that approximately 1,150 trillion Bq of tritium currently remains in the building. In the revised REIA report, the results of the simulation of the discharge of ALPS treated water when approximately 1150 trillion Bq of tritium remains are shown in Appendix IV, and it has already been evaluated that the amount of tritium can be discharged by FY2051 in the range of 22 trillion Bq per year.
The statement "After the sub-committee has compiled its report, explanatory and public hearings will be held..." is clearly erroneous.	As you indicated, the order was incorrect. This has been corrected in the revised REIA report.
You state that "The results of measurement and evaluation of the concentrations of tritium, 62 nuclides (nuclides to be removed by the ALPS), and C-14 in the ALPS treated water will be disclosed each time before dilution and discharge". Are these measurement results the values before or after the dilution?	Based on your comments, for clarity, we have added "before dilution" to the sentence you pointed out and also describe details about the monitoring in the section 9.

Summary of opinions*	Our reply
Discharge into the sea is expected to continue for more than 30 years. How do you guarantee that no nuclides other than 62 nuclides + C-14 will be included during this period?	As explained in detail at the Nuclear Regulation Authority's "Review Meeting on the Implementation Plan for ALPS Treatment Water Discharge" held on February 15, 2022, the amount of fission products and activation products produced before the accident will be evaluated, and based on the fact that these radioactive materials have migrated to the building stagnant water, the migration of radioactive materials to the building stagnant water will be evaluated based on the results of past analyses of the building stagnant water, studies on decommissioning and buried facilities, and other literature. Based on the results, we are considering re-selecting the nuclides to be measured for the ALPS treated water and measuring them.
The "Voluntary operational control values for the eight nuclides with relatively high exposure effects on humans will be established to further reduce radiation environmental effects". Are the values on Table 3-3 before dilution or after dilution?	Operational control values are presented as pre-dilution values.
What is the rationale for the selection of the eight nuclides for which operational control values are set as "the exposure effect on humans is relatively large," and what is the rationale for the operational control values for each nuclide?	Please refer to Reference E of the original REIA report and Reference C of the revised REIA report for the process of selecting 8 nuclides for operation and management.
Since swimming is also assumed in the external exposure, shouldn't we also add swallowing seawater during swimming and inhaling dust on the beach as internal exposure?	We have reviewed the exposure pathways with reference to IAEA TECDOC-1759, etc., and decided to add internal exposure due to accidental ingestion of seawater and inhalation of seawater splash while swimming as exposure pathways, as described in Appendix VI "Migration pathways and exposure pathways other than those to be evaluated." Other various routes were also evaluated, but none of the external exposure routes were found to be necessary to be selected as a route, since their contribution to dose effects was considered to be limited.
Have you considered the idea of "long-term storage and treatment to remove radioactive materials" or "mortar solidification"?	The Sub-committee on the Handling of ALPS Treated Water carefully discussed the proposal, including the method you mentioned, and as a result, the selection was made to discharge the water into the sea. For details, please refer to Section 2 and Reference B, "History of Studies on Each Discharge Method Concerning ALPS Treated Water" in the revised REIA report. In the discharge into the sea, we plans to make effective use of the decommissioning period and to discharge the ALPS treated water with the lowest tritium concentration possible first, thereby decaying the tritium contained in the treated water in storage, etc., to reduce the total amount of tritium to be discharged while securing the necessary site. Please refer to Chapter 2. and Reference B in the revised REIA report for details.
The regulatory concentration is determined according to the effective dose limit of 1 mSv per year, which does not take into account internal radiation exposure and it can't be safe even if complying with the regulatory concentration.	Internal exposure was naturally taken into account in the original REIA report publishid in November 2021. Please see Table 5-10 (page 64) of the original report. According to the ICRP definition, the effective dose takes into account not only external exposure but also internal exposure.
We should strengthen the investigation of seabed soil that continues to be contaminated by radioactivity and assess the impact of "discharge into the sea".	In the vicinity of the power station, we conduct monthly surveys of seabed soil in the northern and southern discharge outlets of Units 5 and 6, and 3 km offshore from the Fukushima Daiichi NPS. In particular, the area of north of the water discharge point of Units 5 and 6 has a slightly higher annual average concentration of 1 to 2 Bq/L than other areas, according to simulation results, and it is also close to the water intake, therefore, we will continuously conduct surveys and additional investigations if any abnormality is detected.
"Discharging" after diluting the radioactive material does not change the absolute amount of radioactive material. Why dilute it 100 times and "discharge" it?	In the planned discharge of ALPS treated water into the sea, (1) the concentration of 63 nuclides other than tritium will be removed by ALPS to the level of the regulatory standards for discharge, and (2) tritium, which is difficult to remove, will not only strictly comply with the regulatory standards defined by the concentration at the site boundary, but will also be diluted to the lower level than the current operational target of 1500 Bq/L for the concentration of sub-drainage water at Fukushima Daiichi NPS in order to dispel concerns of consumers as much as possible. The radiological and environmental effects of such a discharge have been evaluated and confirmed safe in the REIA report, and the contents have been reviewed by the Nuclear Regulation Authority and by the IAEA. We believe that ALPS treated water can be safely discharged into the sea in accordance with regulatory standards. We will comply with all laws and regulations as well as international practices to ensure that we do not create an impact on the humans and environment.
The "discharge into the sea" is to be conducted from 1 km away from the subsea tunnel to avoid retaking the discharged water as sea water for dilution. This may indicate the severity of contamination of the discharged water.	The reason why the location of the water discharge is set at approximately 1 km offshore from the Fukushima Daiichi NPS is to prevent recirculation of tritium by reintroducing diluted water after the discharge. Repeated recirculation will gradually reduce the dilution effect, and if the amount of recirculation is too large, the concentration in the circulating seawater may increase.
Increase/decrease of contaminated water per day and the current increase/decrease of contaminated water should be clarified.	The status of contaminated water generation is reported monthly at the "Meeting of Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment". Please refer to our website (https://www.tepco.co.jp/en/hd/decommission/information/committee/index-e.html) for the monthly documents.

Summary of opinions*	Our reply
The International Atomic Energy Agency IAEA cannot be trusted.	The Charter of the International Atomic Energy Agency (IAEA) gives the IAEA the role of "establishing and adopting, in consultation and cooperation with international organizations, safety standards for the protection of health and the minimization of danger to human life and property," and we recognize that the IAEA is faithfully carrying out this role. The organization has compiled requirements and recommendations for radiation protection based on the latest scientific knowledge available to date, and is considered to be one of the most knowledgeable organizations in the world with regard to radiation protection. In addition to IAEA staff, the review in February 2022 was conducted by a team that included experts from the United States, the United Kingdom, France, Russia, China, the Republic of Korea, Vietnam, and Argentina who belong to organizations other than the IAEA.
The point is the total amount, even if the treated water is to be diluted to observe a certain concentration. We have experienced the behavior of nature that we could never have anticipated, haven't we?	Please refer to Table 5-1-4 in the main text of the original REIA report and Table 6-1-1 to 3 in the revised REIA report for the annual release amounts for each nuclide assumed to be discharged in this evaluation. However, as you pointed out, in order to confirm that the situation is not different from our assumption, we have strengthened and expanded sea area monitoring and started monitoring to confirm the condition of ALPS treated water in April 2022 prior to its discharge into the sea.
