Provisional translation as of 26 July 2022 of the document the NRA Commission decided on 22 July 2022

Review Results Document on the Application for Approval to Amend the Implementation Plan pertaining to Specified Nuclear Facility (Installation of ALPS Treated Water Discharge Facility) of Tokyo Electric Power Company Holdings Fukushima Daiichi Nuclear Power Station

22 July 2022

Nuclear Regulation Authority JAPAN

This translation was prepared to enhance understanding of the international communities. While the NRA tried to ensure the accuracy of translation, some parts are translated not directly but in a readable way in English. The official version is the document written in Japanese and the NRA assume no responsibility for any use of this translation.

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Introduction

1.Application for approval to amend the Implementation Plan

Tokyo Electric Power Company Holdings, Inc. (hereinafter referred to as "TEPCO") submitted to the Nuclear Regulation Authority (hereinafter referred to as the “NRA”), on the basis of Article 64-3 (2) of the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Nuclear Reactors (hereinafter referred to as "the Reactor Regulation Act"), an application document for approval to amend the Implementation Plan for Fukushima Daiichi Nuclear Power Station (hereinafter referred to as "FDNPS") Specified Nuclear Facility on the installation of ALPS treated water discharge facility (hereinafter referred to as the "Application") on December 21, 2021 (partially revised on April 28, May 13 and July 15, 2022).

The Application was prepared by TEPCO on the basis of the "Basic Policy on handling of ALPS Treated Water at the Tokyo Electric Power Company Holdings’ Fukushima Daiichi Nuclear Power Station" decided at the Inter-Ministerial Council for Contaminated Water, Treated Water and Decommissioning Issues held on April 13, 2021 (hereinafter referred to as the "Government Policy"), and submitted to the NRA.

2.Content of the Application

Rain and ground water intrude into the reactor and other buildings, and then become highly contaminated (hereinafter referred to as the "contaminated water"). The contaminated water is processed to remove radioactive materials other than tritium by systems such as the Advanced Liquid Processing System (ALPS) and consequently the treated water is stored at site. Among the stored water, in order to discharge into the sea the water which has been processed to achieve the level that the sum of the ratios of the other radionuclides than tritium to each concentration limit stipulated in the Notification to Establish Requirements for Operational Safety and Physical Protection of Specified Nuclear Fuel Materials of the Nuclear Reactors at TEPCO’s FDNPS (hereinafter referred to as the "Notification") is less than 1 (hereinafter referred to as "ALPS treated water"), the ALPS treated water discharge facility comprising the dilution/discharge facility and the outlet facility (hereinafter referred to as the "discharge facility") is to be installed. The operation and management of the facility is also to be determined.

3.Structure of the Review Results Document

Following the way to review the Application on ALPS treated water discharge which

the NRA Commission approved on 22 December 2021(*[1]), this Review Results Document consists of the following.

"Chapter 1 Examination based on the Reactor Regulation Act" provides the results of the examination whether or not the Application fulfills the requirements relevant to the installation and operation of the Discharge Facility stipulated in the "Items required for measures which should be taken at Tokyo Electric Power Co., Inc.'s FDNPS in line with the Designation as the Specified Nuclear Facility" (decided by the NRA Commission on November 7, 2012, hereinafter referred to as the "Regulatory Requirements").

"Chapter 2 Review in light of the Government Policy" provides the results of the review whether or not the Application is in line with the descriptions in the Government Policy relevant to the design and operation of the Discharge Facility as well as the radiological impact by discharge.

In this Review Results Document, the contents of the provisions of laws and regulations as well as the Application are summarized and paraphrased as necessary.

(*[1]) FY2021 54th NRA Commission Meeting Material 3 "Response to Application to Amend the Implementation Plan for TEPCO's Fukushima Daiichi Nuclear Power Station (ALPS Treated Water Discharge Facility)"

Chapter 1 Examination based on the Reactor Regulation Act

In this chapter, the results of the examination pertaining to Article 64-3 (3) of the Reactor Regulation Act are described for each relevant item of the Regulatory Requirements as follows.

1-1 Overall process and risk assessment of Specified Nuclear Facility
1-2 Treatment, storage and management of radioactive liquid waste
1-3 Treatment, storage and management of radioactive solid waste
1-4 Management of workers' radiation exposure
1-5 Radiation protection in the area surrounding the site by restricting release of radioactive materials
1-6 Emergency measures
1-7 Design considerations
1-8 Measures taken for operational safety
1-9 Safety assessment of facility design
1-10 Enhancing public acceptance on the implementation of the Plan

As a result of examining the Application for those items above, the NRA confirmed that the content of the Application satisfies the Regulatory Requirements.

The details of the examination for each item are as follows.

1-1 Overall process and risk assessment of Specified Nuclear Facility

The Regulatory Requirement "I. Measures to be taken with regard to the overall process and risk assessment" requires that overall process toward completion of decommissioning including the process toward decommissioning of Unit 1 to 4 as well as retrieval and storage of fuel debris from Unit 1 to 4, and the overall process for maintaining and continuing cold shutdown for Unit 5 and 6 shall be respectively defined, overall risks of the Specified Nuclear Facility shall be reduced and optimized through the assessment of each process and stage; and in conducting risk assessment for the overall Specified Nuclear Facility and each equipment, reduction and optimization of risks shall be sufficient to ensure on-site and off–site safety through the assessment including the impact on wide area of off-site environment.

In this examination, the NRA confirms whether or not ALPS treated water discharge contributes to reduction and optimization of risks of Specified Nuclear Facility as a whole.

In the Application, TEPCO states that ALPS treated water discharge is newly introduced to reduce the amount of water stored at site after processed by systems such as ALPS and thus the Discharge Facility is to be installed toward the start of discharge in around spring 2023.

TEPCO also states that, in order to reduce the amount of water stored at site after processed by systems such as ALPS, the Discharge Facility is to be designed and operated so that more amount of ALPS treated water than the contaminated water being generated can be discharged. As a result, tanks currently storing ALPS treated water (hereinafter referred to as "storage tanks") can be dismantled and removed, and areas for installing new facilities such as fuel debris storage facility can be secured; therefore, the Discharge Facility contributes to reduction and optimization of risks of the entire Specified Nuclear Facility in the future.

Furthermore, TEPCO states that the Discharge Facility is to be designed and operated in consideration of equipment failures that may occur during the service period.

The NRA confirmed that risks of Specified Nuclear Facility will be reduced and optimized as a whole by securing areas to install new facilities necessary to move decommissioning forward.

In addition, the NRA confirmed countermeasures to be taken to settle unusual occurrences where ALPS treated water is discharged in a manner TEPCO does not intend (hereinafter referred to as "unusual occurrences") due to equipment failures that may occur during the service period after the start of discharge planned in about spring 2023. This examination result is described in "1-9 Safety assessment of facility design".

Based on the above, the NRA concludes that the Regulatory Requirement "I. Measures to be taken with regard to the overall process and risk assessment" is satisfied.

1-2 Treatment, storage and management of radioactive liquid waste

The Regulatory Requirement "II.9. Treatment, Storage, and Management of Radioactive Liquid Waste" requires that, when treating and storing radioactive liquid waste such as contaminated water generated at site, taking into account its characteristics, radiation dose in the area surrounding the site shall be reduced as low as reasonably achievable by controlling waste generation, treating them appropriately to reduce concentration of radioactive materials, securing sufficient capacity for storage, providing shield, preventing leakage and expansion of contamination; and also treatment and storage facilities shall be equipped with adequate shielding capability and structures that hamper leak of liquid waste

and expansion of contamination so that radioactive materials may not be released into the environment through groundwater or water leak.

Therefore the NRA examined the following items:

1. Capacity of tank groups necessary for ALPS treated water discharge
2. Homogenization and analyses of concentrations of radionuclides in ALPS treated water
3. Dilution of ALPS treated water by seawater
4. Measures to prevent leaks and spread of contamination, and shielding

As a result of the examination of the Application for those items above, the NRA concludes that the Regulatory Requirement "II.9. Treatment, Storage and Management of Radioactive Liquid Waste" is satisfied.

The details of the examination for each item are as follows.

1. Capacity of tank groups necessary for ALPS treated water discharge

In the Application, TEPCO states that, when discharging ALPS treated water, in order to reduce the effective dose at the site boundary as low as reasonably achievable, it reduces the concentrations of radionuclides in water to be discharged into the sea (hereinafter referred to as "discharged water") by diluting ALPS treated water with a large amount of seawater depending on the concentrations of radionuclides contained in ALPS treated water.

Specifically, considering the amount of contaminated water currently being generated and the time required to measure and evaluate the concentrations of radionuclides contained in ALPS treated water, at least approximately 10,000 m^3 of capacity is necessary for each discharge of ALPS treated water. Accordingly, TEPCO plans to have three tank groups each of which capacity is approximately 10,000 m^3 (a tank of approximately 1,000m^3 ×10 tanks) and allocate each tank group to the receiving process, the measurement/confirmation process, and the discharge process of ALPS treated water. Then, ALPS treated water is discharged through the dilution/discharge facility (*[2]) including those tank groups and the outlet facility to the point in the ocean approximately 1km away from the coast through the outlet facility (*[3]).

The NRA confirmed that tanks with enough capacity to cover the daily generated

(*[2]) Consist of ALPS treated water transfer pumps, sea water transfer pumps, a sea water pipe header, a vertical shafts (upperstream storage) and above mentioned tank group.
(*[3]) Consist of a vertical shaft (downstream storage), a discharge tunnel, and a discharge outlet.

amount of contaminated water for the period of analyzing ALPS treated water are secured by utilizing approximately 30,000 m^3 tanks in the already-existing K4 area tank groups for each process of receiving, measurement and confirmation, and discharge.

