Attachment 2

Partial Revisions of the Application Documents for Approval to Amend the Implementation Plan Regarding the Handling of ALPS Treated Water [Overview]

TEPCO

February 14, 2023

Tokyo Electric Power Company Holdings, Inc.

Introduction

- Following the announcement of the Japanese government's Basic Policy on the handling of ALPS treated water in April 2021, TEPCO has been reviewing the details of the design and operation of ALPS treated water dilution/discharge facility and related facilities, and it has been advancing construction works accordingly.
- On November 14, 2022, we submitted the "Application Documents for Approval to Amend the Implementation Plan for Fukushima Daiichi Nuclear Power Station Specified Nuclear Facility" to the Nuclear Regulation Authority (NRA), with additional details/revisions on the organizational structure for operating, maintaining, and managing the ALPS treated water dilution/discharge facilities, nuclides to be measured/assessed to confirm that the ALPS treated water meets the discharge criteria before it is discharged into the sea, and the radiological environmental impact assessment results following the changes to the nuclides to be measured/assessed.
- On February 14, 2023, based on items pointed out by the NRA in the Technical Meeting to Review the Implementation Plan for the Specified Nuclear Facility, etc. and the IAEA findings, we submitted the partial revisions of the "Application Documents for Approval to Amend the Implementation Plan for Fukushima Daiichi Nuclear Power Station Specified Nuclear Facility" (hereinafter referred to as "partial revisions") to the NRA.
- We will continue to do our utmost to increase the understanding of people of Fukushima and domestic and international community regarding the handling of ALPS treated water as part of the decommissioning work, by continuing our efforts to disseminate information based on scientific evidence to parties within and outside Japan in an easy-to-understand manner and taking every opportunity to listen to the concerns and opinions of the public and explain our approach and response.
- Furthermore, we will also work to build trust of people within and outside Japan, by disclosing the construction status of ALPS treated water dilution/discharge facilities, etc. as appropriate and responding sincerely to safety confirmation by municipalities and reviews by the International Atomic Energy Agency (IAEA) to secure objectivity and transparency.

Underlined parts: Major areas of updated

Updated

1-1. Overview of the Partial Revisions of the Implementation Plan

Points to be revised	Slide No.
Chapter III Security at the specified nuclear facility	
Part 1／Part 2 Operations related to security	
Reflected changes in operation structure after the ALPS treated water dilution/discharge facility starts operation	5~6
Part 3 Supplementary explanation regarding security	
Selection of nuclides subject to measurement and assessment in order to confirm before discharging ALPS treated water into the sea that the ALPS treated water meets the discharge criteria (Sum of the ratios of the concentration of each radionuclide to the regulatory concentration of each is less than one)	7~17
<u>Operation management of the ALPS treated water dilution and discharge facilities</u>	<u>18~19</u>
Reference material **Response based on the “Basic Policy on handling of ALPS Treated Water at the Tokyo Electric Power Company Holdings’ Fukushima Daiichi Nuclear Power Station”**	
Radiological Environmental Impact Assessment report regarding the discharge of ALPS treated water into the sea (construction stage)	Attachment 3

2-1. Objective and ALPS Treated Water dilution/discharge facility and related facilities