Is sea food concentrated in mother's milk considered as what the infant will ingest?	Although this assessment did not focus on the route of transfer from breast milk to infants, it is considered that the amount of radioactive materials in breast milk does not exceed the amount of radioactive materials ingested by mothers (ICRP Pub. 95), that not all radioactive materials ingested by mothers are transferred to breast milk, and that the maximum value of 0.00025 mSv/year of the results of the infants' internal exposure assessment is considered to be sufficiently small compared to the dose limit of 1 mSv/year and the dose constraint value of 0.05 mSv/year.
It is not sure whether the annual tritium release amount will really not exceed the amount assumed for normal operation.	Japanese domestic laws and regulations are developed in accordance with internationally recognized standards by the IAEA, ICRP, and others. This time, the Nuclear Regulation Authority (NRA) confirmed that the assessment results for a representative person are sufficiently small compared to the range of variation in annual human exposure due to the region and living environment, i.e., below 0.05 mSv/year, and that the dose targets are equivalent to the dose constraint values in the IAEA safety standards. The dose constraint value is supposed to be determined so that the dose limit will not be exceeded due to influences from multiple facilities as you mentioned. The evaluation results in the REIA report are well below this dose constraint value.
TEPCO, with its irresponsible structure, cannot be trusted in any way.	We would like to express our deepest apologies for the trouble and inconvenience caused by the accident at the Fukushima Daiichi NPS and other incidents to the local community and to the people of Japan. All of us will work as one to restore your trust as soon as possible.
In reality, the ALPS treated water to be discharged contains a large number of radioactive materials such as plutonium, and 62 nuclides and carbon-14 which are purified until the sum of the ratios to regulatory concentrations limits becomes less than 1. No one knows what will happen when they are discharged 1km off the coast of Fukushima over a long period of time.	The evaluation we have conducted this time is for one year, and we are evaluating the impact of discharging the same source term during the period of ALPS treated water discharge (assuming that the water has reached equilibrium with the concentration in seawater in the environment). Some radionuclides are assumed to be absorbed in the seabed soil. In such cases, the concentration on the seawater actually decreases, but in this evaluation, it is assumed that the concentration on the seawater side does not change. As a result of these conservative assessment, the dose limit of 1 mSv/year and the dose constraint value of 0.05 mSv/year were evaluated as sufficiently small. The nuclides that emit alpha rays, such as plutonium, which you pointed out, are evaluated as being included at the lower detection limit, but in reality, they have so far been less than the detection limit.
Organically Bound Tritium attacks the DNA of living organisms. They have potential to cause numerous cancers.	Radiation emitted by radioactive materials in general, not just organically bound tritium (OBT), can damage DNA. DNA has the ability to repair such damage, and in most cases, DNA is repaired, and if the repair fails, the DNA is eliminated so that it does not affect the body through an effect called apoptosis, and if that also fails, DNA is preyed upon by leukocytes through the body's own immune system. Cancer occurs when this protective function is breached, but so far, no cancer risk has been observed in the area below 100 mSv. The question of whether or not radiation affects the living body is a question of the "amount" of radiation one is exposed to. The results of the present assessment show that this dose is sufficiently lower than the dose at which the risk of cancer can be detected and is sufficiently small compared to the dose limit of 1 mSv/year and the dose target of 0.05 mSv/year.
The discharge into the sea is scheduled to take place over a period of more than 30 years. How can we be assured that the discharge will be carried out correctly in accordance with the Basic Policy during that period?	The Nuclear Regulation Authority continuously monitors us through facility inspections. Besides, as already announced, in addition to recieving the IAEA review, we will have third parties appointed by us and the government perform the same analyses that we perform, and will publish the results in a highly transparent manner so that anyone can check the results and demonstrate that we are doing in the right way. We will also disclose the results in a transparent manner so that anyone can check the accuracy of the results.
Why should we be forced into a plan to store only up to 1.37 million tons? Based on this capacity, it has been decided that discharge into the sea must begin by "2023". In addition, there could be any number of cases in which TEPCO would be forced to expand its space for tanks even under its own plans. Regardless of the year 2023, a plan to store more than 1.37 million tons is necessary.	It is required to steadily carry out decommissioning work such as removal of fuel debris and spent fuel in the future. For this purpose, it is necessary to secure the site so that necessary facilities such as fuel debris storage facilities, maintenance facilities for the removal equipment, and temporary storage facilities for spent fuel in dry casks can be installed by discharging ALPS treated water into the sea as planned. Since there is limited room to construct tanks for long-term continuous storage of ALPS treated water, etc., we believe that systematic discharge of ALPS treated water is necessary to ensure safe and steady progress in future decommissioning work.
I am interested in whether TEPCO's methodology has been validated and approved by international authorities such as the IAEA and ICRP.	This evaluation was conducted by us in accordance with international practice, and is currently being evaluated by the IAEA in light of international safety standards. For the results of the evaluation, please refer to the IAEA report to be published in the near future.

Summary of opinions*	Our reply
In the event of an abnormal situation, the discharge of ALPS treated water will be stopped by activation of the emergency isolation valve. From the standpoint of ensuring transparency, TEPCO should clarify all possible abnormal situations that may occur and the operating time of the valve under each situation.	Currently, we envision three major scenarios requiring isolation: (1) abnormal or unidentifiable dilution rate of ALPS treated water, (2) abnormal or unidentifiable radioactivity in ALPS treated water, and (3) other equipment abnormalities or voluntary emergency shutdown. Please refer to pages 39-59 of Document 1-1 of the 13th Review Meeting on the Implementation Plan for the Discharge of ALPS Treated Water held on March 18, 2022 for details, including valve operation times.
In the unlikely event of an emergency isolation valve failure, TEPCO should prepare a plan to deal with the situation and compensate for the amount of radioactive materials discharged into the sea.	In the revised REIA report, the evaluation of potential exposure has been reviewed. In the facility design, when a single failure is assumed, the maximum unintended discharge of ALPS treated water is evaluated to be about 1.2 m3, but two accident scenarios beyond that are assumed and described in 6-2.,"Assessment of Potential Exposure". In the case of leakage from the piping in Case 1, we will patrol the piping once a day to check for leakage, and if leakage is found, we will stop the discharge of ALPS treated water by stopping the transfer pump and closing the emergency isolation valve. Even in the more severe Case 2, where the tank leaks, the amount of leakage may be smaller than expected because double weirs have already been installed around the tank as a facility countermeasure.
Some of the radionuclides in marine products and food stuffs mentioned in the REIA report use literally unfamiliar methods in measuring their concentrations. If it is confirmed that those analytical methods were done through research, TEPCO should share the methods for reference and report any update regarding future monitoring method in Japan that would lead to the completion of this assessment.	Please refer to Chapter 9 of the revised REIA report for a comprehensive description of the target samples, target nuclides, frequency, and an overview of the analysis and evaluation methods for each nuclide in the sea area monitoring.
According to the assessment results, the impact of ALPS treated water on humans and the environment is very small. Obviously, these results are based on models and assumptions made by TEPCO, and the concentration of radioactive materials in seawater is used in the calculations. Did TEPCO directly measure the concentration of radioactive materials of concern in marine products and foods in this assessment?	The Radiological Impact Assessment is a predictive assessment of the planned discharge of ALPS treated water, and the distribution coefficients for seabed soil and the concentration coefficients for marine plants and animals used in this assessment were not researched by us, but were quoted from the values described in documents issued by the ICRP and the IAEA, which are internationally recognized organizations. Although these figures are considered to contain a certain amount of uncertainty, we recognize that they have a scientific basis. Under the Comprehensive Monitoring Plan, the sea area monitoring is conducted to understand the distribution status and temporal movement of the nuclides to be measured in the seabed soil and marine plants, and the results are available on the website of the Nuclear Regulation Authority (https://radioactivity.nsr.go.jp/en/).