2. Homogenization and analyses of concentrations of radionuclides in ALPS treated water

TEPCO states that, in the measurement/confirmation process prior to ALPS treated water discharge, all 10 tanks of the tank group are connected and the water inside 10 tanks is homogenized by circulation pumps and agitation device before sampling. Then the concentrations of radionuclides contained in ALPS treated water are measured and evaluated.

In addition, TEPCO states that the circulation and agitation time required for homogenization is derived appropriately from the demonstration test.

Further, in the analysis after homogenization of ALPS treated water, TEPCO will measure and evaluate the concentrations of the radionuclides to determine the tritium concentration and to confirm that the sum of the ratios of the other radionuclides to each concentration limit in the Notification is less than 1, then TEPCO will judge whether the ALPS treated water can be discharged.

The NRA confirmed that the homogeneity of the concentrations of radionuclides is achieved by the circulation and agitation of ALPS treated water in the tank group for a sufficient time. The NRA also confirmed that the step from the measurement/confirmation process to the discharge process is taken after the determination of tritium concentration required for setting the flow rate of ALPS treated water and the confirmation that the sum of the ratios of the other radionuclides to each concentration limit in the Notification is less than 1.

The details of the examination concerning the analyses of ALPS treated water are described in "1-8 Measures for operational safety".

3. Dilution of ALPS treated water by seawater

TEPCO states that in order to reduce the effective dose at the site boundary as low as reasonably achievable, the ALPS treated water is diluted so that the concentration of tritium contained in discharged water is less than 1500 Bq/L, which is the operational limit, and the dilution ratio by seawater is 100 times or more.

(1) Necessary amount of seawater to dilute ALPS treated water

TEPCO states that based on the tritium concentration determined in the measurement/confirmation process, the flow rate of ALPS treated water is set and controlled within the planed maximum flow rate of 500 m^3 per day by ALPS treated water transfer pumps, ALPS treated water flow rate control valves and ALPS treated water flow meters.

Also TEPCO states that in order to make the tritium concentration in discharged water less than the operational limit 1,500 Bq/L and the dilution ratio 100 times or more, three seawater transfer pumps with a capacity of 170,000 m^3 per day are installed, and two or more seawater transfer pumps are operated at all times thereby ensuring the seawater volume required to dilute the flow rate of ALPS treated water. The seawater for dilution is taken from the outside of the port by removing the permeation prevention bank which separates the inside and outside of the port on the north side of the FDNPS.

Further TEPCO states that, during normal operation, since such situation is the most stringent operational condition for achieving the dilution rate that ALPS treated water flow rate is set on 500 m^3/day and two seawater transfer pumps are in operation, the tritium concentration of ALPS treated water to be discharged is limited to 1 million Bq/L in order to keep the tritium concentration in discharged water less than 1500 Bq/L even in the said most stringent condition.

(2) Evaluation of dilution state of ALPS treated water by analysis code

TEPCO states that ALPS treated water is discharged after diluted by seawater in the seawater pipe header and seawater pipes.

Also TEPCO states that the dilution state of ALPS treated water by seawater in the seawater pipe header and sea water pipes is evaluated by numerical simulation using analysis code as follows.

① Evaluation method

a. Concept of evaluation

To confirm that ALPS treated water is diluted enough in the seawater pipe header and seawater pipes, the ratio of ALPS treated water in discharged water is evaluated.

b. Analysis code

In evaluating dilution state, STAR-CCM+ code is used. This code

provides analysis and evaluation of fluid motion (flow velocity, pressure) and temperature in three-dimensional space and has been validated by turbulence experiments.

c. Evaluation conditions

As a condition that the dilution ratio becomes the lowest among the operational conditions assumed during normal operation, the flow rate of ALPS treated water is set on the planned maximum flow rate 500 m^3 per day while the flow rate of seawater for dilution is set on the planned minimum flow rate 340,000 m^3 per day.

d. Criteria

The ratio of ALPS treated water in discharged water at the outlet of seawater pipes shall be 1.0% or less, which mean the dilution ratio is 100 times or more.

② Evaluation results

As a result of the evaluation, the ratio of ALPS treated water in discharged water at the end of the rising seawater pipe is 0.28%, which satisfies the criteria at the outlet of the seawater piping.

Regarding the dilution method of ALPS treated water and the evaluation of dilution state, the NRA confirmed that during normal operation ALPS treated water is sufficiently diluted by seawater at the seawater pipe header and seawater pipes as follows:

(1) Necessary amount of seawater to dilute ALPS treated water

- In order to make the tritium concentration in discharged water less than the operational limit 1,500 Bq/L and the dilution ratio 100 times or more, the amount of seawater sufficient for dilution is taken from the outside of the port by installing seawater transfer pumps with a required capacity; and the tritium concentration of ALPS treated water to be discharged is limited to 1 million Bq/L in order to keep the tritium concentration in discharged water less than 1500 Bq/L.

(2) Evaluation of dilution state of ALPS treated water by analysis code

- Setting the criteria to judge whether or not the dilution ratio is100 times or more, the evaluation of the dilution state in the dilution/discharge

facility is conducted using the analysis code and the result satisfies the criteria

4. Measures to prevent leaks and spread of contamination, and shielding

TEPCO states that since the dose rate at the surface of the ALPS treated water storage tanks is evaluated to be less than 1μSv/h, shielding is not needed to be considered in the design of the dilution/discharge facility. TEPCO takes appropriate measures to prevent a leak and spread of contamination as follows.

(1) In order to prevent a leak, equipment such as ALPS treated water transfer pumps is made of appropriate materials corresponding to the installation conditions and the properties of internal fluid.

(2) Alarms such as leak detection are displayed in the main control room of the Seismic Isolation Building so that operators can notify abnormalities reliably and take appropriate measures.

(3) Equipment containing ALPS treated water is installed in a compartment with a surrounding weir to prevent spread of leakage and leak detector is installed to enable early detection of leaks.

(4) Pipes containing ALPS treated water are isolated from the drain channels as much as possible. For polyethylene pipes, exterior pipes (waterproof covers at joints) are attached to the outside of the pipes.

The NRA confirmed that the dilution/discharge facility does not require a shielding function because they handle only ALPS treated water, and that a leak and spread of contamination by leakage are appropriately prevented by using materials with corrosion resistance and installing leak detectors and weirs at locations where there is a risk of a leak.

1-3 Treatment, storage and management of radioactive solid waste

The Regulatory Requirement "II.8. Treatment, storage and management of radioactive solid waste" requires that when treating and storing radioactive solid waste such as rubble generated in the facility, taking into account its characteristics, radiation dose in the area surrounding the site shall be reduced as low as reasonably achievable by treating them appropriately, securing sufficient capacity for storage and providing appropriate management such as shielding.

The NRA confirmed that the estimated amount of rubble and felled trees generated from the installation of the discharge facility (approximately 4,550 m^3, the surface dose rate of 0.1mSv/h or less) is expected within the current storage capacity (approximately 334,780 m^3) according to the Implementation Plan Chapter III "2.1.1 Management of radioactive solid waste" and therefore sufficient storage capacity is secured for the estimated amount. In addition, the NRA confirmed that these rubble and felled trees will be appropriately stored and managed by storing them in areas corresponding to the surface dose rate and periodically patrolling and checking the storage amount.

Based on the above, the NRA concludes that the Regulatory Requirement "II.8. Treatment, storage and management of radioactive solid waste" is satisfied.

1-4 Management of workers' radiation exposure

The Regulatory Requirement "II.12. Management of workers' exposure dose" requires that considering workability of radiation workers under the existing exposure situation, the dose rate of the workers' entering area and exposure dose associated with their work shall be reduced as low as reasonably achievable by taking necessary radiation protection measures such as providing shield, deployment of equipment, remote control, prevention of radioactive material leaks, ventilation and decontamination, and also controlling exposure of radiation workers during their work.

The NRA confirmed that, in accordance with the provisions of the Implementation Plan Chapter II "1.12 Control of Exposure Doses to Workers" and the Implementation Plan Chapter III, Part 3 "3 Supplementary Explanation on Radiation Control," designating workers who engage in the installation, operation, check and maintenance of the discharge facility as radiation workers, TEPCO will control the radiation exposure dose to the workers by checking exposure history data , measuring/evaluating the dose of the workers constantly and making the workers wear protective clothing corresponding to the level of radiation.

Based on the above, the NRA concludes that the Regulatory Requirement "II.12. Management of workers' exposure dose" is satisfied.

1-5 Radiation protection in the area surrounding the site by restricting release of radioactive materials

The Regulatory Requirement "II.11. Radiation protection in the area surrounding the site by restricting release of radioactive materials" requires that radiation dose in the area surrounding the site shall be reduced as low as reasonably achievable, taking appropriate measures to restrict release of radioactive materials from the Specified Nuclear Facility into environment such as atmosphere and the ocean, and specifically the effective dose at the site boundaries due to rubble and contaminated water, etc. generated after the accident which are stored in the facility (estimated value taking into account additional releases of radioactive materials from the overall facility) shall be reduced less than 1mSv/year.

TEPCO newly introduces ALPS treated water as water to discharge in addition to bypassed groundwater and treated water from the subdrain and other purification facilities, and controls the concentration of tritium in discharged water to be less than 1500 Bq/L by diluting ALPS treated water with seawater (100 times or more) upon discharge.