Remain the original

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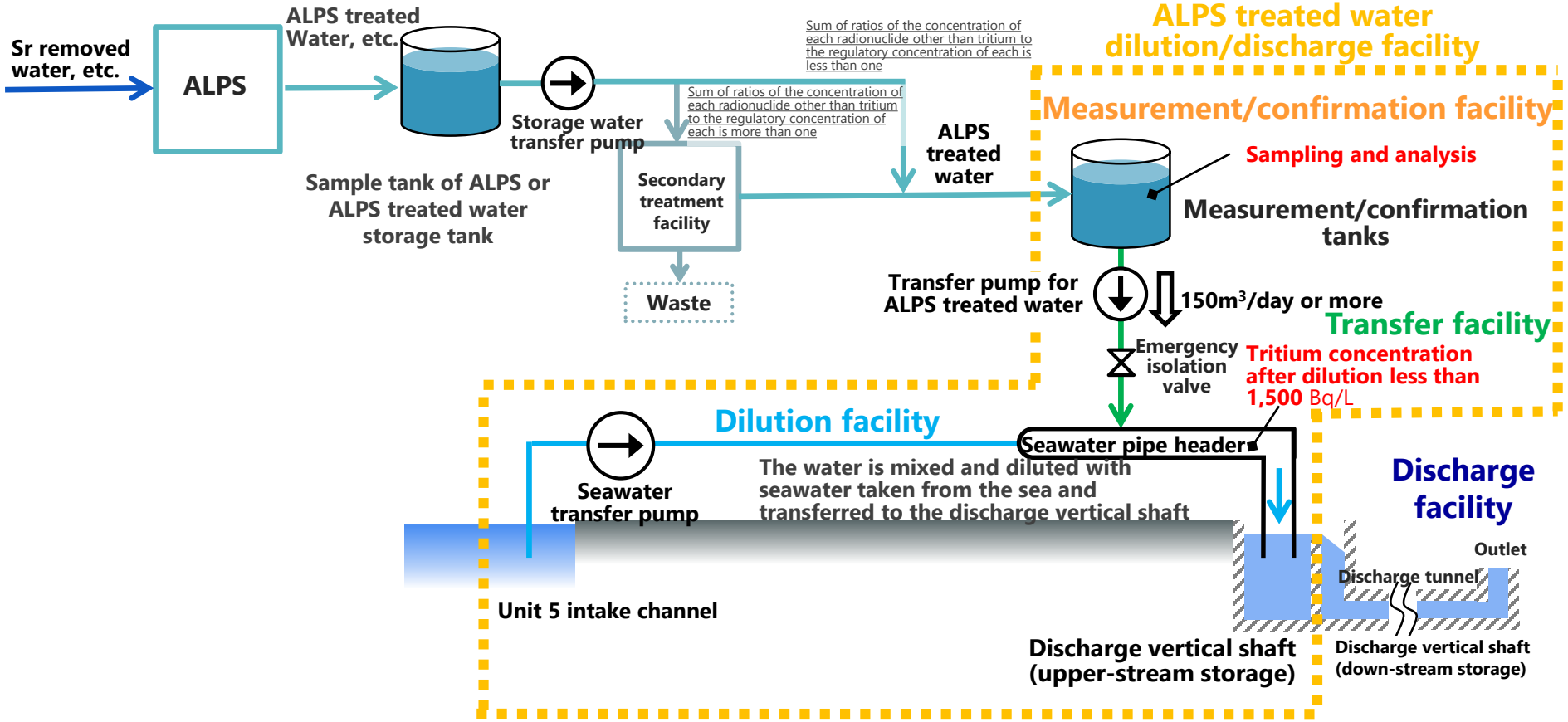
Objective

Water which radioactive nuclides has been removed using ALPS until the radionuclide concentration is at a sufficiently low concentration, will be diluted with seawater and discharged into the sea after confirming that the water meets the regulatory requirements (water with the sum of ratios of legally required concentrations, excluding tritium, less than 1).

Facility overview

In the measurement/confirmation facility, once the radionuclides in the water in the measurement/confirmation tank are uniformly dispersed, samples are taken and analyzed to confirm the water meets regulatory standards. The ALPS treated water is then transferred to the seawater pipe header using the transfer facility and mixed with the seawater taken from the Unit 5 intake channel using the dilution facility until the tritium concentration is below 1,500 Bq/L. This is then discharged using the discharge facility. At the discharge facility, the water will be discharged from the outlet 1km off the coast.



2-2. Overview of ALPS treated water dilution/discharge facility and related facilities

Remain the original

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Secondary treatment facility（newly installed reverse osmosis membrane facility）

Secondary treatment of treated water to be re-purified (sum of the ratios of nuclides, excluding tritium, is between 1 and 10)

Secondary treatment facility（ALPS）

Secondary treatment of Treated water to be re-purified (sum of the ratios of nuclides, excluding tritium, is 1 or higher)

