

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

10 May 2023

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.

## **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 operational measures of ALPS treated water discharge (hereinafter referred to as the "Application") on November 14, 2022 (partially revised on February 14, February 20, and April 24, 2023).

### 2. Content of the Application

TEPCO establishes the organizational structure to manage operation and maintenance of the ALPS treated water dilution/discharge facility and the outlet facility (hereinafter referred to as the "discharge facility") necessary to discharge water which has been processed by systems such as the Advanced Liquid Processing System (ALPS) 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") . Also, TEPCO establishes the scheme to select radionuclides to be measured and evaluated before each discharge in order to ensure that the sum of the ratios of the other radionuclides than tritium to each concentration limit is less than 1 (hereinafter referred to as "radionuclides to be measured and evaluated").

In addition, due to the progress of the facility construction and the preparation of operational procedures, the contents of the Implementation Plan on Installation of ALPS Treated Water Discharge Facility approved on 22 July 2022 is updated and amended.

### 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 16 November 2022<sup>(1)</sup>, this Review Results Document consists of the following.

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<sup>1</sup> FY2022 51st NRA Commission Meeting Material 2 "Response to Application to Amend the Implementation Plan for TEPCO's Fukushima Daiichi Nuclear Power Station (Operational Measures of ALPS Treated Water Discharge)"

"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 organizational structure to manage operation and maintenance of the discharge facility and the scheme to select radionuclides to be measured and evaluated 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 "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") relevant to the suspension of discharge as well as the assessment of 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.

## **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 the relevant item of the Regulatory Requirements “III. Items concerning measures taken for operational safety of the Specified Nuclear Facility”.

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.

Considering the content of the Application, the NRA examined the following items:

1. Organizational structure to manage operation and maintenance of the discharge facility
2. Scheme to select radionuclides to be measured and evaluated
3. Other items (updates and amendments of the approved contents)

As a result of examining the Application for those items above, the NRA concludes that the content of the Application satisfies the Regulatory Requirements “III. Items concerning measures taken for operational safety of the Specified Nuclear Facility” and thus is sufficient for preventing disasters to be caused by nuclear fuel materials, materials contaminated by nuclear fuel materials or nuclear reactors.

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

### **1-1. Organizational structure to manage operation and maintenance of the discharge facility**

In the Application, TEPCO states that, as the organizational structure to manage operation and maintenance of the discharge facility after the start of operation, it establishes the following structure: the ALPS treated water program department performs duties on the planning of the operation of the ALPS treated water dilution/discharge facility, the operation shift team for water treatment system performs duties on the operation management of the ALPS treated water dilution/discharge

facility, the water storage facility group performs duties on the maintenance management of mechanical equipment of the ALPS treated water dilution/discharge facility, and the water treatment instrumentation group performs duties on maintenance management of instrumentation equipment of the ALPS treated water dilution/discharge facility. Also considering the increased duties associated with the start of the operation of the discharge facility, TEPCO increases the number of workers in the operation shift team for water treatment system and conducts training to ensure the competence of workers.

The NRA confirmed that the organizational structure necessary to manage operation and maintenance of the discharge facility is to be appropriately established through clarifying the responsibility and authority of each group involved for operation management including responses to unusual occurrences and maintenance management of equipment and increasing the number of workers who have enough competence for operation.

#### **1-2. Scheme to select radionuclides to be measured and evaluated**

As confirmed in the examination of the Implementation Plan on Installation of ALPS Treated Water Discharge Facility, which the NRA approved on 22 July 2022, TEPCO planned, based on the knowledge on decommissioning and repository within the country, to identify radionuclides that may possibly exist in the highly contaminated water, which is generated in the reactor and other buildings due to the intrusion of rain and ground water (hereinafter referred to as "contaminated water"), at the time of discharge considering radioactive decay and then to select radionuclides to be measured and evaluated to ensure that the sum of the ratios of the concentration of other radionuclides than tritium to each concentration limit is less than 1, and the NRA planned to examine the result in due course before the start of discharge.

In the Application, TEPCO states the scheme to select radionuclides to be measured and evaluated is set as follows:

Step 1 : Are radionuclides present in the results of the inventory<sup>2</sup> assessment

【Yes → move on to Step 2】

Step 2 : Whether noble gas (except Rn) or not

【No → move on to Step 3】

Step 3 : Does the ratio of the concentration of each radionuclide to the regulatory concentration limit exceed 1/100 assuming the whole inventory of the

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<sup>2</sup> Quantity of each radionuclide (Bq)

radionuclide is transferred to the water stored in the treated water storage tanks

【Yes → move on to Step 4】

Step 4 : Does the ratio of the concentration of each radionuclide to the regulatory concentration limit exceed 1/100 in the transfer assessment of the radionuclide to contaminated water

【Yes → move on to Step 5】

Step 5 : Is the ratio of the concentration of each radionuclide to the regulatory concentration limit confirmed less than 1/100 in the analytical results of contaminated water in the past

【No → except tritium, selected as radionuclides to be measured and evaluated】

Also, TEPCO states that, due to the possibility that the condition of contaminated water may change depending on the progress of the decommissioning work in the future, it periodically checks the validity of the selection of radionuclides to be measured and evaluated and, as necessary, re-assess the selection of radionuclides, considering the result of gross  $\alpha$ , gross  $\beta$  and Ge semi-conductor detector measurements to be conducted for each discharge batch, as well as the trend of the concentration of major radionuclides in contaminated water,.