TEPCO evaluates the effective dose of ALPS treated water discharge. For the contribution of tritium, the operational limit 1,500 Bq/L is divided by the concentration limit of tritium stipulated in the Notification, and for the contribution of all other radionuclides, the operational limit “1”, which means the effective dose 1 mSv/year, of the sum of the ratios of each radionuclide to the concentration limit stipulated in the Notification is divided by the minimum dilution ratio by seawater (100 times). The sum of two quotients above is estimated to be 0.035mSv/year as the effective dose. Since the effective dose due to radioactive liquid waste is counted using the maximum value among different discharging systems, the estimated effective dose remains 0.22 mSv/year which is evaluated for the groundwater bypass system and the largest of all.

The NRA confirmed that the effective dose at the site boundary due to ALPS treated water discharge after dilution by seawater is below the evaluated value for the groundwater bypass system described in the Implementation Plan Chapter III "2.2.3 Dose Assessment of radioactive liquid waste", and that ALPS treated water is discharged by a different system from the groundwater bypass system. Therefore, the effective dose due to radioactive liquid waste remains to be 0.22 mSv/year and the sum of the effective doses at the site boundary continue to be less than 1 mSv/year.

Based on the above, the NRA concludes that the Regulatory Requirement "II.11. Radiation Protection in the area surrounding the site by restricting release of radioactive materials" is

satisfied.

1-6 Emergency measures

The Regulatory Requirement "II.13. Emergency measures" requires that facilities needed in case of accident, such as emergency response center and escape routes, and equipment for emergency shall be prepared; appropriate alarm system and equipment for communication shall be provided so that proper directions may be conveyed to everyone in the Specified Nuclear Facility in case of accident; and also equipment for communication between the Specified Nuclear Facility and off-site relevant places shall be provided with redundancy and diversity.

The NRA confirmed that in preparation for large-scale events such as earthquakes and tsunami, in accordance with the provisions of the Implementation Plan Chapter II "1.13 Emergency Measures", paging and telecommunication equipment specialized for operational safety are provided in order to give workers in the site instructions for necessary countermeasures and to notify the relevant organizations of the occurrence and the status of emergency measures. Thereby communication means within and outside of the Specified Nuclear Facility are appropriately equipped. Also, safety evacuation routes are provided in the multi-nuclide transfer facility building where equipment such as ALPS treated water transfer pumps are installed and the east side electric appliance building of Units 5 and 6.

Based on the above, the NRA concludes that the Regulatory Requirement "II.13. Emergency Measures" is satisfied.

1-7 Design considerations

The Regulatory Requirement "II.14. Design considerations" requires that the design of facility should give appropriate considerations to the following items, taking into account the importance for safety.

1-7-1 Applied codes and standards

1-7-2 Design considerations for natural phenomena

1-7-3 Design considerations for human-induced external events

1-7-4 Design considerations for fire

1-7-5 Design considerations for operational environment

1-7-6 Design considerations for operability

1-7-7 Design considerations for reliability
1-7-8 Design considerations for inspection

The details of the examination for each item are as follows.

1-7-1 Applied codes and standards

The regulatory requirement "II.14. Design considerations (1) Applied codes and standards" requires that design, selection of materials, fabrication and inspection of SSCs with safety function shall conform to those codes and standards which are considered to be appropriate taking into account the importance of their safety function respectively.

TEPCO states that since SCCs constituting the dilution/discharge facility is regarded as equivalent to the waste treatment facilities in the "NRA Regulations on Technical Standards for Commercial Power Reactors and Auxiliary Facilities"(NRA ordinance No.6 in 2013), the provisions of class 3 equipment in the "JSME S NC1-2012 Standards of Nuclear Facilities for Power Generation: Design and Construction Standards" are applied to containers and steel pipes containing ALPS treated water, and Japanese Industrial Standards and other private-sector standards are applied to other equipment as needed.

The NRA confirmed that the design, selection of materials, fabrication and inspection of the dilution/discharge facility are based on the codes and standards which are generally applied at nuclear facilities in Japan and recognized to be applicable to the dilution/discharge facility.

Based on the above, the NRA concludes that the Regulatory Requirement "II.14. Design Considerations (1) Applied codes and standards" is satisfied.

1-7-2 Design considerations for natural phenomena

The Regulatory Requirement "II.14. Design considerations (2) Design considerations for natural phenomena" requires that SSCs with safety function shall be classified to appropriate seismic categories considering the importance of their safety function and possible safety impact caused by the loss of function due to earthquakes, and be designed to sufficiently withstand design seismic load considered to be appropriate and shall be designed so that the

safety of the facilities may not be impaired by postulated natural phenomena other than earthquakes (tsunami, heavy rains, typhoons, tornadoes, etc.).

In this examination, the NRA confirms whether or not appropriate measures are taken against natural phenomena such as earthquakes, taking into account the radiological impacts on the public in the event that the function of the discharge facility is lost.

Therefore, the NRA examined the following items.

1.Design considerations for earthquakes

2.Design considerations for tsunami

3.Design considerations for other natural phenomena (heavy rains, typhoons, tornadoes)

As a result of the examination of the Application about those items, the NRA concludes that the Regulatory Requirement "II.14. Design Considerations (2) Design considerations for natural phenomena" is satisfied.

The details of the examination for each item are as follows.

1. Design considerations for earthquakes

(1)Seismic design class considering safety impact

TEPCO states that referring to the concept of seismic ground motion in the seismic design of FDNPS and its application (*4), which was approved by the NRA Commission on September 8, 2021, TEPCO sets seismic class of the dilution/discharge facility by evaluating the radiological impacts on the public in the event that the safety function of the dilution/discharge facility that handles ALPS treated water is lost.

TEPCO states that as a result of the evaluation, even if external exposure due to direct and skyshine radiation and internal exposure due to evaporation and transfer to the atmosphere of a part of the leaked ALPS treated water are considered, the effective dose is less than 1 μSv/event. Therefore, the seismic design class of the said facility is C.

The NRA confirmed that the dilution/discharge facility is classified as seismic-resistant class C because the evaluation result of the public exposure is less than 50 μSv/event even if internal exposure, in addition to external exposure due to direct and skyshine radiation, is assumed for the event that a part of leaked ALPS treated water due to earthquakes evaporates and transfers

(*4) Material 2 "Seismic ground motion in the seismic design of Fukushima Daiichi Nuclear Power Station and its application considering the earthquake occurred on 13th February 2021 (second time)" of the 30th NRA Commission meeting in FY2021.

to the atmosphere, and that the outlet facility is also class C because this facility handles only discharged water and does not require a safety function.

(2)Countermeasures on earthquakes

TEPCO states that in the seismic design of the discharge facility, TEPCO ensures the necessary strength against seismic force to be applied to seismic-resistant class C equipment and also seismic resistance of pressure-resistant hoses, polyethylene pipes used for the said facility by means of the flexibility of materials. Furthermore, the following measures are taken to prevent or mitigate the effects to the outside due to the spread of leakage, assuming the case that there is a leak of ALPS treated water from the dilution/discharge facility or a risk of a leak due to earthquakes.

① It is designed that discharge can be suspended by manual operation from the main control room of the Seismic Isolation Building when an earthquake occurs with a seismic intensity 5-low or more. Also the motor-operated valves on the outlet of the measurement/confirmation facility are closed and it is checked whether or not there are any leaks by tank water levels and equipment abnormalities.

② For the perimeter weir around the tank groups of the measurement/confirmation facility, the strength is ensured against the horizontal design-basis seismic intensity for seismic-resistant class B structure. Also when the accumulation of leaked ALPS treated water is detected in the weir, leakage water is retrieved by equipment such as temporary pumps or high-pressure suction vehicles and drained to other tanks or buildings which soundness is confirmed.

③Pipes containing ALPS treated water are isolated from drain channels as far as possible and polyethylene pipes are covered by exterior pipes (waterproof covers at joints).

The NRA confirmed that earthquakes are appropriately considered in the design and measures as follows:

- the discharge facility is designed to withstand the seismic force to be applied to seismic-resistant class C facilities;
- pressure-resistant hoses are ensured to be seismic resistant by flexibility of the materials;
- perimeter weir is designed to withstand the static seismic force to be applied

to seismic-resistant class B facilities;

- it is designed to be able to suspend discharge by manual operation from the main control room of the Seismic Isolation Building in the event of an earthquakes with a seismic intensity 5-low or more; and
- in case of a leak from the dilution/discharge facility due to earthquakes, temporary pumps are prepared to retrieve and drain ALPS treated water accumulated in perimeter weir and ALPS treated water transfer pipes are isolated from drain channels as far as possible so that the impact of a leak is reduced.

2. Design considerations for tsunami

TEPCO states that the following points are considered against tsunami in the design of the dilution/discharge facility.

(1) Among the dilution/discharge facility, the measurement/confirmation facility and part of ALPS treated water transfer pipes are installed at the location of Tokyo Peil (hereinafter referred to as "T.P.") approximately 33.5m or higher where tsunami is not assumed to reach.

(2) It is designed that discharge can be suspended by manual operation from the main control room of the Seismic Isolation Building when a tsunami advisory is alerted, considering possible impact of equipment damage and leaks caused by tsunami.

(3) Emergency isolation valve 1 in an area of T.P. approximately 11.5m is installed inside the tide wall against the Japan Trench Tsunami for mitigating tsunami effects.

The NRA confirmed that tsunami is appropriately considered in the design as follows;

- The measurement/confirmation facility and part of ALPS treated transfer pipes which contain ALPS treated water are installed at a height of T.P. approximately 33.5m or higher where the tsunami for design consideration is not assumed to reach;
- emergency isolation valve 1 is installed inside the tide wall against the Japan Trench Tsunami constructed at an area of T.P. approximately 11.5m, in order to mitigate the impact of damage and leaks caused by tsunami; and
- it is designed to be able to suspend discharge by manual operation from the main control room of the Seismic Isolation Building when a tsunami advisory

is alerted.