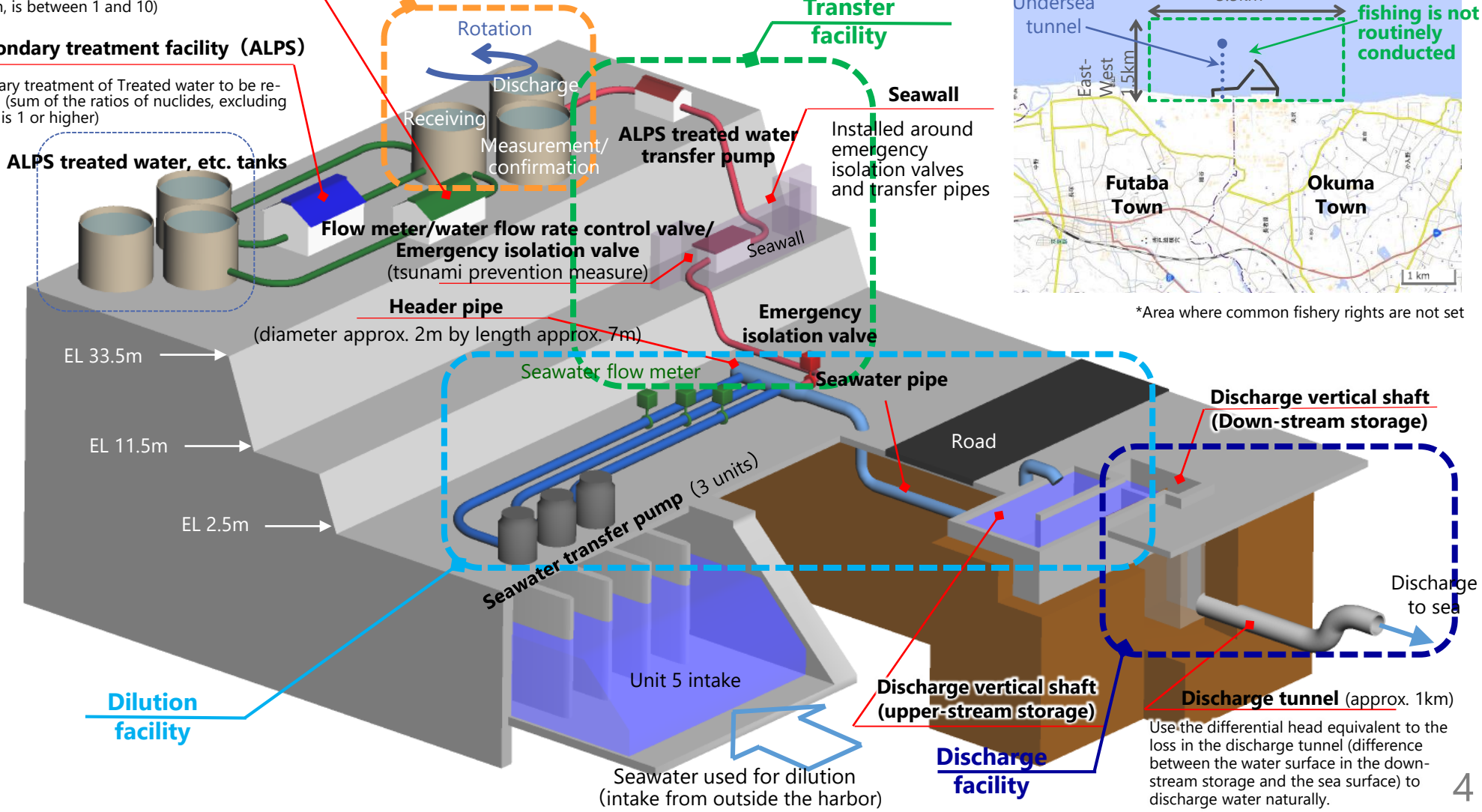
Measurement/confirmation facility (K4 tank group)

Comprised of three sets of tank groups each with the role of receiving, measurement/confirmation, and discharge. In the measurement/confirmation stage, water that has been made homogenized through circulation and agitating is sampled and analyzed (approx. 10,000m^3 × 3 groups)

Transfer facility

Seawall

Installed around emergency isolation valves and transfer pipes



Source: Developed by Tokyo Electric Power Company Holdings, Inc. based on the map developed by the Geospatial Information Authority of Japan (electronic territory web)
https://maps.gsi.go.jp/#13/37.422730/141.044970/&base=std&ls=std&disp=1&vs=c1j0h0k0l0u0t0z0r0s0m0f1

*Area where common fishery rights are not set

3-1. Organizational structure(overview)

- The ALPS Treated Water Program Department will continue to be in charge of planning and managing the project of facilities related to the discharge into the sea even after the ALPS treated water dilution/discharge facilities start operation. The Implementation Plan was updated to clarify the specific departments that would be in charge of maintenance management and operation management of equipment. No changes have been made in the partial revision's application.

Organization	Operations related to security
ALPS Treated Water Program Department	Development of plans, management and operation methods for facilities related to sea discharge and the operation plans of ALPS treated water dilution/discharge facilities
Water Treatment Team, Operation Dept., Construction, Operation, and Maintenance Center	Operation management of contaminated water treatment facilities, buildings for storing stagnant water, ALPS, subdrain and other water treatment facilities, and the ALPS treated water dilution/discharge facilities
Storage Facilities G, Mechanical Engineering Dept., Construction, Operation, and Maintenance Center	Maintenance management of civil engineering equipment in contaminated water treatment facilities (storage facilities) and mechanical equipment in ALPS treated water dilution/discharge facilities Construction, installation, and maintenance management of contaminated water treatment facilities (ancillary facilities to storage facilities), and rainwater treatment facilities
Water Treatment Instrumentation G, Electrical, Instrumentation and Control Dept., Center for Construction, Operation, and Maintenance	Construction, installation, and maintenance management of instrumentation for contaminated water treatment facilities, buildings storing stagnant water, ALPS, subdrain and other water treatment facilities, oil treatment facilities, facilities to intake water inside the Unit 3 primary containment vessel, ALPS treated water dilution/ discharge facilities

Red letters: : Updated areas

The department in charge of works other than the above is as described in the current, approved version of the Implementation Plan. The following Groups will work on each of the tasks as appropriate.