The dose assessment only considers a very limited number of food types and does not seem to be representative of food as a whole.	Since the disposal method assumed in this study is to discharge into the sea, the migration pathway from seawater to marine plants and animals was targeted as the route of transfer to food, and the exposure due to the ingestion of marine products was evaluated. In the assessment, all marine products consumed are conservatively evaluated as if they were caught in the assessment area, and market dilution due to the consumption of marine products caught in other areas is not taken into account. Compared to exposure from the consumption of marine products, the effects of exposure from other foods are extremely small, so we think we do not need to be evaluated.
It does not seem realistic to assume a hypothetical scenario in which all nuclides simultaneously meet Japanese regulatory standards and thereby consider human exposure from the ingestion of marine products. In reality, as Japan has long assured us, the treated water will have a sum of the ratios of all nuclides (except tritium) to the Japanese regulatory standard of less than one (rather than all having the same concentration as the Japanese regulatory standard at the same time) before it is allowed to be discharged. Thus, the relative importance of these radionuclides in a practical situation depends on the actual concentration of each radionuclide after it has been properly treated by ALPS and diluted for discharge. Our concern is what levels of radioactive material concentrations in marine food products could result from the discharge of treated water if the dilution mechanism did not work. A description of this scenario is also mentioned in the report. The appropriate case for this scenario would be the case where the tritium concentration is at the maximum level (about 2.5 million BqL) and one of the other nuclides is near the regulatory threshold. Even under these circumstances, it is appropriate to ensure that the concentration of radionuclides in marine products is below the International Commission on Food Standards (CAC) levels (as is most relevant for food contamination issues outside Japan). Since only the average concentration over a 10 km x 10 km area was considered in this assessment, it is possible that in some local sea areas the concentration may be much higher than the average.	In the orginal REIA report published in November 2021, there were four source terms: three tank groups (K4, J1-C, and J1-G) with actual measured values for 64 nuclides and a hypothetical source term, but the tritium concentration in the hypothetical source term was set at 100,000 Bq/L, lower than the lowest measured value. The reason why the tritium concentration in the hypothetical source term was set at 100,000 Bq/L, which is lower than the lowest measured tritium concentration, is that as the annual tritium discharge is kept under 22 trillion Bq, the lower tritium concentration results in the discharge of more treated water, and the amount of non-tritium nuclides discharged increases accordingly. On the other hand, as you pointed out, it is uncertain what the concentration composition of nuclides other than tritium will be until secondary treatment is performed. However, the analysis results for the seven major nuclides, Tc-99, and C-14 detected to date for the 80 tanks were arranged by concentration category and compared to the three tank groups with actual measured values for all 64 nuclides, and the nuclide compositions for the three groups were generally representative of the 80 tank groups. Therefore, it is unlikely that the nuclide composition of ALPS treated water to be discharged after secondary treatment will change significantly in the future. As a result of discussions with the Nuclear Regulation Authority (NRA), we have decided to delete this hypothetical source term from the text of this revised report, judging that it is an overly conservative assumption that does not fall under the "conservative yet realistic" category in the IAEA GSG-10. We have decided to delete this hypothetical source term from the REIA report. As for your comment on the use of the average concentration over a 10 km x 10 km area for evaluation, as you pointed out, the daily average concentration may slightly increase locally, but such highly concentrated water does not stay in one place continuously due to ocean currents, marine animals are also active within a certain range, and even if a nuclide is biologically concentrated, it takes time for it to be taken into the body and concentrated to a certain degree due to the low concentration discharged. Therefore, we believe that an assessment with the average concentration is appropriate.
I would like to know comments on the methodology developed by the IAEA and ICRP, especially the appropriateness of the current scenario of discharging ALPS treated water from the Fukushima Daiichi NPS into the sea.	We understand that the IAEA will publish a report on the results of the IAEA's review. Please refer to it.

Summary of opinions*	Our reply
The Government of Japan and TEPCO have continued to ignore the protests of nations in Pacific Islands expressed so far. As called for by our leaders and the region's organizations, we must design a better process for consultation between the Government of Japan and its closest neighbors, including governments in Pacific Islands, and ensure public participation.	We have been providing explanations and exchanging opinions with countries in Pacific Ocean on the discharge method of ALPS treated water as needed. We will continue to take this matter seriously. We understand that experts from the Marshall Islands are members of the team that conducts the review by the IAEA.
Before proposing a new discharge of radioactive liquid waste into the Pacific Ocean in the future, you have not disclosed the full extent of the contamination from the 2011 accident.	Although it is very difficult to accurately determine the total amount of emissions since the accident because it is necessary to make various assumptions in the evaluation, there have been some cases where this has been done. As part of our accident investigation, we estimated the amount of each major nuclide released into the atmosphere as a result of the accident to be approximately 500 PBq of noble gas, 500 PBq of I-131, and 10 PBq each of Cs-134 and Cs-137. (In Japanese only) https://www.tepco.co.jp/cc/press/betu12_j/images/120524j0105.pdf Various organizations and institutions have made estimates of this. Two examples are given below for reference. Ministry of the Environment (Xe-133, I-131, Cs-137, etc.) (In Japanese) https://www.env.go.jp/chemi/rhm/h29kisoshiryo/h29kiso-02-02-05.html (In English) https://www.env.go.jp/en/chemi/rhm/basic-info/1st/02-02-05.html Professor Aoyama et al. of Tsukuba University (Cs-137 only) (In English) https://reader.elsevier.com/reader/sd/pii/S0265931X19307945?token=25F1FD9A6648DF1AF0FF713EDAA5F6A85CF91D9F2E417EB53D901CA678E7AF65CE3488A52A3E4D1341BCF25A0CDE42F7&originRegion=us-east-1&originCreation=20220425002444
It does not present any possible options other than the discharge of treated radioactive liquid waste into the Pacific Ocean.	Comprehensive comparisons including the options you mentioned have been made by the ALPS Subcommittee Report, including dose assessments using the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) method as part of that process. Since then, we have had a series of dialogues with relevant stakeholders, which led us to bring out the government Basic Policy announced in April 2021. Please refer to Chapter 2. and reference B in the revised REIA report for a summary of this history.
The Pacific Ocean circulation system favors long-distance, long-duration transfer of radioactive materials (both dissolved and absorbed) and thus contributes to the progressive increase in radioactive contamination throughout the ocean. A 2021 paper by a group of scientists at Seika University, published in National Science Review, analyzed the dispersion process of treated Fukushima accident contaminated water. This report does not consider this Pacific circulation system or the circulation of radioactive contaminants around the world.	Since we do not discharge contaminated water into the sea, and what we are planning to discharge is ALPS treated water, from which radioactive materials have been removed as much as possible, properly diluted with a large amount of seawater, we will answer your question by reading "contaminated water" as "ALPS treated water". Based on the results of the dispersion simulation conducted by our company this time, there is almost no area within the modeling range that is affected by the realistic level that needs to be watched, and the results of the evaluation of tritium concentration at the boundary of the model (annual average maximum 2.4E-04Bq/L at the eastern boundary, daily average maximum 1.1E-02Bq/L at eastern boundary), indicates that the concentration is less than that outside the boundary, and also considering the tritium concentration existing in the natural world, we do not necessarily need a model covering a wider area such as the entire Pacific Ocean, and we believe that the model range is sufficient. Please refer to Appendix VII of the revised REIA report for a discussion of this point. As a result of reviewing the paper you mentioned, we have confirmed the following. According to the original work by the Seika University team in China, the highest concentration in the contour map is 10^0 Bq/m3, or 0.001 Bq/L. This is several digits lower than the tritium concentration in seawater not only in the surrounding sea area but also in the North Pacific Ocean, which is less affected by land water with relatively high tritium concentration (background concentration due to atmospheric nuclear tests, etc. is 0.07 ± 0.01 Bq/L (Povinec et al., 2013)). We believe that the analysis is based on a concentration level that is undetectable in the real world. The paper also mentions the background concentration of tritium, and we understand that the level is well within the range of fluctuations in nature. We do not believe that a North Pacific scale evaluation is necessary because the report takes into account background concentrations and evaluates the extent of the impact. These factors do not affect our assessment of the discharge into the sea of treated water from the ALPS system, etc., which we concluded that "the impact on humans and the environment will be very slight.