3. Design considerations for other natural phenomena (heavy rains, typhoons, tornadoes)

TEPCO states that the following points are considered in the design of the dilution/discharge facility against natural phenomena other than earthquakes and tsunami (including heavy rains, typhoons, tornadoes, hereinafter referred to as "other natural phenomena").

(1) Among the dilution/discharge facility, circulation pumps, ALPS treated water transfer pumps and other electric components such as control panel are installed inside buildings that are less susceptible to heavy rains and typhoons (strong winds).

(2) ALPS treated water transfer pipes installed outdoors are fixed with foundation bolts so that they will not fall over easily during typhoons (strong winds) and covered by heat insulators with carbon black added which prevent deterioration due to ultraviolet rays in order to prevent damage due to freezing and deterioration due to ultraviolet rays.

(3) Among the dilution/discharge facility, electric equipment is designed to prevent damages caused by lightning strikes by means of installation of lightning rods, grounding of equipment, etc.

(4) It is designed that discharge can be suspended by manual operation from the main control room of the Seismic Isolation Building when warnings such as tornado watches or storm surge warnings are alerted, considering the possibility of damage to the dilution/discharge facility.

(5) It is designed that the invasion of marine organisms (jellyfish) and small animals is prevented by means of installing northern breakwaters and partition weir at the seawater intake area of seawater transfer pumps, and applying sealing materials for outdoor equipment such as terminal box penetrations and electric path ends.

The NRA confirmed that other natural phenomena are appropriately considered in the design because:

- equipment susceptible to heavy rains, lightning strikes, etc., is installed indoors;
- outdoor equipment is designed to prevent falls due to strong winds, deterioration due to ultraviolet rays and freezing of internal fluids by means

of fixing them with foundation bolts, covering them with heat insulation with carbon black added to prevent deterioration due to ultraviolet rays; and

- it is designed to be able to suspend discharge when tornado watches or storm surge warnings that could affect the operation of the dilution/discharge facility are alerted.

1-7-3 Design considerations for human-induced external events

The Regulatory Requirement "II.14. Design considerations (3) Design considerations for human-induced external events" requires that SSCs with safety function shall be designed so that the safety of the facilities may not be impaired by postulated human-induced external events and shall be designed to be provided with appropriate means to protect them against any illegal access by outsiders.

In this examination, the NRA confirms whether or not appropriate measures are taken against possible human-induced external events, considering that the dilution/discharge facility is installed adjacent to the ocean and the operations of discharge are conducted via telecommunications lines.

Therefore, the NRA examined the following items.

1.Design considerations for ship collisions

2.Design considerations for electromagnetic interference

3.Design considerations for prevention of illegal intrusion

As a result of the examination of those items, the NRA concludes that the Regulatory Requirement “II.14. Design considerations (3) Design considerations for human-induced external events” is satisfied.

The details of the examination for each item are as follows.

1. Design considerations for ship collisions

TEPCO states that drift of a ship in the vicinity of the FDNPS is newly assumed as a possible human-induced external event with regard to the installation of the dilution/discharge facility. On the other hand, the safety function of the dilution/discharge facility may not be impaired because of the following reasons.

(1) Marine traffic around the FDNPS is approximately 4 kilometers away from the port of the FDNPS even considering the nearest route, and it is unlikely that ships passing through the route collide with the dilution/discharge facility.

(2) Even if small ships which do not navigate on regular routes drift in the vicinity of

the FDNPS, they will be obstructed by the northern breakwater and the partition weir, so that they will not affect the water intake function of the dilution/discharge facility.

The NRA confirmed that the marine traffic around the FDNPS is approximately 4km away from the port of the NPS even considering the nearest route, and that the northern breakwater and partition weir prevent the collision of small ships with the dilution/discharge facility, which drift near the FDNPS.

2. Design considerations for electromagnetic interference

TEPCO states that the dilution/discharge facility is designed to be unaffected by disturbances caused by electromagnetic interference by means of installing line filters and insulation circuits in the power supply receiving section connected to the control panel, installing line filters and insulation circuits in the signal input/output section from outside, and applying optical cables in the communication line.

The NRA confirmed that sufficient measures to prevent electromagnetic wave intrusion are taken for the monitor and control system required for the operation of the dilution/discharge facility by means of installing line filters and insulation circuits to the power supply receiving section connected to the control panel and to the signal input/output section from outside and applying optical cables in the communication line.

3. Design considerations for prevention of illegal intrusion

TEPCO states that monitor and control system for operation of ALPS treated water discharge are designed to block illegal access from outside so that such monitor and control system are not subjected to illegal access through telecommunications lines (including cyber terrorism).

The NRA confirmed illegal access to monitoring and control devices via telecommunications lines from outside is blocked by system design, and that illegal approaches by irrelevant people to the dilution/discharge facility are prevented by installing ALPS treated water dilution/discharge facility inside the protected areas with physical barriers in accordance with the provisions of the Implementation Plan Chapter II “1.14 Design Considerations".

1-7-4 Design considerations for fire

The Regulatory Requirement “II.14. Design considerations (4) Design considerations for fires” requires that the facilities shall be designed so that safety may not be impaired by fire, by combining appropriately measures such as fire prevention, fire detection and extinguishing, and mitigation of impacts by fire.

TEPCO states that the following measures are taken by appropriately combining measures to prevent fires, to detect and extinguish fires, and to mitigate the impacts of fires so that fires do not impair the safety of the dilution/discharge facility.

1. In order to prevent fires from occurring, non-combustible or flame-retardant materials are used for the dilution/discharge facility as much as practicable, and combustible materials are eliminated as much as possible in the vicinity of the said facility.
2. In order to detect fires at an early stage, in addition to patrolling and checking, fire detectors are installed in the multi-nuclide transfer facility building and in the east electrical component building of Units 5 and 6. Also in order to extinguish fires at an early stage, fire extinguishers are installed in the vicinity of each device.
3. In order to mitigate the impacts of fire, the combustible materials used for part of pipes are covered with non-combustible or flame-retardant materials, and equipment requiring biserial operations is kept apart each other as far as possible so that the function of the equipment will not be impaired by fires at the same time.

The NRA confirmed that measures to prevent fires from occurring, to detect and extinguish fires, and to mitigate the impacts of fires are appropriately combined so that the safety functions of the dilution/discharge facility are not impaired by fires.

Based on the above, the NRA concludes that the Regulatory Requirement "II.14. Design considerations (4) Design considerations for fires" is satisfied.

1-7-5 Design considerations for operational environment

The Regulatory Requirement "II.14. Design Considerations (5) Design Considerations for Environmental Conditions" requires that SSCs with safety function shall be designed to withstand any operational environment including aging effect, and in particular, countermeasures shall be taken with adequate consideration of integrity assessment for the structures affected by the accident and the earthquakes.

In this examination, the NRA confirms whether or not the dilution/discharge facility is designed in consideration of all possible operational environment provided that the facility is not installed in buildings damaged by the accident and the earthquakes.

TEPCO states that the following measures are taken for the dilution/discharge facility so that the facility withstand all possible operational environment.

1. Design considerations for pressure and temperature

   Equipment with the appropriate maximum operating pressure and maximum operating temperature is selected according to the pressure and temperature assumed during normal operation of the dilution/discharge facility and in case of unusual occurrences.

2. Design considerations for corrosion

   Two-phase stainless steel with strong corrosion resistance, polyethylene, synthetic rubber and carbon steel coated with corrosion resistance are used for equipment which store or transfer ALPS treated water and seawater.

3. Design considerations for radiation degradation

   Material used for the dilution/discharge facility such as polyethylene is evaluated to identify the period during which there is no significant change in the property caused by radiation, and replaced with spare parts beforehand not to be used beyond the said period.

The NRA confirmed that the dilution/discharge facility is designed properly considering all possible operational environment such as temperature, pressure and corrosion, through applying materials with appropriate maximum operating pressure, maximum operating temperature and corrosion resistance, taking situations into account, such as the system pressure and temperature assumed in ALPS treated water transfer system and the sea water transfer system as well as the fact that ALPS treated water and sea water are corrosive to carbon steel.

Based on the above, the NRA concludes that the Regulatory Requirement "II.14. Design considerations (5) Design considerations for environmental conditions" is satisfied.

1-7-6 Design considerations for operability

The Regulatory Requirement "II.14. Design considerations (7) Design considerations for operator's action" requires that the facilities shall be designed to be provided with appropriate preventive measures against operators' erroneous actions.

TEPCO states that it takes the following measures so that operators' erroneous actions are prevented and also operators can easily operate the equipment necessary to cope with events in case of unusual occurrence or natural phenomena that may affect the operation of the Discharge Facility.

1. The monitor and operation terminals are designed to be easily operated by providing uniformity (visual factors such as color and shape) in the status display and operation method of the equipment.
2. For critical operations such as discharge and transfer of ALPS treated water and process shutdown, a double action is required on the control panel. In addition, the operation to allow discharge is designed to require operation with key switch in addition to the double action.
3. It is designed that when the analytical results of tritium obtained in the measurement/confirmation process are registered in the monitor and control system, the results are mechanically read by scanner to prevent mistakes caused by manual calculation or duplication.
4. In the measurement/confirmation process and the discharge process of ALPS treated water, it is designed to provide interlocks not to proceed to the next step when an appropriate tank group is not selected among the three tank groups for measurement/confirmation, so that ALPS treated water before measurement/confirmation will not be discharged.
5. Emergency isolation valves are installed to suspend discharge when an unusual occurrence deviating from normal operation is detected, and interlocks for closing the valves are provided to enable immediate suspension of discharge without operator's action.