- Work related to procedures in operation management：Center for Construction, Operation, and Maintenance, Operation Dept., Operational Support G
- Maintenance management of electrical equipment：Center for Construction, Operation, and Maintenance, Electrical, Instrumentation and Control Dept., Electrical Equipment Maintenance G
- Maintenance management of civil engineering equipment：Center for Construction, Operation, and Maintenance, Civil Engineering Dept., Civil Engineering Equipment G
- Maintenance management of construction equipment：Center for Construction, Operation, Construction Dept., Construction Equipment Maintenance G
- Discharge management of liquid waste：Emergency Preparedness/Radiation Control Center, Radiation/Environment Dept., Discharge/Environmental Monitoring G
- ALPS treated water analysis：Emergency Preparedness/Radiation Control Center, Radiation/Environment Dept., Analysis and Assessment G

[Reference] Organization chart for the discharge of ALPS treated water into the sea

Newly added (Nov. 14 submission)

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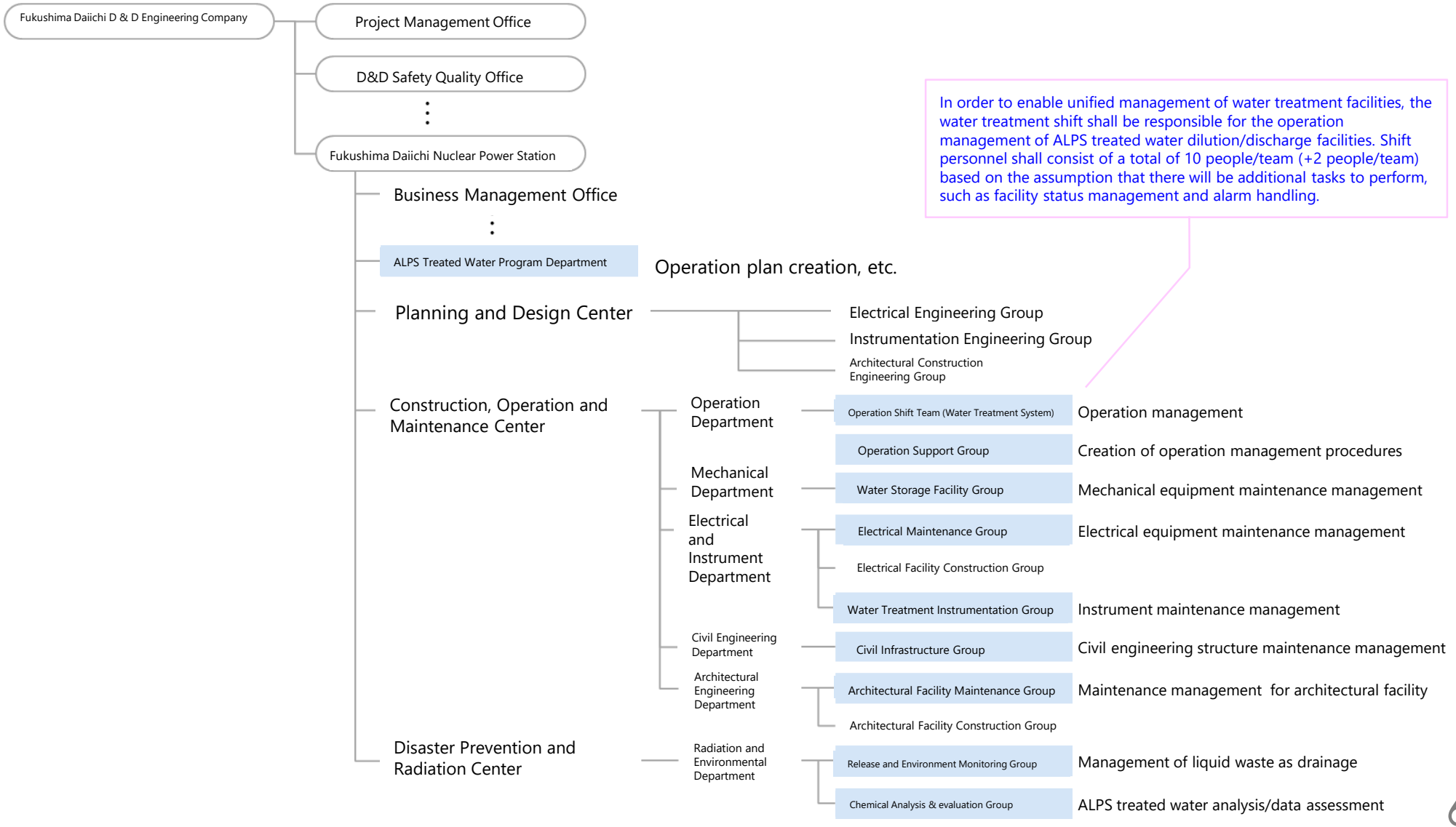
- The organizational chart of the FDEC below has been used to show the departments that will be managing the sea discharge of ALPS treated water
- It was confirmed at the Technical Meeting to Review the Implementation Plan for the Specified Nuclear Facility that facility maintenance and operation departments are covered.