Summary of opinions*	Our reply
The phrase "radionuclides except tritium has been removed" in this report is inaccurate. Our concern is about other (non-tritium) nuclides remaining in the composition of ALPS treated water. In common with much of the public announcement from nuclear officials in Japan, the METI document does not provide an accurate list of all the nuclides that remain in the water after ALPS treatment and the concentration of each nuclide (e.g., Bq/L).	The phrase "removable except for tritium" (not "removed except for tritium") indicates that ALPS is capable of reducing the concentration of 62 nuclides (excluding tritium) out of the 63 nuclides evaluated to be present in contaminated water at 1/100 or more of the regulatory concentration limits to a level (the sum of the ratio to regulatory concentration limits is less than 1) at which they can be discharged into the environment without dilution in accordance with the Japanese law which is based on the internationally recognized standards, etc. The water currently stored in the power station as treated water to be re-purified will not be discharged as it is, but will undergo secondary treatment using ALPS, etc., and only water in which the total concentration of nuclides other than tritium is confirmed by measurement and confirmation facilities to be less than the sum of regulatory concentration ratios of 1 will be discharged. Therefore, since the composition of radioactive materials in the water will change through secondary treatment before discharge, we do not measure the concentration of radioactive materials in the stored water at this time, but plan to measure and confirm the concentration just before discharge. Based on the results of our previous studies, we believe that there is little possibility that the nuclides contained in the ALPS treated water could affect the dose assessment. However, we are now reviewing this process in order to make absolutely sure about the safety.
The LNT model for radiation dose is recommended by the ICRP and has been adopted by authorities on radiation protection worldwide. In the LNT model, radiation is always harmful, there is no safety threshold, and the accumulation of very small exposures is considered to have the same biological risk as a single large exposure. The Government of Japan and TEPCO's stance on the use of LNT is not clear.	The ICRP states that the LNT hypothesis is an effective radiation protection measure, but also warns that it should not be used for other purposes, such as quantifying cancer risk, because there is no data available to determine radiation hazards in the low-dose range. Although we have confirmed in this assessment that the dose is well below the guideline values (0.05 mSv/year) set by the Nuclear Regulation Authority, we intend to follow the spirit of the ICRP and review the annual discharge amount each year to keep the dose to the general public as low as achievable.
Many exposure effect models are done by referring to a "representative person," but it is widely known that the typical "representative person" is male, between the ages of 18 and 30 to 40, with a clear gender/age/health status bias. To date, there is no evidence that this gender/age/health status bias has been resolved by those planning and managing the discharge in Fukushima.	The ICRP definition of a representative person does not define any distinction by gender. This is because gender and age averages for all organs and tissues are used so that a single effective dose value can be applied to either gender for radiological protection purposes (see ICRP Pub. 103). Therefore, we do not believe that there is a gender bias as you have indicated. ICRP Pub. 89 also discusses differences in body size among racial groups.
Catastrophic impact on fisheries and biodiversity (tunas). Pacific tunas of several species are for a traditional and highly valued occupation and self-sufficiency, providing commercial fishery operations that take place in most of the area in the northern, southern, and temperate waters of the Pacific Ocean.	As you pointed out, tunas are migratory and do not stay in one place for a long period of time, so we believe that they do not stay around the power station for a long period of time. When considering the impact on tuna habitat, it is practically difficult to conduct assessment on all the species living on the earth. Therefore, the ICRP defines certain types of plants and animals that have similar anatomical, physiological, and life-cycle characteristics and are classified into the same "family" level as standard plants and animals, so that radiation doses can be evaluated for existing organisms of the same type. Since the ICRP also identifies three types of standard animals and plants in the marine environment: flatfish, crabs, and brown algae, we decided to assess all of them in this assessment. Tunas, which swim in the surface to middle layers of the ocean, are less susceptible to the effects of seafloor soil, which easily absorbs and accumulates radioactive materials, and are therefore considered to be much less affected than benthic flatfish, which are also carnivorous fish but are benthic and sedentary.
As a Pacific Rim country, Japan must recognize the fact that many of its closest neighbors in the Pacific region have agreed to and ratified the Rarotonga Treaty, also known as the South Pacific Nuclear Free Zone (SPNFZ). Unlike treaties in other parts of the world, the SPNFZ has a broader purpose than just establishing a nuclear-weapon-free zone, and is particularly opposed to the dumping of radioactive and nuclear materials and improper waste disposal in the Pacific Ocean.	Japan is not a signatory or ratifier of the Rarotonga Convention that you have pointed out. Our company, as a member of the international community, intends to fulfill its responsibilities and will remove all nuclides except tritium by ALPS and sufficiently dilute tritium that cannot be removed with a large amount of seawater before discharging it into the sea at a level well below the dose target (0.05 mSv/year) that the Nuclear Regulation Authority has set as equivalent to a dose constraint. These measures are no different from those used for the disposal of liquid radioactive waste in countries around the world, including signatories to the Convention.
The calculation of the contribution from non-tritium nuclides in this assessment does not follow customary practice and is based on a very limited sample of water currently stored in the tank, which is probably not representative. The contamination levels of these nuclides are highly variable and therefore cannot be accurately and reliably assessed unless data for all nuclides in all tanks are verified by a third party. It is currently difficult, not impossible, to verify the measurement results of the nuclides in the tanks because independent researchers cannot access to them.	The source term based on the measured values used in the assessment was selected in the position that all 64 nuclides were measured or evaluated. but the seven major nuclides, Tc-99, C-14, and tritium, which are analyzed relatively frequently, were estimated to have a sum of the ratios to regulatory concentrations limits of less than 1. We have confirmed that these concentrations are not unique among the analysis results of the tank groups, but are central to the analysis results. For water requiring secondary treatment, the nuclide composition of radionuclides contained in the water is to be measured and evaluated after the secondary treatment and just before discharge. Please refer to the discussion on the uncertainty of the radionuclide composition in 8-1-1. Regarding our source monitoring, we understand that measurements will be conducted by a third party designated by us, a third party designated by the government, and the IAEA, and that the results will be measured and evaluated independently of our company and made public. Therefore, we believe that you can evaluate the accuracy of our measurement and evaluation results by using such measurement and evaluation results of other companies.
The uptake ratios of many of the radionuclides of concern other than tritium in marine ecosystems and seabed soils are much higher than considered in this assessment. Such risks must be accurately quantified.	The values used in this assessment were established by internationally recognized organizations such as the IAEA and ICRP based on observed values in the environment, and we believe that they are highly reliable, but we understand that they all contain uncertainty. In the revised REIA report, this uncertainty is discussed in Chapter 8, and we believe that the resulting uncertainty has a small impact on the conclusions derived from the evaluation results.