The NRA confirmed that the dilution/discharge facility is designed to appropriately prevent operator's erroneous action by providing unified visual design of monitor and operation terminals for identification, by mechanically reading the data with scanners when registering the analysis results of tritium in monitor and control system in order to prevent errors by manual calculation/duplication, and by providing interlocks not to proceed to the next process unless an appropriate tank group is selected in the measurement/confirmation

process and discharge process; and that the emergency isolation valves with interlocks can suspend ALPS treated water discharge without expecting operator's action.

Based on the above, the NRA concludes that the Regulatory Requirement "II.14. Design Considerations (7) Design considerations for operator's action" is satisfied.

1-7-7 Design considerations for reliability

The Regulatory Requirement "II.14. Design Considerations, (8) Design considerations for reliability" requires that SSCs with safety function and monitoring function shall be designed so that adequately high reliability can be ensured and maintained, and systems with safety function of especially high importance shall be designed to achieve their safety function, and shall be designed to be provided with redundancy, diversity and independency, taking into consideration their configuration, operating principle and safety function to be fulfilled.

In this examination, the NRA confirms whether or not it is designed to ensure reliability against equipment failure that may occur during the service period, while as described in 1. (1) of "1-7-2 Design considerations for natural phenomena", the dilution/discharge facility is not categorized as systems with safety function of especially high importance because there is little radiological impact on the public in the event of the loss of the safety function.

TEPCO states that the dilution/discharge facility is designed to ensure sufficiently high reliability by the following measures in order to prevent occurrence of ALPS treated water discharge in an unintended manner or minimize the discharged amount when an unintended discharge occurs.

1. For the measurement/confirmation facility consisted of three tank groups, the valves used as the boundary of the tank groups are multiplexed in series in order to prevent water mixing between the tank groups.
2. For ALPS treated water flowmeters, the differential pressure transmitter and its transmission line are multiplexed in order to confirm whether or not dilution of ALPS treated water into seawater is performed within the set range.
3. For emergency isolation valves, motorized emergency isolation valve-1 and air-actuated emergency isolation valve-2 are installed to provide redundancy with respect to the isolation mechanism and diversity with respect to the driving source, and designed as fail-closed to ensure that discharge can be suspended even in the event of a loss of external power supply.

The NRA confirmed that the valves for preventing water mixing between tank groups, ALPS treated water flowmeters necessary for appropriate monitoring of dilution, and the emergency isolation valves for suspending discharge are designed with redundancy or diversity considering the operating principles of each requested function, in order to ensure sufficiently high reliability.

Based on the above, the NRA concludes that the Regulatory Requirement "II.14. Design considerations (8) Design considerations for reliability" is satisfied.

1-7-8 Design considerations for inspection

The Regulatory Requirement "II.14. Design Considerations, (9) Design considerations for inspection" requires that SSCs with safety function shall be designed so that their functions may be tested by means of appropriate methods to verify their integrity and capability.

TEPCO states that, in order to confirm the integrity and capability of the dilution/discharge facility, SCCs constituting the said facility are designed so that their functions can be appropriately inspected including by visual inspection as follows.

1. Tanks are designed to be equipped with inspection ports on the top plate and side part so that internal inspections can be carried out.
2. Pipings are designed so that the gasket of flange (seal) part can be inspected and replaced.
3. Pumps and valves are designed so that they can be disassembled, checked, and replaced.
4. Flowmeters are designed so that check of output value against the reference input value and calibration to prevent deviations beyond instrument errors can be performed.
5. Emergency isolation valves (including logic circuits) are designed so that the operation signal of the valves can be confirmed to be activated against input signal.
6. Seawater pipe header is designed to be equipped with a manhole for inspection so that internal inspections can be carried out.

The NRA confirmed that the dilution/discharge facility is designed as necessary maintenance, check and function tests on SCCs are available by visual observation, disassembly and replacement, calibration of flow meter, and simulated signal test.

Based on the above, the NRA concludes that the Regulatory Requirement "II.14. Design considerations (9) Design considerations for testability" is satisfied.

1-8 Measures taken for operational safety

The Regulatory Requirement "III. Items concerning measures taken for operational safety of the Specified Nuclear Facility" requires that by taking appropriate measures such as operation management, maintenance management, radiation control, radioactive waste management, emergency measures, on-site and off-site environmental radiation monitoring, “II. Items concerning measures to be taken for design and facilities” shall be ensured to be appropriately and reliably implemented, as well as workers’ and on-site/off-site safety shall be ensured; particularly, with regard to emergency measures during accident or disaster, systems for communication with relevant organizations and medical care system in emergency shall be prepared in addition to responses to emergency; and education and training shall be appropriately conducted for employees and workers including those of contracted and subcontracted companies to maintain and improve their skills and capabilities.

Therefore, the NRA examined the following items.

1. Radionuclides contained in ALPS treated water
2. Organizational framework for analysis of ALPS treated water
3. Operation and control of the dilution/discharge facility

As a result of examining the Application for those items, the NRA concludes that the Regulatory Requirement "III. Measures to be taken for operational safety of Specified Nuclear Facility" is satisfied.

The details of the examination for each item are as follows.

1. Radionuclides contained in ALPS treated water

TEPCO states that before ALPS treated water is diluted with seawater and discharged, it is confirmed by measurement and evaluation whether or not the sum of the ratios of each radionuclide other than tritium to the concentration limit stipulated in the Notification satisfies less than 1.

Currently, TEPCO designates tritium, ALPS removal target 62 radionuclides and carbon14 as target for measurement/evaluation. Since carbon 14 was detected from the difference between the sum of radioactivity of the major seven nuclides (*[5]) and the total beta value, there has been no substantial difference between the sum of radioactivity of the major seven nuclides/carbon 14 /technetium 99 and the total beta value which could indicate any suspicion of the presence of other nuclides.

(*[5]) Cs-134, Cs-137, Sr-90, I-129, Co-60, Sb-125 and Ru-106 significantly detected relative to the Notified Concentration Limit

Furthermore, some of the ALPS removal target radionuclides are considered not to exist substantially by the time of discharge because of decay. Thus, TEPCO considers the sum of the ratios of each radionuclide other than tritium to the concentration limit can be confirmed to be less than 1 by measurement/evaluation of 63 radionuclides.

Meanwhile, TEPCO plans, based on the knowledge on decommissioning and repository within the country, to select radionuclides to be measured/evaluated after revalidating what radionuclides other than tritium substantially exist in contaminated water.

The NRA concluded that the sum of the ratios of each radionuclide other than tritium to the concentration limit can be confirmed to be less than 1 by measurement/evaluation of 63 radionuclides even in case any other radionuclide exists than ALPS removal target radionuclides and carbon 14. The reason is that, since differences between the sum of radioactivity of the major seven nuclides and the total beta value were observed and then the existence of carbon 14 and technetium 99 was identified from the difference in shape of beta energy spectrum, there has been no data from the other storage tanks which could indicate any suspicion of the presence of other radionuclides.

Nevertheless, as TEPCO plans, based on the knowledge on decommissioning and repository within the country, to identify radionuclides that possibly exist at the time of discharge and to select radionuclides to be measured and evaluated, the NRA will examine the result in due course before the start of discharge.

2. Organizational framework for analysis of ALPS Treated Water

When analyzing radionuclides contained in ALPS treated water, it is necessary to assess whether the current analytical environment, analytical resources and methods are adequate, and if there is a shortage, to secure resources necessary for analysis before discharge is started.

Therefore, the NRA examines whether TEPCO has a plan to establish an organizational framework required for analysis of ALPS treated water and to ensure objectivity and reliability for analytical methods and results.

TEPCO states that, for analyzing radionuclides contained in ALPS treated water collected at the measurement/confirmation facility, after identifying resources (e.g., analytical equipment and analysts) necessary for analysis of radionuclides newly added for measurement, it establishes an organizational framework required for

analysis of ALPS treated water and to ensure objectivity and reliability for analytical methods and results based on the quality management system plan described in the Implementation Plan Chapter III, Part 1, Article 3 by conducting the following.

- Analysts are procured from outsourcing companies certified by the International Organization for Standardization for the analysis of specific radionuclides, and the competency of analysts and those who supervise analysis is maintained through education and training.
- In consideration of the resources required for the analysis at the entire FDNPS, an organizational framework is established with roles clearly allocated within the organization, including subcontractors.
- Analysis and evaluation is conducted basically using the official methods, and quantitative evaluation of analytical data including uncertainties in analytical results is conducted while obtaining the involvement of a third-party analytical institution with expertise in the appropriateness and verification of the analytical method.

The NRA confirmed that as part of the activities based on the quality management system plan described in the Implementation Plan Chapter III, Part 1, Article 3, TEPCO plans to establish an organizational framework required for the analysis of ALPS treated water and to ensure objectivity and reliability for analytical methods and results by procuring analysts from specialized outsourcing companies and doing comparative verification of the analysis results with third-party institution. In addition to the establishment of this organizational framework, the NRA confirmed that TEPCO also plans to secure resources necessary for the analysis at the entire FDNPS including sea area monitoring

3. Operation and control of the dilution/discharge facility

(1) Operational controls of the dilution/discharge facility

TEPCO states that in order to reduce the effective dose at the site boundary as low as reasonably achievable, the following operational controls are implemented for the dilution/discharge facility upon discharge.