The NRA confirmed the following points about the scheme of the selection, and thus confirmed that this scheme is valid to identify radionuclides that may possibly exist in contaminated water and then select radionuclides to be measured and evaluated:

- TEPCO comprehensively includes fission products and activation products as radionuclides that may possibly exist in contaminated water. Also, the analysis codes used for the inventory assessment have already been validated by measures such as experiments. 【Step 1】
- For selecting radionuclides to be measured and evaluated effectively, the concentration of each radionuclide in contaminated water is evaluated step by step with the decay considered. Also, the transfer to contaminated water is evaluated using the analytical results whose reliabilities including analytical methods are validated. 【Step 1~4】
- The criteria to exclude radionuclides by 1/100 of the regulatory concentration limit or less are set with consideration given to the contributions to dose of the radionuclides excluded and the ones which move on to the next step. 【Step 3&4】

- Radionuclides excluded at step 5 are limited to those which concentrations in contaminated water have been clearly confirmed below 1/100 of the regulatory concentration limits in the analytical results. 【Step 5】
- Considering possible changes of the condition of contaminated water depending on the progress of the future decommissioning work, TEPCO periodically checks the validity of the selection of radionuclides to be measured and evaluated by continuously conducting measurements of contaminated water and, as necessary, re-assess the selection. 【Step 1~5】

### **1-3. Other Items (updates and amendments of the approved contents)**

TEPCO states that, due to the progress of the facility construction and the preparation of operational procedures, it adds the description on how to set the unusual value at sea area monitoring which triggers discharge suspension and amends the description of the structure of the discharge tunnel as well as the operational procedure for discharge suspension to the Implementation Plan on Installation of ALPS Treated Water Discharge Facility approved on 22 July 2022.

The NRA confirmed that the updates and amendments above are to embody the contents as a result of the progressing preparation of ALPS treated water discharge, and therefore do not affect the previous review results on the Implementation Plan on Installation of ALPS Treated Water Discharge Facility approved on 22 July 2022 (i.e., it satisfies the Regulatory Requirements).



## **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 16 November 2022, with regard to “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, the NRA reviewed whether the contents amended from the approval on 22 July 2022, namely the item “Starting with a small amount of discharge, and discharge suspension when unusual values are observed by marine monitoring” and “Radiological impact assessment of discharge”, are in line with the descriptions in the Government Policy relevant to the suspension of discharge as well as the assessment of the radiological impact by discharge.

As a result of reviewing the measures to the two items above, the NRA concludes that they are in line with the relevant descriptions in the Government Policy.

Specifically, the NRA reviewed the item “Starting with a small amount of discharge, and discharge suspension when unusual values are observed by marine monitoring” along with the examination based on the Reactor Regulation Act. The review results on the item “Radiological impact assessment of discharge” are described in the following “2-1 Radiological impact assessment of discharge”.

### **2-1 Radiological Impact Assessment of discharge**

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

The NRA confirmed the following points on the contents amended from 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 “previous report”), which had been confirmed upon the review of the Implementation Plan on Installation of ALPS Treated Water Discharge Facility approved on 22 July 2022.

- The discharge amount of each radionuclide which is used as input to the assessment (hereinafter referred to as the “source term”) is set by the concentrations of the radionuclides to be measured and evaluated, selected based on the “1-2. Scheme to select radionuclides to be measured and evaluated” in “Chapter 1 Examination based on the Reactor Regulation Act” as well as tritium, and the annual discharge volume

of ALPS treated water.

- With the above source term and the same assessment method as the previous report whose validity was already confirmed, the assessment results are below the criteria which the NRA Commission approved on 16 February 2022<sup>3</sup> as follows, and thus the impact both on humans and the environment remains sufficiently small.
  - The estimated dose to the representative person is approximately  $10^{-3}$  to  $10^{-2}$   $\mu\text{Sv}/\text{year}$  ( $10^{-2}$  to  $10^{-1}$   $\mu\text{Sv}/\text{year}$  in the previous report), which is considerably small compared to criterion, 50  $\mu\text{Sv}/\text{year}$ .
  - The estimated dose to the representative person in potential exposures is respectively  $10^{-4}$  mSv/event in the scenario of the rupture of ALPS treated water transfer pipe ( $10^{-4}$  to  $10^{-3}$  mSv/event in the previous report), and  $10^{-3}$  to  $10^{-2}$  mSv/event in the scenario of the breakage to the tank groups for measurement and confirmation ( $10^{-2}$  to  $10^{-1}$  mSv/event in the previous report). In both cases, the estimated doses are considerably small compared to 5 mSv/event which is shown in GSG-10<sup>4</sup> as a typical criterion for radioactive material and sources with a low capacity for a radioactive discharge in an accident.
  - The estimated dose rates to marine animals and plants in normal operation are sufficiently below the lowest value of the Derived Consideration Reference Levels<sup>5</sup>.

End

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<sup>3</sup> 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 NRA Commission Meeting in FY2021, Appendix 3 "Approaches and Evaluation Guidelines for Confirmation of Radiological Impact Assessment"

<sup>4</sup> IAEA Safety Standards Series No.GSG-10 "Prospective Radiological Environmental Impact Assessment for Facilities and Activities",IAEA,2018.

<sup>5</sup> The Derived Consideration Reference Levels 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.