Newly added

4-1. Selecting nuclides for measurement/assessment (overview)

Objective

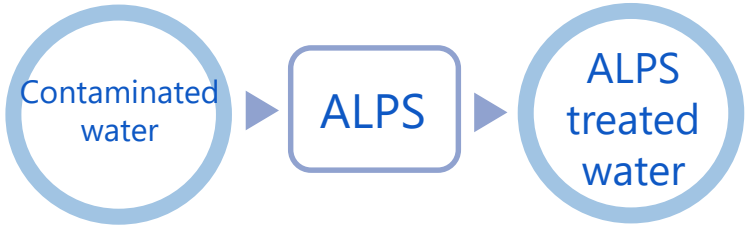
Why did we select the nuclides to be measured/assessed now?

In order to confirm that the ALPS treated water meets discharge requirements, we thoroughly re-examined the approach to selecting the nuclides to be measured/assessed prior to the dilution/discharge of ALPS treated water

How did we examine?

Review

After performing a review based on our approach to selecting the nuclides to be measured/assessed, we **confirmed that there could be significant concentrations of 29 nuclides in contaminated water.**



We additionally analyzed the nuclides focused on in existing research on decommissioning.

We **found no new nuclides** (including alpha nuclides) that had not previously been found in ALPS treated water.

29 nuclides are selected for measurement/assessment

These 29 nuclides include the primary seven nuclides*, carbon-14, and technetium 99

※ Major 7 nuclides : Cesium-134, Cesium-137, Strontium-90, Iodine-129, Cobalt-60, Antimony-125, Ruthenium-106 that were found in significant concentrations compared to the regulatory concentration in the analysis of the 62 nuclides conducted in the past.

Going forward

The nuclides targeted for measurement/assessment shall be regularly checked

Since changes may occur in the nuclides to be measured/assessed in conjunction with the progress of decommissioning, we will regularly check the **nuclides targeted for monitoring**.