Summary of opinions*	Our reply
No evidence was presented regarding the location selection of the discharge point. How was the decision made? From the standpoint of dispersion and bioavailability, it would have been somewhat more advantageous to go deeper offshore.	The reasons for the selection of the location of the water discharge point are described in 5-3-5. of the revised REIA report. Specifically, the followings are the reasons; -The location of the discharge point should be somewhat remote in order to control the impact by re-intake of the discharged water, in response to the intake of water from outside the port, which can eliminate the effects of seawater with relatively high concentrations of radioactive materials in the port. -The discharge point is located in a "non-participating area" where fishing is not conducted on a daily basis to reduce the impact on the fishery. -The results of the geological survey showed that stable bedrock was exposed and that the construction work could be carried out safely and steadily. As for advection and dispersion, compared to the plan of coastal discharge, the average value of 10 km x 10 km used in the evaluation showed no significant difference, only about 20%, but the concentration around the power station in particular was lower.
Only one incredibly optimistic accident scenario is described (for assessing potential exposure). Others, including pipe rupture and sudden discharge, earthquake and tsunami damage, equipment degradation, human factors over 40 years, etc., are naturally expected and must be assessed and described as potential impacts.	The potential exposure was pointed out by the Nuclear Regulation Authority in the review meeting of amendmet of the implementation plan, and the source term, assumed scenario, and exposure pathways were largely revised in the revised REIA report. For details, please refer to 6-2 in the revised REIA report.
The simulation of the dispersion of radioactive materials in the ocean is generally performed with a convincing method, but the details of the parameters used are not described, so the conclusions cannot be verified. For example, water temperature, density and sepcific gravity are unknown. It is also said to be discharged 1 km away from land through an undersea tunnel, but the velocity of the flow at that time is not indicated.	The revised REIA report describes in more detail the conditions used in the dispersion simulation than the originl report published in November 2021. Please see 6-1-2.(2) of the revised REIA report. The flow velocity at the time of discharge varies depending on the number of seawater transfer pumps in operation, but the plan is to discharge the water upward at a low velocity of 1 m/s or less.
Without an assessment of the damage to the human body, organisms and ecosystems, the Japanese and local economies, and psychological suffering, it cannot be called an assessment, given the impacts to date.	This assessment of the impact on the environment, including people, animals, and plants, resulted that the impact was extremely small. The results of this assessment can be used to prevent reputational damage that may affect the local economy to the maximum extent possible, and with the understanding of as many people as possible, we will do our utmost to prevent any adverse impact on reputation.
The evaluation should be led by someone other than TEPCO, and should include local residents, stakeholders, and experts who are opposed to the project.	This assessment was conducted in accordance with the IAEA Safety Standards Document as the responsible entity for the discharge of ALPS treated water into the sea. The validity of the evaluation was reviewed by the Nuclear Regulatory Authority, which legally regulates us, as well as by the International Atomic Energy Agency (IAEA), the world's leading organization for nuclear safety initiatives. We also solicited opinions at the same time as the announcement, and received comments from people in various positions, both in favor and against the proposal. We have revised the REIA report based on those results.
I hear they call it ALPS treated water, but I don't think we can say that the water is safe for life.	The term "ALPS treated water" is defined as "water that has been purified by ALPS, etc. to a level where radioactive substances other than tritium are definitely below the regulatory standard for safety," which is different from contaminated water containing a large amount of radioactive materials that is retained underground in the buildings. We are able to meet the regulatory standards by purifying water by ALPS, etc. to a level where radioactive materials other than tritium can be discharged into the environment, and further by diluting tritium significantly more than 100 times with a large amount of seawater. Through these efforts, we believe that it is possible to discharge water without affecting people or the environment, as is the case with water from nuclear facilities in Japan and abroad. Furthermore, this assessment has concluded that the impact on humans and the environment is extremely small.
There has been no proper health impact study on the safety of tritium.	Epidemiological studies on the effects of tritium on human health have been conducted around the world since the 1950s, when atmospheric nuclear tests were frequently conducted, and also around nuclear power statiions. Based on the results of these investigations, domestic laws have been established to comply with international standards that have been set with a margin of safety, and we plan to discharge into the sea at standards much lower than those set by domestic laws. Epidemiological studies in the vicinity of nuclear power stations that actually emitted tritium have so far reported no human or environmental effects that could be attributed to tritium emitted from nuclear power stations. 1,500 Bq/L and 22 trillion Bq/year are stated in the government Basic Policy. 1,500 Bq/L is the effluent standard for groundwater pumped up by the groundwater bypass and sub-drainage facilities already in operation at the Fukushima Daiichi NPS, and 22 trillion Bq/year is the target value for tritium released from the Fukushima Daiichi NPS before the accident. The concentration of 1,500 Bq/L is a fraction of 60,000 Bq/L, which is the regulatory standard for tritium concentration in liquid radioactive waste, and a fraction of 10,000 Bq/L, which is the standard for drinking water as specified in the WHO Guidelines for Drinking Water Quality.
Will the treated water after secondary treatment be stored once in tanks? If so, how will it be stored? Are storage sites secured?	The water after the secondary treatment is stored in a tank for measurement and confirmation to check whether the concentration of tritium and the concentration of 63 nuclides other than tritium are below 1 of the sum of the ratio to regulatory concentration limits. For the ALPS treated water, which has been confirmed that the sum of the ratios to regulatory concentrations limits for nuclides other than tritium is less than 1, we plan to further dilute it with a large amount of seawater so that the tritium concentration is less than 1,500 Bq/L and then discharge.

Summary of opinions*	Our reply
There is no description of monitoring details such as monitoring locations, monitoring intervals, and monitoring nuclides.	As for the monitoring plan, please refer to pages 6 to 9 pages of the "Sea Area Monitoring Plan for the Handling of ALPS Treated Water Fukushima Daiichi Nuclear Power Station" released on March 24, 2022, and chapter 9. of the revised REIA report. https://www.tepco.co.jp/en/hd/decommission/information/newsrelease/reference/pdf/2022/reference_20220324_02-e.pdf
It is said that "the results of radioactivity measurements at the time of discharge will be made public as needed". However, with the current scientific capabilities, it is much expected that the data should be disclosed in real time, and we request improvement.	As for the sea area monitoring, it takes time to conduct on-site sampling, transport samples to an analytical laboratory, and conduct detailed analysis, so we cannot publish the results in real time. However, we will disclose swiftly as soon as the analysis results are organized.
It is said that "The maximum discharge rate of ALPS treated water is 500 m3/day." However, the maximum amount of contaminated water generated is 140 m3/day, and the maximum rate should be 250 m3/day or less.	The maximum discharge volume of ALPS treated water, 500 m3/day, was set based on the tritium concentration in the ALPS treated water in storage and the annual discharge limit of 22 trillion Bq for stable discharge of ALPS treated water throughout the year, as shown on page 23 of Attachement 2, "Review Status of Facilities to Secure Safety on the Handling of Water Treated with Multi-Nuclide Removal Equipment" released on August 25.