①The circulation and agitation time in the measurement/confirmation facility is appropriately set based on the demonstration test so that the representativeness of samples can be ensured. In order to reduce variations in tritium concentration within the tank group prior to circulation and agitation, ALPS treated water to be received in the measurement/confirmation facility as one

batch is controlled not to have significantly different tritium concentration.

② TEPCO states that, in order to make the dilution ratio 100 times or more, based on the tritium concentration determined in the measurement/confirmation process, the flow rate of ALPS treated water is set and controlled within the planed maximum flow rate of 500 m^3 per day (the minimum flow rate is more than the amount of contaminated water generation) by ALPS treated water transfer pumps, ALPS treated water flow rate control valves and ALPS treated water flow meters, and two or more seawater transfer pumps are operated at all times thereby ensuring the seawater volume required to dilute the flow rate of ALPS treated water. Furthermore, at the initial stage of discharge, a small amount of discharge will be carefully carried out with the aim of verifying that water is diluted as expected in the discharge vertical shaft (upstream shaft) and that the operation procedures are reliably followed.

③ In order to achieve sufficient dilution so that the tritium concentration in discharged water becomes less than the operational limit 1,500 Bq/L, the tritium concentration of ALPS treated water to be discharged is limited to 1 million Bq/L. Then the operational control value for tritium in discharged water is decided taking into count uncertainties associated with the entire process of discharge as well as the result of the numerical simulation of dilution.

④ To ensure that the annual amount of tritium to be discharged falls within 22 tera Bq, the annual discharge plan for ALPS treated water is established for each fiscal year and discharge is conducted in accordance with the plan.

The NRA confirmed that the dilution/discharge facility is operated and controlled in a manner to achieve sufficient dilution.

In addition, the NRA confirmed that discharge will be started with a small amount at the initial stage of discharge in order to confirm that the tritium concentration in the water sampled in the discharge vertical shaft (upstream shaft) is less than 1,500 Bq/L and that the operation procedures can be followed reliably, and that the annual amount of tritium to be discharge is controlled within 22 tera Bq at the whole FDNPS by the establishment and operation of the annual discharge plan.

(2) Responses to unusual occurrences: suspension of discharge

TEPCO states that ALPS treated water discharge will be suspended by the

emergency valves automatically or manually in case of occurrence of an event that may lead to ALPS treated water discharge in a manner TEPCO does not intend, or in case that an usual value is detected by sea monitoring, in addition to normal operation and shutdown of the dilution/discharge facility.

In addition, for equipment required to prevent or immediately mitigate ALPS treated water discharge in an unintended manner, its maintenance plan is established to check and maintain the performance. If the performance of the equipment cannot be confirmed through inspection and it is determined that immediate recovery is difficult, ALPS treated water discharge will be suspended.

The NRA confirmed that, in addition to automatic operation of the emergency valves in the event of a loss of external power supply, discharge can be reliably suspended by manual operation by operators according to the criteria to stop operation.

1-9 Safety assessment of facility design

In order to reduce and optimize risks of the entire Specified Nuclear Facility in the future, it is necessary to consider equipment failures of the discharge facility that may occur during the service period.

In this examination, the NRA confirms whether or not the most stringent unusual occurrences in terms of ALPS treated water discharge in a manner TEPCO does not intend is appropriately selected regardless of during operation or inspection, and measures to settle the said occurrence are valid.

1. TEPCO's assessment in the Application

(1) Selection of unusual occurrence

TEPCO states that in selecting unusual occurrence, it selects events which trigger occurrences leading to discharge in an unintended manner (hereinafter referred to as "initiating events"), and then, considering measures to prevent the occurrence of initiating events and countermeasures after initiating events occur, analyzes whether or not the events lead to unusual occurrences.

① Definition of unusual occurrence

In discharge of ALPS treated water, an occurrence leading to discharge in an unintended manner is defined as unusual occurrence, specifically as follows.

a. Occurrence in which discharge is conducted in a state of inadequate confirmation on radioactive materials contained

b. Occurrence of discharge in which the tritium concentration in discharged water is the operational limit or more, or the dilution rate is less than the minimum rate of operation.

c. Occurrence of discharge without dilution due to a leak

② Selection of initiating events

For SCCs constituting the dilution/discharge facility that handles ALPS treated water (including the power supply and measurement control system), failures that may occur during the service period are selected as initiating events. Referring to the specifications, piping and instrumentation diagrams, interlock block diagrams, layout drawings, and operation procedures of respective component, initiating events are systematically selected.

③ Selection of unusual occurrences subject to assessment

The unusual occurrences of ① a. and c. above are not subject to assessment because the unintended discharge can be prevented by measures to prevent the initiating events which cause the unusual occurrences or countermeasures after the initiating events occur, specifically by providing interlock checks in the measurement/confirmation process and the discharge process, identifying leak points by patrolling/checking or leak detectors and manually or automatically closing the upstream valves in the event of a leak from the device.

The unusual occurrence of ①b. above is selected subject to assessment because "trip of a seawater transfer pump during operation with 2 or 3 pumps" and "loss of external power supply" among the initiating events lead to ALPS treated water discharge in an unintended manner even considering countermeasures in design and operation.

(2) Conditions of equipment in assessment

TEPCO states that regarding "trip of a seawater transfer pump during operation with 2 or 3 pumps" and "loss of external power supply" selected to be subject to the assessment in (1), the conditions of major equipment are assumed as follows in order to make the discharge amount of ALPS treated water larger in the assessment.

① Initial condition

It is assumed that the unusual occurrence happens during normal operation of ALPS treated water discharge. The flow rate of ALPS treated water is set as the rated flow of ALPS treated water transfer pump (720 m^3 per day) assuming that ALPS treated water flow rate control valve is fully opened in order to exceed the planned maximum flow per day during normal operation (500 m^3).

② Equipment for coping with unusual occurrence and its operating conditions

The emergency isolation valves are installed as equipment necessary to cope with unusual occurrences.

The response time of the signal for activating the emergency isolation valves is set 5 seconds, which covers the time constant of the seawater flow meter (4 seconds), and the closing time of the emergency isolation valve-1 and the emergency isolation valve-2 are set 10 seconds and 2 seconds respectively, which are the maximum time required for fully closing.

③ Assumption of a single failure

As for equipment for coping with unusual occurrences, a single failure assumption is applied to active components.

Specifically, with regard to the emergency isolation valves, a single failure of emergency isolation valve-2 is assumed, where the amount of ALPS treated water retained in the transfer system when fully closed is larger and the total closing time is shorter.

(3) Assessment results

TEPCO assesses the discharge amount for the cases where countermeasures by equipment necessary to cope with the unusual occurrence are taken in the event of the unusual occurrence triggered by "loss of external power supply" and "trip of a seawater transfer pump during operation with 2 or 3 pumps" as follows.

① Loss of external power supply

Such occurrence is assumed that during ALPS treated water discharge, the external power supply is lost due to a failure of transmission systems and seawater transfer pumps and ALPS treated water transfer pumps are stopped, while ALPS treated water is continuously transferred by hydraulic head

pressure of tanks and height difference and is discharged without dilution.

When the said occurrence happens, the power to emergency isolation valves is also lost, while the emergency isolation valve-1 is actuated by the fail-close function of the valve. Therefore discharge is suspended at least in 10 seconds after external power supply is lost.

Consequently, when the emergency isolation valve-1 is closed, the discharge amount is approximately 1.1 m^3, which is calculated by adding the amount of ALPS treated water existing in the downstream pipe of the emergency isolation valve-1 (approximately 1.02 m^3) and the amount transferred by the time the emergency isolation valve-1 is fully closed (10 seconds, approximately 0.08 m^3). This amount is sufficiently smaller than the planned maximum flow per day during normal operation (500 m^3).

② Trip of a seawater transfer pump during operation with 2 or 3 pumps

Such occurrence is assumed that during ALPS treated water discharge, a seawater transfer pump is stopped among 2 or 3 pumps operating, thus the flow rate of seawater to dilute ALPS treated water is reduced.

When the said occurrence happens, the emergency isolation valve-1 is actuated by receiving a signal of "trip of sea water transfer pump" or "sea water flow rate is low". Therefore discharge is suspended at least in 15 seconds after the said occurrence happen.

Consequently, when the emergency isolation valve-1 is closed, the discharge amount is approximately 1.2 m^3, which is calculated by adding the amount of ALPS treated water existing in the downstream pipe of the emergency isolation valve-1 (approximately 1.02 m^3) and the amount transferred by the time the emergency isolation valve-1 is fully closed after receiving the signal (15 seconds, approximately 0.12 m^3). This amount is sufficiently smaller than the planned maximum flow per day during normal operation (500 m^3).

2. NRA's confirmation of the assessment

The NRA confirmed that initiating events leading to the unusual occurrence are appropriately selected by using a top-down analytical method to identify initiating events and its causes, and that in the case of occurrence of initiating events, countermeasures suitable for the Discharge Facility are taken.

The NRA also confirmed that in the assessment the transfer flow rate of ALPS

treated water and the activation time of the emergency isolation valve-1 are set conservatively, and that a single failure of the active components is appropriately assumed.

Moreover, the NRA confirmed that even if the most stringent unusual occurrence is assumed in terms of the discharge amount of ALPS treated water, by taking measures such as closing the emergency isolation valves-1, the discharge amount is assessed to be approximately 1.2m^3, and this amount is sufficiently smaller than the planned maximum flow per day during normal operation (500 m^3).

Based on the above, the NRA concludes that the design of the Discharge Facility is appropriate in order to mitigate and settle the unintended discharge of ALPS treated water.