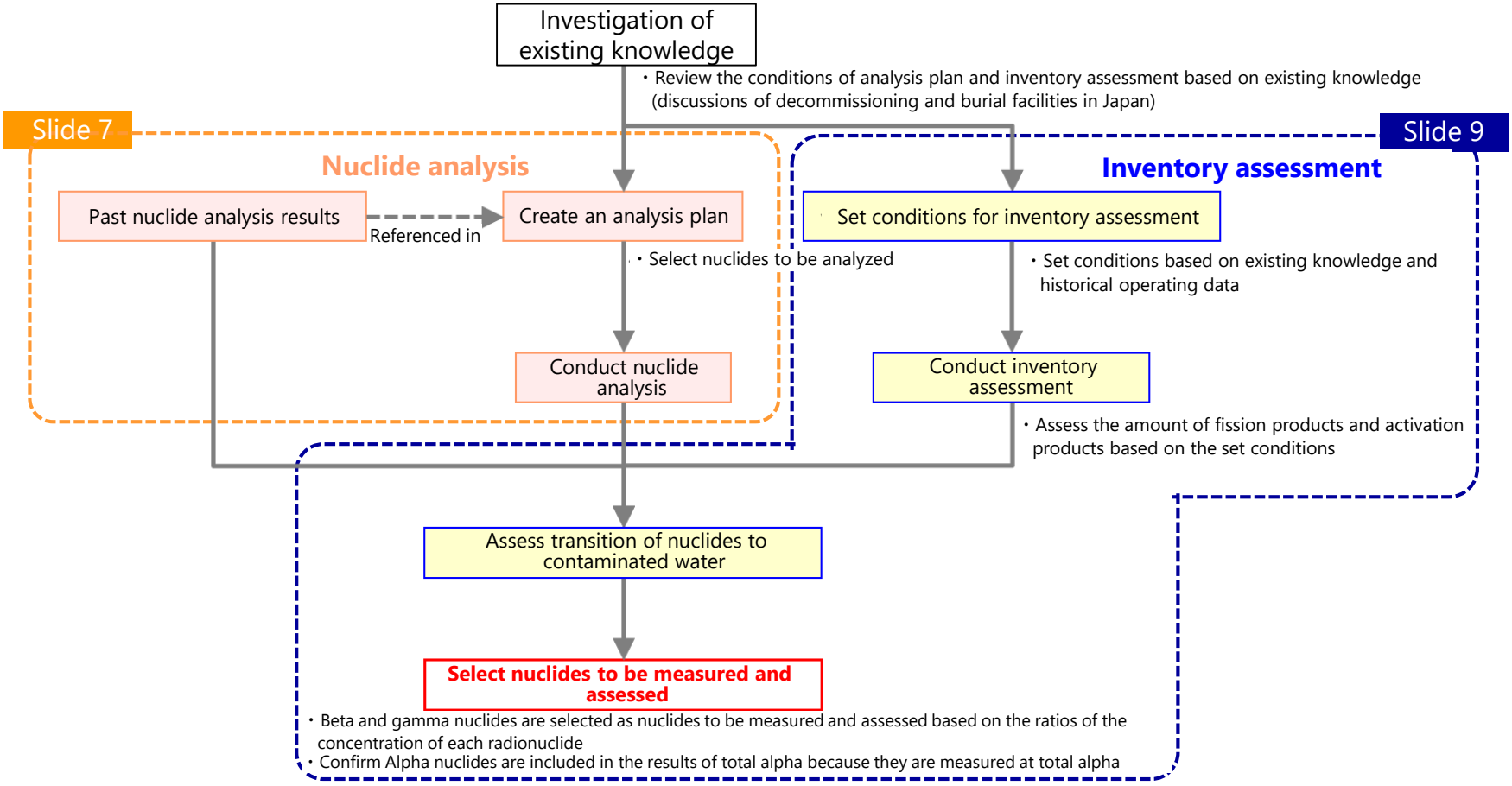
Voluntary measurements

Out of the 62 nuclides that are targeted for removal by ALPS, **we shall measure the concentration of the 39 nuclides that are not the targets of measurement/assessment to ensure that they are below detectable levels in order to prevent adverse impacts on reputation.**

Primary changes to this revised application ▶ Based on discussions at the Technical Meeting, etc., we have partially revised procedures for selecting nuclides targeted for measurement/assessment through an inventory assessment, and have reselected the nuclides targeted for measurement/assessment (29 nuclides) and the nuclides targeted for monitoring (six nuclides).

4-2. Selection of nuclides to be measured and assessed

- Approach to selecting nuclides that could impact dose assessment in ALPS treated water
  - The existing approved Implementation Plan stated "the policy for **selecting nuclides subject to measurement and assessment with rigorous verification** to ensure that the **ALPS treated water meets the discharge criteria after it has been diluted before discharge** (sum of the ratios of the concentration of each radionuclide to the regulatory concentration of each, excluding tritium, in the ALPS treated water is less than 1) based on the knowledge in Japan on decommissioning and disposal facilities". We have described our approach to the selection of nuclides based on the results of the verification this time.



Overview of the discussions of the selection of nuclides to be measured and assessed

4-3. Results of the additional nuclide analysis

- In the verification, analysis results in the past were assessed and additional analysis was conducted to see if the nuclides garnering attention in the research on decommissioning and burial facilities exist in significant quantities in the stagnant water, Sr removed water, ALPS treated water, etc.
- Results of this verification showed that **the nuclides (including α nuclides) garnering attention in the research on decommissioning and burial facilities were not detected in the ALPS treated water.***

※ : Below or equal to the 1/100 of the regulatory concentration and below the detection limit ; Uranium was detected in very small amounts of natural uranium in the environment

Nuclides measured in the past

Source : the 9th ALPS Treated Water Review Meeting materials

Fission products: 56 nuclides

Rb-86 Rubidium	Sr-89 Strontium	Sr-90 Strontium	Y-90 Yttrium	Y-91 Yttrium	Nb-95 Niobium	Tc-99 Technetium
Ru-103 Ruthenium	Ru-106 Ruthenium	Rh-103m Ruthenium	Rh-106 Rhodium	Ag-110m Silver	Cd-113m Cadmium	Cd-115m Cadmium
Sn-119m Tin	Sn-123 Tin	Sn-126 Tin	Sb-124 Antimony	Sb-125 Antimony	Te-123m Tellurium	Te-125m Tellurium
Te-127 Tellurium	Te-127m Tellurium	Te-129 Tellurium	Te-129m Tellurium	I-129 Iodine	Cs-134 Cesium	Cs-135 Cesium
Cs-136 Cesium	Cs-137 Cesium	Ba-137m Barium	Ba-140 Barium	Ce-141 Cerium	Ce-144 Cerium	Pr-144 Praseodymium
Pr-144m Praseodymium	Pm-146 Promethium	Pm-147 Promethium	Pm-148 Promethium	Pm-148m Promethium	Sm-151 Samarium	Eu-152 Europium
Eu-154 Europium	Eu-155 Europium	Gd-153 Gadolinium	Tb-160 Terbium	Pu-238 Plutonium	Pu-239 Plutonium	Pu-240 Plutonium
Pu-241 Plutonium	Am-241 Americium	Am-242m Americium	Am-243 Americium	Cm-242 Curium	Cm-243 Curium	Cm-244 Curium

Corrosion products: 6 nuclides

Mn-54 Manganese
Fe-59 Iron
Co-58 Cobalt
Co-60 Cobalt
Ni-63 Nickel
Zn-65 Zinc

Nuclides other than those on the left: 2 nuclides

H-3 Tritium	C-14 Carbon

Nuclides other than the 64 nuclides: 20 nuclides

Cl-36 Chlorine	Ca-41 Calcium	Ni-59 Nickel
Se-79 Selenium	Nb-94 Niobium	Mo-99 Molybdenum
Tc-99m Technetium	Te-132 Tellurium	I-131 Iodine
I-132 Iodine	La-140 Lanthanum	U-233 Uranium
U-234 Uranium	U-235 Uranium	U-236 Uranium
U-238 Uranium	Np-237 Neptunium	Pu-242 Plutonium
Cm-245 Curium	Cm-246 Curium	

Nuclides selected based on the existing knowledge and additionally analyzed in this study this time (in addition to the nuclides below, alpha nuclides that could exist in significant quantities in stagnant water, Sr removed water, and ALPS treated water, etc. were also analyzed).