It is said that "③ the seawater transfer pumps and seawater transfer piping will be installed at a point 2.5 m above sea level on the seaward side of Units 5 and 6." If this is the case, it is necessary to protect the surrounding area, including the emergency isolation valve, with a seawall, but this has not been done. It is a problem.	When considering the location of an emergency isolation valve, the following considerations must be taken into account. -The emergency isolation valve should be installed as close to the seawater piping as possible (because the water on the side of downstream of the valve may go out to sea without being diluted). -Furthermore, since the above emergency isolation valve must be installed at 2.5 m above sea level, another emergency isolation valve should be installed inside the seawall at 11.5 m above sea level, which is not affected by tsunamis, etc. The design is such that even if the emergency isolation valve installed at 2.5m above sea level does not operate or is damaged by a tsunami, the emergency isolation is not affected. Therefore, we plan to install one near the seawater piping to reduce the amount of water discharged without dilution, and the other inside the seawall for backup in case a tsunami strikes.
There is no description of details such as the height of the new partitioning weir that will be constructed when the intake facility is built. In addition, it is necessary that the partitioning weir will be constructed before the partial removal of the north breakwater, and the seawater in the once demarcated water intake area should be used after all the seawater in the planned intake area is drained and moved into the port and the dredging work in the planned intake area is conducted. Otherwise, the accumulated radioactive soil would be dumped into the sea along with the diluted drainage. However, there is no detailed description of the construction process in this regard.	The detailed design of the partitioning weir was still under design when the original REIA report was published in November 2021, but the design has progressed since then, and the detailed design and construction method, etc. were reported at the Nuclear Regulation Authority's review meeting. For details, please refer to Document 1-1 of the 12th Review Meeting on amendment of the Implementation Plan for the Discharge of ALPS Treated Water.
In the section "(1) External exposure due to radiation from seawater surface in offshore operations", the amount of external exposure due to seawater adhesion is not taken into account at all.	With regard to your point about seawater adhering to skin during offshore operations, we believe that the amount of seawater adhering to skin and the concentration of radioactive materials are negligible compared to exposure during underwater operations.
In the section "(2) External exposure from radioactive materials adhering to ship hulls in offshore work," the survey is inappropriate because it does not consider exposure to radiation when working in close proximity to ship hulls during ship repairs, hull cleaning, etc., and exposure to radiation from seawater adhering to ship hulls.	In the setting of representative persons, we assume fishermen who work in the closest proximity to the vessel for the longest period of time. Exposure due to approaching vessel for ship repairs, etc. was not selected because it is temporary. The seawater adhesion to the hull is considered by using the transfer coefficient to the hull of 100 (Bq/m2)/(Bq/L).
The evaluation point is 1 m high, and children, infants, and lying on the beach are not expected in this assessment and it is not assumed that sand or sea water will be adhered to for a long period of time.	In ICRP Pub. 101a "Assessing Dose of the Representative Person for the Purpose of the Radiation Protection of the Public and The Optimisation of Radiological Protection: Broadening the Process", it is stated that "It is generally recognised that for external exposure in the environment, there is little variability in dose per unit of exposure with age." Therefore, we believe that there is no necessity to categorize external exposures by ages. In this evaluation, gamma rays are evaluated, and the effect of the height of the evaluation is negligible due to exposure from a wide area of the earth's surface. Furthermore, for many of the beta-gamma nuclides, the conservative Co-60 dose conversion coefficients were used, resulting in a conservative assessment.
No consideration was given to radiation exposure during the repair of fishing gear.	Regarding the repair of fishing gear, we believe that the majority of the fishing nets are stacked together and that there is not much difference from the exposure from the fishing nets that we are conducting in this assessment. Furthermore, for many of the beta-gamma nuclides, the conservative Co-60 dose conversion coefficients were used, resulting in a conservative assessment.
"Infants and young children were set at 1/2 and 1/5 of the adult intake, respectively." However, it should be 1/4 for infants.	In the assessment we conducted this time, we set the dose level as such in reference to the "Evaluation of Doses to the General Public in Safety Examinations of Light Water Reactor Facilities for Power Generation" and other documents.
The section "2) For individuals who consume a large amount of marine products", impact should be evaluated by adding 2.5 times the standard deviation, not 2 times.	IAEA GSG-10 Paragraph 6.3 states that the 95th percentile value can be used, although it is inappropriate to do so for all exposure routes, and accordingly, the intake of marine products with the greatest exposure impact was conservatively evaluated by adding 2 times the standard deviations to the mean value.

Summary of opinions*	Our reply
Instead of "the average concentration distribution at the sea surface for each season," a monthly assessment should also be provided.	The concentration distribution based on dispersion simulation results varies mainly due to seasonal changes in winds, currents, and other factors. Since the seasons do not change every month, we have indicated each of the four seasons in the REIA report. Please note that although the concentration may be temporarily higher or lower depending on the day or month, the IAEA safety standard document stipulates that the evaluation should be based on the annual average exposure, so the annual average value should be used. Please also refer to the video content on our website for the daily average concentration distribution. https://www4.tepco.co.jp/en/news/library/archive-e.html?video_uuid=s48059wd&catid=61785
If you say "from the viewpoint of checking the effects of nuclides other than tritium, which has a large effect on exposure," isn't it theoretical that the safety factor should be one or two digits higher than that for radioactive materials?	As stated in IAEA GSG-10, it is necessary to be somewhat conservative, but at the same time it must be a realistic assumption. We have set it up from this perspective. The hypothetical source term was pointed out by the Nuclear Regulation Authority (NRA) and others as "overly conservative and unrealistic," and therefore, in the revised REIA report, it is treated separately from the main body of the REIA report as Reference C.
The report says, “Long-term changes will be confirmed and addressed through environmental monitoring after initiating the discharge of ALPS treated water into the sea". It means that the number of years of research is insufficient. The implementation of ocean dumping should be postponed and a sufficient period of time should be taken to re-investigate.	Based on this assessment, we believe that the impact on the concentration in seawater after initiating the discharge of ALPS treated water into the sea will be limited, but we will continue to monitor changes through the sea area monitoring before and after the start of discharge.
The report says, "We will consider the analysis and disclosure of the results of radioactivity measurement at the time of discharge by a third party," but there is only the word "consider," and there is no indication that the company is willing to undergo evaluation and criticism by a third party.	The selection of a third party is currently under careful consideration. We will announce the results as soon as they are determined.
The report says, “(iv) in accordance with standards and guidelines established by internationally recognized bodies such as the IAEA and ICRP.” However, even ICRP and UNSCEAR2016 could be out of date. In this sense, the latest research findings, not the standards of international organizations, should be applied ahead of time.	We intend to base this assessment on current internationally recognized standard criteria and guidelines rather than on the Company's own views.
The "Basic Policy on the Discharge of ALPS Treated Water at TEPCO's Fukushima Daiichi NPS" (April 13, 2021, Inter-Ministerial Council for Contaminated Water, Treated Water and Decommissioning Issues) states that the Basic Policy is to ensure safety before discharging it into the sea, but this meeting body, the "Inter-Ministerial Council" is only for the purpose of exchanging information. It is not a meeting body that can make any kind of governmental decision.	The Basic Policy for the discharge of ALPS treated water was decided at Inter-Ministerial Council for Contaminated Water, Treated Water and Decommissioning Issues held on April 13, 2021. This meeting is established based on the decision of the Nuclear Emergency Response Headquarters established under Article 16 of the Act on Special Measures Concerning Nuclear Emergency Preparedness. Specifically, the decision of the Nuclear Emergency Response Headquarters stipulates that Inter-Ministerial Council for Contaminated Water, Treated Water and Decommissioning Issues will be held in order for the government to make concerted efforts toward a fundamental solution to the problems of decommissioning, contaminated water, and treated water. We are aware that the policy on ALPS treated water was also decided by this Inter-Ministerial Council in accordance with this regulation.