1-10 Enhancing public acceptance on the implementation of the Plan

The Regulatory Requirement "VII. Promotion of understanding of the Implementation Plan" requires that in carrying out the Implementation Plan, measures in the Plan, contents of risk assessments, and progress on measures shall be continually explained to the public at large including local residents and municipalities, and the relevant information shall be disclosed in an effort to promote understanding.

TEPCO states that the Decontamination and Decommissioning Information & Planning Management Office (*6) is newly designated as an organization responsible for facilitating understanding of the Implementation Plan Chapter VI upon the start of ALPS treated water discharge.

The NRA confirmed that the Decommissioning Information and Planning Office established directly under the chief executive officer for decommissioning and contaminated water countermeasures is newly designated as an organization to provide guidance and advices for the continuous efforts for enhancing public acceptance of the Implementation Plan, and that the organizational system for confirmation and communication is strengthened to continuously and promptly disclosing easy-to-understand information. Since the adequate efforts are made as above, the NRA concludes that the Regulatory Requirement "VII. Promotion of understanding of the Implementation Plan" is satisfied.

(*6) An organization established on August 1, 2021, directly under the Chief Decommissioning Officer as the headquarters within the Fukushima Daiichi Decontamination and Decommissioning Engineering Company, in order to enable information dissemination and facility installation in response to local perspectives at the event of troubles, medium-scale disasters and emergencies, as well as upon making progress in the decommissioning activities.

1-11 Examination results

Considering the confirmation in Chapter 1, the NRA concludes that the Application satisfies the relevant items of the Regulatory Requirements and thus is sufficient for preventing disasters to be caused by nuclear fuel materials, materials contaminated by nuclear fuel materials or nuclear reactors.

Chapter 2 Review in light of the Government Policy

Following the way to review the application on ALPS treated water discharge which the NRA Commission approved on 22 December 2021, the NRA reviewed whether "the measures in response to the Basic Policy on handling of ALPS treated water at the Tokyo Electric Power Company Holdings' Fukushima Daiichi Nuclear Power Station" (hereinafter referred to as the "Measures in response to the Government Policy"), which was submitted as reference material separately from the main text of the Implementation Plan, are in line with the descriptions in the Government Policy relevant to the design and operation of the Discharge Facility as well as the radiological impact by discharge.

TEPCO addressed the following six items as being relevant to the design and operation of the Discharge Facility as well as the radiological impact of discharge within the Government Policy.

(Measures relevant to the design and operation of the Discharge Facility)

①Necessary procedures and the construction of the facility for starting the discharge in around spring 2023

②Involvement of a third party with expertise in analysis of radioactive materials

③Extensive dilution of ALPS treated water

④Total amount of tritium discharged per year

⑤Starting with a small amount of discharge, and discharge suspension when unusual values are observed by marine monitoring

(Measures to assess impact on the marine environment)

⑥Radiological impact assessment of discharge

After reviewing the measures to those six items, the NRA concludes that they are in line with the relevant descriptions in the Government Policy.

Specifically, the NRA reviewed ① to ⑤ along with the examination based on the Reactor Regulation Act. The review results on ⑥ are described in the following "2-1 Radiological impact assessment of discharge".

2-1 Radiological Impact Assessment of discharge

The Government Policy states that measures shall be taken to assess the potential impact

on the marine environment (*[7]).

TEPCO submitted to the NRA the "Radiological Impact Assessment Report regarding the Discharge of the ALPS Treated Water into the Sea (design stage, revised version)" (hereinafter referred to as the “Radiological Impact Assessment”) as an attachment to the Measures in response to the Government Policy.

In this Radiological Impact Assessment, TEPCO conducted an assessment of radiation dose to humans by planned discharge, as specified in IAEA Safety Standards, GSG-9 (*[8]), and stated that the methodology for the assessment is in accordance with the IAEA Safety Standards, GSG-10 (*[9]). In addition to the assessment specified in GSG-9, an assessment of radiation dose to humans in potential exposures as well as to marine animals and plants in normal operation were also carried out in accordance with the procedures shown in GSG-10. The Radiological Impact Assessment is currently based on the information at the design stage, and TEPCO will conduct the assessment again as necessary taking into account new information and knowledge relevant to the design and operation including the selection of target radionuclides for measurement and evaluation before discharge.

Following the way which the NRA Commission approved on 22 December 2021, the NRA confirmed and concluded that the Radiological Impact Assessment is conducted with reference to the relevant IAEA Safety Standards’ Requirements and Guides (GSR-Part3 (*[10]), GSG-9, GSG-10), and that the assessment results are below the criteria (*[11]) that the NRA Commission approved on 16 February 2022 and thus the impact both on humans and the environment is sufficiently small.

Referring to the relevant IAEA Safety Standards’ Requirements and Guides, the review results are described below respectively on “1. Assessment of radiation dose to humans”, “2. Assessment of radiation dose to humans in potential exposures”, “3. Assessment of radiation dose to marine animals and plants in normal operation”, and “4. Consideration of uncertainty”. The criteria for the review are: for the assessment 1, 50 μSv/year which the NRA Commission approved as equivalent to the dose constraint; for the assessment 2, 5 mSv

(*[7]) Written in the Government Policy of “3. Specific method of discharge of the ALPS treated water into the sea, (2)A method of discharge that minimizes adverse impacts on reputation, 7)”.
(*[8]) IAEA Safety Standards Series No.GSG-9 "Regulatory Control of Radioactive Discharges to the Environment", IAEA, 2018.
(*[9]) IAEA Safety Standards Series No.GSG-10 "Prospective Radiological Environmental Impact Assessment for Facilities and Activities", IAEA, 2018.
(*[10]) IAEA Safety Standards Series No.GSR Part 3 "Radiation Protection and Safety of Radiation Sources: International Basic Safety Standard", IAEA, 2014.
(*[11]) Material 2 "Review Status of Application for Amendment of Implementation Plan for Fukushima Daiichi Nuclear Power Plant, TEPCO Holdings Co., Ltd. (ALPS Treated Water Discharge Facility)" of the 65th Nuclear NRA in FY2021, Appendix 3 "Approaches and Evaluation Guidelines for Confirmation of Radiological Impact Assessment"

per event which is shown in GSG-10 as a typical criterion for radioactive material and sources with a low capacity for a radioactive release in an accident; and for the assessment 3, the lowest values of the Derived Consideration Reference Levels which are described as "a set of dose rate bands within which there is either no evidence (for most of the reference animals and plants) or only some evidence of deleterious effects of ionizing radiation" in GSG-10.

1. Assessment of radiation dose to humans

(1) Selection of the source term

The discharge amount of each radionuclide, which is used as input to the assessment, is called "source term" hereinafter. Referring to paragraph 5.9 to 5.11 of GSG-10 on selection of the source term, the NRA confirmed mainly whether the selected source term is the composition and amount of relevant radionuclides typical to the activity subject to the assessment.

The details of the confirmation are as follows:

- Using the data of ALPS treated water in the three tank groups (hereinafter referred to as the "three tank groups") for which 64 radionuclides have been measured and evaluated, the source term is set by the concentrations of the radionuclides contained in and the annual discharge amount of ALPS treated water.
- There is no substantial difference in radionuclide composition between ALPS treated water in the three tank groups and the water in the other tank groups of which the sum of the ratios of radionuclides other than tritium to each concentration limit is less than 1.
- Regarding the organically bound tritium (OBT), tritium in ALPS treated water to be discharged is considered to mostly take the form of tritiated water (HTO) as little organic compounds are contained in ALPS treated water; and the ratio of tritium becoming OBT in marine biota is set conservatively even though no OBT has been detected in the monitoring results of fish from the sea area near the FDNPS.
- Considering the fact that the concentration of radionuclides in seawater within the port is higher than that of seawater in the surrounding sea area, the effects of radionuclides contained in seawater are confirmed in the assessment assuming the cases where seawater is taken from the north side of the discharge port of Unit 5/6, which is outside the port, and where seawater is taken within the port.
- With regard to radionuclides to be measured and evaluated before ALPS treated water discharge, TEPCO plans, based on the knowledge on decommissioning and

repository within the country, to identify radionuclides that possibly exist at the time of discharge, to select radionuclides to be measured and evaluated, and accordingly to revisit the selection of the source term. On the other hand, some of the ALPS removal target radionuclides are considered not to exist substantially by the time of discharge because of decay. In addition, at the time of analysis of water in the storage tanks, there was no substantial difference between the sum of radioactivity of the major seven nuclides/carbon 14 /technetium 99 and the total beta value which could indicate any suspicion of the presence of other nuclides. Taking the above into account, even if there exists any other radionuclide than ALPS removal target 62 radionuclides and carbon14, the impact to humans is considered small because of low-energy radiation, and thus the impact of the revisit of the source term to the assessment would be small.

(2) Modelling of dispersion and transfer in the environment

Referring to paragraph 5.12 to 5.25 of GSG-10 on modelling of dispersion and transfer in the environment, the NRA mainly confirmed:

- Whether the concentration of radioactivity in the environment caused by discharge of radioactive materials is estimated by analytical model; and
- Whether the selected dispersion and transfer model is suitable for simulating dispersion, dilution, transfer, accumulation of radionuclides and their decay as necessary, taking into account the characteristics of discharge expected during normal operation.

The details of the confirmation are as follows:

- Estimation of radioactivity concentration in the ocean was conducted using the Regional Ocean Modeling System (hereinafter referred to as "ROMS"), which has been broadly applied both inside and outside the country as well as verified for reproducibility in calculating radioactivity concentrations when releasing radionuclides into the sea area near the FDNPS.
- As ROMS is a model for simulating advection and diffusion in a wide area and does not reproduce the physical flow near the outlet, the concentration distribution may differ near the outlet due to the effect of discharging water upward. However, the possible difference is considered to be sufficiently small by the ocean dispersion in the domain for the assessment.
- Since the tritium concentration at the boundary of the target domain is sufficiently smaller than the one in the sea area around Japan, the target domain is considered

sufficient enough for simulation.