Fe-55 Iron	**Ni-59** Nickel	**Nb-93m** Niobium	**Mo-93** Molybdenum	**Sn-121m** Tin	**Cl-36** Chlorine	**Ca-41** Calcium	**Zr-93** Zirconium	**Ba-133** Barium	**Se-79** Selenium	**Pd-107** Palladium

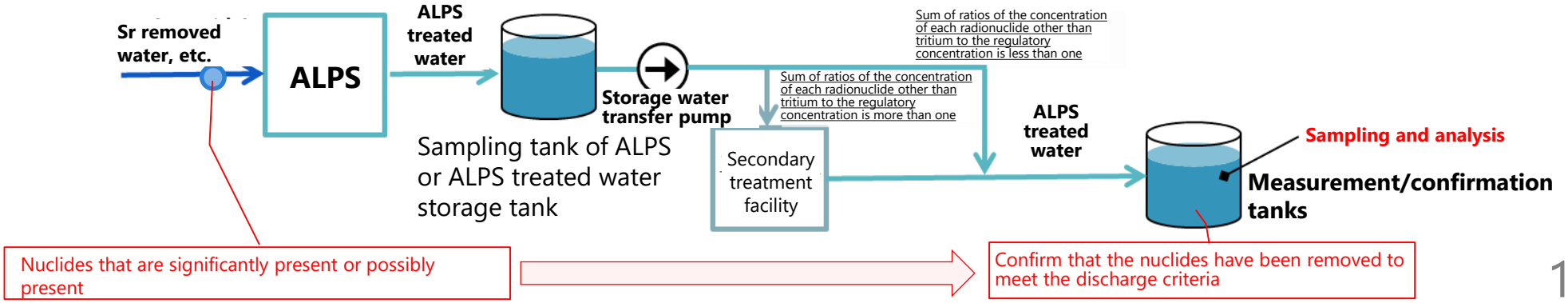
[Reference] Approach to selecting nuclides to be measured and assessed

Remain the original (partly updated)

TEPCO

- In the ALPS treated water etc., there is no discrepancy that would suggest the presence of radionuclides other than the current 64 nuclides between total beta measurements and the sum of analysis results for radioactive concentration of 7 major nuclides* plus carbon-14 and technetium-99. Total alpha also remained undetectable.
  ※ Major 7 nuclides : Cesium-134, Cesium-137, Strontium-90, Iodine-129, Cobalt-60, Antimony-125, Ruthenium-106 that were found in significant concentrations compared to the regulatory concentration in the analysis of the 62 nuclides conducted in the past.
- In addition to the above, as shown in the previous slide, results of individual analyses on nuclides other than the current 64 nuclides, that are garnering attention in decommissioning and burial facilities research, demonstrate that these nuclides did not exist in significant concentrations in ALPS treated water.
- Through these efforts, we were able to verify again that the ALPS nuclide removal function was performing as expected, and the nuclides that could exist in significant concentrations were the major 7 nuclides, Carbon-14, and Technetium-99.

- Nevertheless, based on the discussions at previous review meetings related to ALPS treated water and comments from the NRA and the IAEA, **nuclides to be measured and assessed are selected with a perspective of confirming before the discharge that nuclides that are significantly present or possibly present in significant concentrations in stagnant water, Sr removed water, etc. have been removed to meet the discharge criteria in the ALPS treated water to be discharged into the sea**.



4-4. Selection of nuclides to be measured and assessed through inventory assessment

Underlined parts: Major areas of updated

Updated

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- The nuclides to be measured and assessed were selected using the following process.
- Regarding the following process, first, the nuclides that can realistically exist are selected considering the half-life of the nuclides based on the findings pointed by the IAEA and the NRA. Next, we conduct another desk study assuming※ that all of the radioactive materials have been transferred to the ALPS treated water storage tanks. Then nuclides that could exist in significant concentrations in contaminated water are evaluated based on the actual measured data of contaminated water and the properties of nuclides that we have accumulated over the past 12 years.
- In the revised application, Step 5 was partially revised based on discussions in the Technical Meeting to Review the Implementation Plan for the Specified Nuclear Facility, etc.

※ Assumption based on the fact that contaminated water has been continuously treated and stored in the tanks over the 12 years since the earthquake.