The 1,500 Bq per liter is based on the assessment that the amount of tritium must be limited to this value in order to achieve 1 mSv per year at the site boundary due to the release of other radioactive materials from the site, etc. This is based on the rationale for limiting sub-drainage and groundwater bypass to these values, and in no way for reasons such as "fostering a sense of security among the general public".	Currently, in the dose assessment at the site boudary, in addition to tritium (concentration of 1,500 Bq/L), cesium and strontium are assessed based on the assumption of operational targets, resulting in 0.22 mSv/year in the assessment. Therefore, 1,500 Bq/L of tritium is not the upper regulatory limit. The "Regulatory Concentration Limit" is set so that the annual exposure dose from drinking 2 L of water containing radioactive materials at that concentration every day is 1 mSv. The annual exposure dose in the case of 1,500 Bq/L is evaluated to be 1/40 of 1 mSv, or 0.025 mSv. In the discharge of ALPS treated water into the sea, nuclides other than tritium may be included up to a maximum sum of the ratios to regulatory concentration limits of 1 before dilution, but they will be diluted in the same way when tritium is diluted. Assuming a low dilution ratio of 100, the average radiation dose for 70 years of drinking 2 liters per day would be 0.035 mSv/year.
It is said that the possibility of exceeding the evaluation criteria for dose limits is not great. I interpreted this to mean that there is more or less such possibility.	Based on the Radiological Impact Assessment of this time, we believe that the dose is extremely small compared to the dose limit and that there is no risk of exceeding the dose limit if the discharge into the sea is carried out in accordance with the plan.
It is impossible to target only the supernatant liquid, which does not contain sediment, for discharge into the sea, and the sediment would be released with it. As a result, there may be a concern that a larger amount of radioactive materials than expected may be discharged into the sea before anyone in the implementing entity or a third party is aware of it.	ALPS treated water is filtered by a cross-flow filter, which is a physical filter installed in the ALPS, and insoluble suspended solids are removed. The analysis performed in the measurement and evaluation facility involves sufficient stirring within each tank and circulation between tanks to ensure homogeneity of the water within the tank group. This will homogenize the water quality before sampling and sending it for analysis. To avoid the concerns you may have, we will comply with the regulatory standards and will discharge water through careful design and operation.

Summary of opinions*	Our reply
The Tritiated Water Task Force compiled a report which stated that discharge into the sea would cost 3.4 billion yen and take 7 years and 4 months to complete, and based on this report, the current discharge policy was decided. However, now that a 1-km undersea tunnel has been constructed for the discharge, the cost of discharging the water into the sea is expected to be considerably higher. The time required for discharge was extended from 7 years and 4 months to about 30 years. According to TEPCO, the company's policy is to reduce the amount of ALPS treated water generated to 100 m3/day by 2025. ALPS treated water will continue to be generated beyond 2025. The time period for discharge is likely to be extended in tandem. In other words, the premise of the decision to discharge into the sea has been destroyed.	The Tritiated Water Task Force and the Sub-committee on the Handling of ALPS Treated Water, etc., have comprehensively examined not only costs but also international best practices, options with the least adverse impact on human health and the environment, social perspectives such as reputational damage, and technical feasibility from a professional standpoint. The report presents the view that discharge into the sea has a proven track record in relation to the amount of discharge, and that it can be reliably implemented, including the ease of operation of the discharge facilities and the monitoring system. The report of the Tritiated Water Task Force was compiled in 2016, so there may be some discrepancies with the current timeframe and costs. Furthermore, we understand that the selection to discharge ALPS treated water into the sea was not made based on the Tritiated Water Task Force Report, but as a result of comprehensive discussions by the ALPS Sub-committee, including social perspectives such as an adverse impact on reputation, a report was compiled that indicated that discharge into the sea was realistic, leading to the decision by Inter-Ministerial Council for Contaminated Water, Treated Water and Decommissioning Issues. We understand that this led to the announcement at the ALPS subcommittee meeting. For details, please refer to Reference B, "History of Studies on Each Discharge Method Concerning ALPS Treated Water. In addition, as you pointed out, ALPS treated water will continue to be generated in the future, and we cannot continue to store the ALPS treated water forever within the limited premises of the station. We recognize that the announcement on the Basic Policy to discharge the ALPS treated water into the sea was made in order to steadily proceed with the decommissioning work and to reduce the greater risks such as handling of spent fuels and fuel debris.
It is a serious problem that local governments and local residents, who should be the most important stakeholders, have been placed in a lower position in the consideration of discharge methods.	Local government officials and local residents are important stakeholders for the government and our company, and both the government and we have been asking for their opinions. We will continue to provide detailed explanations for them to deepen their understanding and will also reflect this in our policies as necessary.
The TEPCO statement says, "In light of this national policy." but the opinions of local residents and the public are at odds with the government policy. How does your company "take into account" the opinions of local residents and the public?	Before the government announced its Basic Policy for the discharge of ALPS treated water, the government took the lead in actively and carefully consulting with and listening to the opinions of local governments, local residents, and related organizations, and we are aware that the policy announcement was made based on their opinions. We will continue to make maximum use of the period of time before the start of discharge into the sea to thoroughly implement the necessary measures.
In this report, the evaluation is mainly based on the concentration of radioactive materials as a parameter for the nuclides to be discharged, and although the significance of the evaluation focusing on the concentration of radiation is acknowledged, the only reference to the speed of seawater discharged, i.e., the amount of seawater discharged, is dilution level as "seawater diluted more than 100 times". Along with the evaluation using the concentration of radiation as a parameter, is it also necessary to evaluate the amount of water discharged (or the amount discharged per hour) as a parameter?	The actual assessment is performed by dividing the upper limit of the annual release of 22 trillion Bq by the tritium concentration set in the source term to obtain the annual discharge volume, which is then further divided by the number of hours of a year (365 days x 24 hours for both 2014 and 2019, or 8,760 hours) to obtain the hourly discharge volume. The amount of radioactivity obtained by multiplying the discharge amount by the concentration of each nuclide is put into the model to conduct dispersion calculation, and then averaging the hourly results over the year, season, day, etc., to produce a plot. Please refer to 6-1-3.(1) of the revised REIA report for the contour plots that have been drawn. As you pointed out, diluted ALPS treated water is advected and dispersed with the ocean currents, resulting in various concentration distributions depending on the conditions of the ocean currents. In the REIA report, we also presented various dispersion conditions in the form of daily average concentration diagrams. However, since the exposure is evaluated throughout the year, fish and shellfish are widely distributed in the entire sea area, and fishing is also widely conducted in the entire sea area, the average concentration over a 10 km x 10 km area during a year is used.
I think it is inadequate that, while the discharge method section specifies the chemical properties of the discharged water, there is no provision for the location of the discharge and the discharge flow rate.	In the original REIA report published in November 2021, the discharge point is described in Figure 3-2 in the main body of the report, and the discharge flow rate is described as pump capacity in section "3-3. Discharge Facilities" in the main body of the report. In the revised REIA report, the description has been enhanced in Section 5-3, based on the progress of the subsequent study.