- Since there is no ascending trend in the radioactivity concentration during the one-year calculation period of simulation, the average concentration of one year can represent the typical state for the whole duration of discharge.
- From the results of simulation using meteorological and oceanographic data for each of the seven years from 2014 to 2020, differences in the estimated annual average radioactivity concentration are confirmed to be small. With this understanding, the data of 2019, from which result was relatively high, is decided to be used for simulation.
- For radionuclides other than tritium, the dynamics does not necessarily coincide with tritium, which is a tracer in simulation, in the environment due to adsorption such as into seabed soil. However it is assumed in the estimation that the other radionuclides are advected and diffused in a state dissolved in seawater like tritium, and this assumption is conservative without account taken of decrease in concentration in seawater.
- On the other hand, the accumulation of radionuclides associated with transfer such as to beach sand, is assumed in equilibrium with the radioactive concentration in seawater from the start of discharge, which means the assessment is conducted in a state where the radioactive concentrations in the environment are considered to become the highest during the long-term discharge.
- There is no significant difference between the result of the reproduction calculation using ROMS by the NRA and the one of simulation carried out by TEPCO.
- The transfer models are set with reference to the previous assessments conducted for the existing nuclear facilities in Japan, in addition the other transfer models not subject to the above assessments are considered based on GSG-10.
- Transfer factors based on GSG-10 as well as the ones used in the process of licensing of nuclear facilities in Japan are applied.

(3) Identification of exposure pathways

Referring to paragraph 5.26 to 5.31 of GSG-10 on identification of exposure pathways, the NRA mainly confirmed:

- Whether exposure pathways are selected both for internal and external exposure with the nature of this discharge considered; and
- Whether there is a justifiable reason to exclude specific exposure pathways from consideration.

The details of the confirmation are as follows:

- Exposure pathways to humans are set with reference to the previous assessments conducted for the existing nuclear facilities in Japan, in addition the other exposure pathways not subject to the above assessments are considered based on GSG-10.

(4) Identification of the representative person

Referring to paragraph 5.32 to 5.35 of GSG-10 on the identification of the representative person (*12), the NRA mainly confirmed whether the representative person is identified by using the typical data after obtaining the habit data of the population living in the region and the country where the facility is located such as from the statistics, including inhalation rates and consumption rates of food and drinking water.

The details of the confirmation are as follows:

- Since it is not possible to obtain habit data characteristics in the region near the FDNPS in a comprehensive manner so as to be used for the identification of the representative person, the representative person is set applying the characteristics of individuals with reference to the previous assessments conducted for the existing nuclear facilities in Japan as well as the results of the survey on food consumption by Japanese citizens.
- In response to future improvements in the surrounding environment of the FDNPS, such as lifting of difficult-to-return zones and the associated relaxation of restrictions on habitation, TEPCO plans to consider whether to apply habit data characteristics for identifying the representative person.

(5) Assessment of the dose to the representative person

Referring to paragraph 5.36 to 5.37 of GSG-10 on the assessment of the dose to the representative person, the NRA mainly confirmed whether internal and external exposure are assessed using dose coefficients with appropriate consideration given for different age groups.

The details of the confirmation are as follows:

- Dose coefficients based on GSG-10 as well as the ones used in the process of

(*12) The representative person is defined in GSR Part 3 as “An individual receiving a dose that is representative of the doses to the more highly exposed individuals in the population”, referring to ICRP Publication101 "Assessing Dose of the Representative Person for the Purpose of the Radiation Protection of the Public/The Optimization of Radiological Protection - Broadening the Process” and is used for determining compliance with the dose constraint for the purpose of protection of the public.

licensing of nuclear facilities in Japan are used in assessing external and internal exposures.

- Assessment of internal exposure is conducted for different age groups of adults, children and infants.

(6) Comparison of estimated doses with dose constraint

Referring to paragraph 5.38 to 5.42 of GSG-10 on comparison of estimated doses with dose constraints, the NRA confirmed the following:

- As a result of the above assessment, the estimated dose to the representative person is approximately 10-2 to 10-1 μSv/year, which is considerably small compared to 50 μSv/year, the criterion which the NRA Commission approved on 16 February 2022.
- With the above result in mind, recognizing that, in the process of deciding the Government Policy, consideration was given to factors for optimization of protection and safety associated with ALPS treated water discharge such as the planning of the entire decommissioning, the effect of decay, the risk of accidental discharge during storage, occupational exposure, and societal impacts, TEPCO has decided that the annual amount of tritium to be discharged is controlled at a level lower than 22 tera Bq.
- TEPCO plans to periodically revisit the annual amount of tritium to be discharged within the range of the dose constraint taking into account factors to be considered in the optimization process.

2. Assessment of radiation dose to humans in potential exposures

Referring to paragraph 5.43 to 5.75 of GSG-10 on assessment for the protection of the public against potential exposures, the NRA mainly confirmed:

- Whether scenarios for potential exposures are identified on the basis of the safety assessment for the facility and activities;
- Whether radiation dose to the representative person is estimated after identifying source term, dispersion and transfer model, exposure pathways and the representative person appropriate to the identified scenarios; and
- Whether the estimated dose is below the criteria for potential exposure.

The details of the confirmation are as follows:

(1) Identification and selection of potential exposure scenarios

- Conservative scenarios are assumed for two cases identified as damages which could lead to an unintended discharge, beyond equipment malfunctions postulated for the assessment of the design of the Discharge Facility: ①rupture of ALPS treated water transfer pipe, and ②breakage to the tank groups for measurement and confirmation.

(2) Selection of the source term

- According to the potential exposure scenarios, the source term is set by the same concentrations of radionuclides as 1. and the ALPS treated water discharge amount per day for each case is: ①the planned maximum flow volume during normal operation, and ②the total amount contained in the measurement/confirmation tanks.

(3) Modelling of dispersion and transfer in the environment

- Using the same simulation model, the same inputs are applied except the discharge point which is the only difference from normal operation and decided corresponding to the potential exposure scenarios.
- As there is no difference for transfer models depending on the discharge points, the same transfer models as 1. are applied.

(4) Identification of exposure pathways

- The same exposure pathways as 1. are applied in the same manner as the transfer models.

(5) Identification of the representative person

- While the exposure time and point are set according to the potential exposure scenarios, the other characteristics of the representative person are the same as 1.

(6) Assessment of the dose to the representative person for potential exposures

- The same methods and coefficients as 1. are used in estimating the dose to the representative person for potential exposures.
- The concentration of radioactivity in seawater used in the assessment is conservatively assumed to remain the same during the whole exposure time.

(7) Comparison of estimated doses with criterion

- As a result of the above assessment, the estimated dose is 10^{-4} to 10^{-3} mSv/event in the scenario ①, and 10^{-2} to 10^{-1} mSv/event in the scenario ②, which means, in both cases, the estimated dose is below 5 mSv/event which is shown in GSG-10 as a typical criterion for radioactive material and sources with a low capacity for a radioactive discharge in an accident.

3. Assessment of radiation dose to marine animals and plants in normal operation

Referring to paragraph I.19 to I.25 of GSG-10 Annex I on the assessment of protection of flora and fauna in normal operation, the NRA mainly confirmed:

- Whether dose rates are estimated for the reference animals and plants selected according to the marine ecosystem in the sea area near the FDNPS, with the same source term and modelling of dispersion and transfer as used in 1. as well as the exposure pathways to be considered for marine animals and plants; and
- Whether the estimated dose rates are below the lowest values of the Derived Consideration Reference Levels.

The details of the confirmation are as follows:

(1) Selection of the source term

- The source term is the same as used in 1.

(2) Modelling of dispersion and transfer

- The same simulation model is used with the same inputs as 1.
- The transfer models are selected from the ones identified in 1. with account taken of the habitat environment of marine animals and plants.

(3) Identification of exposure pathways

- Exposure pathways are identified based on GSG-10.

(4) Selection of the reference animals and plants

- According to the marine ecosystem in the sea area near the FDNPS, reference flatfish, reference crab and reference brown seaweed are selected.

(5) Assessment of dose rates to reference animals and plants

- Dose coefficients based on GSG-10 are used for external and internal exposures.

(6) Comparison estimated dose rates with Derived Consideration Reference Levels

- As a result of the above assessment, the estimated dose rates are sufficiently below the lowest value of the Derived Consideration Reference Levels.

4.Consideration of uncertainty

Referring to paragraph 6.1 to 6.9 of GSG-10 on consideration of variability and uncertainty in radiological environmental impact assessment, the NRA mainly confirmed:

- Whether the level of uncertainty is understood with the nature of uncertainty included in the assessment being comprehended; and
- Whether consideration is given to identify sources of uncertainty contributing most to the assessment result.

The details of the confirmation are as follows:

- Understanding the nature of uncertainty, such as random uncertainty with statistical distribution and uncertainty arising from incomplete knowledge, sources of uncertainty contributing largely to the assessment result are identified as the radionuclide composition of the source term and concentration factors in sea animals.
- As the estimated dose to the representative person in 1.(6) is considerably small compared to the criterion, there is no need to give detailed consideration to uncertainty. Even if the main source of uncertainty identified as above is considered in the assessment, the variance would be one order of magnitude and therefore the conclusion that the estimated dose is below the criterion remains the same.

End