The reason why long-term storage is not possible is that the current tanks are too small, and if huge tanks like those used for oil stockpiling were built, storage over several decades would be possible.	The Sub-committee on the Handling of ALPS Treated Water has been studying the storage of large-capacity tanks (both aboveground, underground, and offshore), which you mentioned. The results have found that the capacity efficiency per area is not much different from that of the standard tanks currently installed, and even though the storage capacity does not increase significantly, the time required for installation, leak inspections, etc. will be prolonged and the amount of leakage will be enormous in case of damage. In addition to the above, underground tanks have no advantage because they are buried underground, making it difficult to detect leaks promptly. Please refer to Reference B for the history of the study.
It should be clarified whether the publication is about pre-dilution or post-dilution measurements.	ALPS treated water is measured in the tank for analysis and confirmation before dilution with seawater. We will also measure the diluted water before discharge for the time being, and periodically thereafter.
The report itself may be well explained (although questions remain). I think the attitude of collecting public comments is good, but I am concerned that the specifics are not reaching the general public at all. In fact, I would like to see the same kind of energy spent in explaining the situation as was done in the public relations campaign (which was actively pursued in the various media) during the promotion of nuclear power.	The REIA report evaluates the radiological impact of the discharge of ALPS treated water into the sea on humans and the environment using internationally recognized methods such as those used by the IAEA. We have published the report for the public to view and comment on, and also for ourselves to receive a review mission conducted by the IAEA. We will continue to provide information on environmental impact to the Japanese and international community as needed, while ensuring a high level of transparency. As you pointed out, we recognize the importance of having the media know and disseminate information correctly, and we will continue to listen to your opinions as we strive to improve our communication.

Summary of opinions*	Our reply
Regarding the discharge of contaminated water into the sea, we are told that it is safe because it complies with government standards, but I don't trust them very much. Before the accident at the Fukushima nuclear power plant occurred, people were saying "it is safe" and "accidents will not happen," but accidents did happen. Therefore, I don't think that discharging contaminated water into the sea this time is a good idea at all just because it is in accordance with the government's standards	The national regulatory standards, which are based on internationally recognized standards such as ICRP, require that the concentration at the site boundary be less than the regulatory concentration limit, and in the case of releases of multiple radioactive materials, the sum of the ratios to the regulatory concentration limit must be less than 1. In our planned discharge of ALPS treated water into the sea, the total regulatory concentration ratio of nuclides other than tritium will be reduced to less than 1 by ALPS, etc., and tritium concentration will be diluted more than 100 times with seawater to be less than 1,500 Bq/L, equivalent to 1/40 of the regulatory concentration limit of 60,000 Bq/L. This means that the overall concentration of radioactive materials at the upper-stream storage outlet, which is the site boundary, will be significantly reduced to less than 1/40th of the regulatory standard (the sum of the ratios to regulatory concentrations limits is 1). The results of this assessment were evaluated in consideration of the dispersion of radioactive materials in the environment and their concentration in marine products, and we believe that the level of radioactive materials will have no impact in the future. We have assessed, in the 6-2. Assessment of Potential Exposure, the impact imposed by the following two cases: 1) the case of a pipe rupture, where 10,000 m3 of water would be discharged from the tanks over a period of 20 days without dilution, 2) the case where all the tanks at the measurement and confirmation facilities were damaged simultaneously due to a huge earthquake and 30,000 m3 of water would be discharged in one day without dilution. The results of the evaluation of the potential exposure in both cases were found to be negligible.
The Government of Japan should be the entity responsible for conducting this impact assessment.	This report is an assessment that we, as the entity responsible for implementing the discharge of ALPS treated water into the sea, have taken responsibility for.
Over a 40-year timeframe, even if the amount of water collected were to decrease by 30% (from 140 to 100 m3/day), the power station would still need to store and treat an additional 1.4 million m3 of water, doubling the tank water volume considered here. Such time frames and additional water and tritium risks are not discussed in the report.	In Appendix IV of the revised REIA report, we discuss the discharge period of ALPS treated water. As a result, even in the case with the highest total amount of tritium (where all of the pre-accident tritium inventory remains in the building and tanks), discharge can be completed without problems, even assuming that discharge of the ALPS treated water will be started in 2023 and will be completed in 2051. For details, please refer to Attachment IV.
In several places in the report, it is stated that the ALPS treated water is diluted more than 100 times in order to reduce the concentration to less than 1500 Bq/L. Tritium concentrations in more than 200 tanks have been reported so far, with the maximum value reaching 2500500 Bq/L, requiring a dilution of 1700 times to reach the stated 1500 Bq/L condition.	As you pointed out, our explanation of more than 100 times was based on the lowest dilution ratio, i.e., the water with the lowest tritium concentration. As you can see, the dilution ratio must be increased according to the tritium concentration, including those that will be generated in the future, and the highest concentration currently known is needed diluted more than 1,400 times. However, we plan to reduce the total amount of tritium discharged by prioritizing the discharge of low concentrations over high concentrations and allowing the high concentrations to decay naturally by storage. In the revised REIA report, we have specified this point.
This plan does not relate to the normal operation of a nuclear power plant with established discharge levels. This brings up several issues. 1) Are these "concentrations required by regulations" established for normal nuclear power plants applicable? 2) Even if the sum of the ratios to regulatory concentrations limits is less than 1 at the point of discharge, accumulation in the ocean over time may change this ratio due to bioaccumulation in some nuclides or in association with seabed soils. 3) What are the consequences of setting a precedent for discharges into the sea? With so many aging nuclear power plants along rivers and coastlines, I wonder if discharge into the sea is an acceptable option. 4) Transboundary impacts that require consultation with neighbors in the Pacific Ocean need to be considered.	Based on the results of this assessment, we believe that the water generated from the nuclear facility that experienced the accident can be discharged after it is treated to meet the regulatory standards, which is the same as the water discharged from a normal nuclear power station. Regarding 1), the sum of the ratio to the regulatory concentration limits is not set only for normal nuclear power station operation, but is a system that can be used at each stage of power station operation. Please refer to Reference A of the revised REIA report for the details of the concept of setting up such a system. Regarding 2), as you pointed out, the effects of concentration and sedimentation in the sea cannot be evaluated by the regulatory concentration limits or the sum of the ratios to regulatory concentrations limits, and therefore, as has been done for other nuclear facilities in Japan, the Radiological Impact Assessment that takes into account the migration and dispersion of radioactive materials in the environment has been conducted in the REIA report. Regarding 3), it is customary at domestic nuclear power stations to discharge radioactive liquid waste into the surrounding waters after removing as much radioactive material as possible. At that time, based on the ALARA principle of the ICRP, it has been decided that efforts should be made to keep the effective dose to the general public outside the perimeter monitoring area to 0.05 mSv/year or less. In this study, we have evaluated this 0.05 mSv/year as the dose constraint and confirmed that it is well below this value. Regarding 4), even for tritium, which is released at the highest concentration of each nuclide, the assumed impact is extremely small even within the range of the present dispersion simulation using meteorological and oceanographic data for seven years from 2014 to 2020. The annual average concentration at the boundary of the model is 1.1 to 2.6E-04Bq/L (1.1 to 2.6E-07Bq/m3) and the daily average annual maximum concentration is 5.3E-03 to 1.4E-02Bq/L (5.3E-06 to 1.4E-05Bq/m3) (both at 143.50°E at the eastern end of the model) (See 6-1-3.(1) in the revised REIA report) since further dilution and dispersion will occur outside the modeled area, the radiological impact outside this area is considered to be even smaller, and therefore the modeled range is considered sufficient.

*Similar questions are summarized and representative questions are listed. The opinions in the Summary of opinions are basically excerpts from the comments we have received, howevwer we have corrected obvious typographical and conversion errors. Comments that do not fit the purpose of this request for comments are not included.