Library of radioactive nuclides used in the inventory assessment (around 1,000 nuclides)

Consideration based on inventory assessment

Step 1

Exists 12 years after reactor shutdown (2023) ※

※： Decay time in the Inventory assessment will be set appropriately according to the time frame when the selection results will be used

Step 2

210 nuclides

Not gas generated during operation

Step 3

206 nuclides

Ratio of the concentration of each radionuclide to the regulatory concentration is 0.01 or more in the assessment results on the transition of nuclides to the water in the ALPS treated water , etc. storage tank

<Reason for the revision>
Clearly established the "ratios to the regulatory concentrations is less than 0.01" as the criteria regardless of whether the nuclide was detected in past analyses.
(Step description before revision)
Ratios to the regulatory concentration in past contaminated water analyses is 0.01 or more

In addition to the above, considerations based on measured data and properties of nuclides

Step 4

93 nuclides

Ratio of the concentration of each radionuclide to the regulatory concentration is 0.01 or more in the transition assessment of nuclides to contaminated water

Step 5

36 nuclides

Confirm that the ratios to the regulatory concentrations in past contaminated water analyses is less than 0.01

If it is confirmed that the ratios to the regulatory concentrations is less than 0.01

6 nuclides

Nuclides to be monitored

Nuclides that will be continuously monitored to ensure they don't exist in contaminated water in significant quantities

If it cannot be confirmed that the ratio to the regulatory concentration of the radioactive substance is less than 0.01

Excluding tritium（cannot be removed by ALPS)

Nuclides to be measured and assessed

29 nuclides

Nuclides to verify against the discharge criteria

4-5. Selected nuclides to be measured and assessed

- **29 nuclides in the table below and tritium are the nuclides to be measured and assessed in discharging the ALPS treated water into the sea.** They were selected using the selection flow on the previous slide.
- At the time of submission of the application for approval to amend the Implementation Plan in November 2022, 30 nuclides had been selected as nuclides to be measured and assessed. Based on discussions in the Technical Meeting to Review the Implementation Plan for the Specified Nuclear Facility, etc., Iron-55 was selected and Cadmium-113m and Curium-243 were not selected (See slide 14 for details) in the revised application.

【Nuclides to be measured and assessed (29 nuclides)】

Before, during and after the discharge of ALPS treated water into the sea, we will confirm that the following nuclides meets the discharge criteria (sum of the ratios of the concentration of each radionuclide to the regulatory concentration of each is less than one).

※ In addition to the nuclides in the table below, tritium will be also measured.

C-14 Carbon	Sr-90 Strontium	I-129 Iodine	Eu-154 Europium	Pu-239 Plutonium
Mn-54 Manganese	Y-90 Yttrium	Cs-134 Cesium	Eu-155 Europium	Pu-240 Plutonium
Fe-55 Iron	Tc-99 Technetium	Cs-137 Cesium	U-234 Uranium	Pu-241 Plutonium
Co-60 Cobalt	Ru-106 Ruthenium	Ce-144 Cerium	U-238 Uranium	Am-241 Americium
Ni-63 Nickel	Sb-125 Antimony	Pm-147 Promethium	Np-237 Neptunium	Cm-244 Curium
Se-79 Selenium	Te-125m Tellurium	Sm-151 Samarium	Pu-238 Plutonium	

Nuclides added based on the selection flowchart (as of November 2022 when the original application was submitted)

Nuclides added in the revised application based on the selection flowchart (in this revised application)

※：Of the two nuclides not selected as nuclides to be measured and assessed, Cd-113m was selected as a nuclide to be monitored. Cm-243 was selected neither as a nuclide to be measured and assessed nor as one to be monitored, but TEPCO will voluntarily measure it to confirm its concentration is below a detectable level.

4-6. Periodic check of nuclides to be measured and assessed

Underlined parts: Major areas of updated

Updated

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- Regarding the nuclides to be measured and assessed on the previous page, we will continue to implement confirmations below, since there is a possibility that the situation may change depending on the progress of future decommissioning work.
- If significant quantities of nuclides other than those to be measured and assessed (hereinafter referred to as "other nuclides") are found, the nuclides to be measured and assessed will be re-evaluated. Decay of radionuclides will be also reflected in the selection following process.

【 Confirmation for each release 】

Confirm that other nuclides in significant quantities do not exist by measuring γ-rays with Ge semiconductor detectors, total alpha, and total beta.

【 Confirmation of trend of radioactive concentration in contaminated water 】

Confirm that the radioactive concentration of contaminated water after the process of the central radioactive waste treatment facility is below or equal to the concentration confirmed in the past.

【Research and analysis】

In the research and analysis, if any concerning trends are found in the above confirmation, we will research the presence of other nuclides. Regardless of the existence of concerning trends, we will research the presence of other nuclides by confirming that nuclides to be monitored are not found in significant quantities once a year in Sr removed water.

○nuclides to be monitored (6 nuclides)

Nuclides not detected in significant quantities in past analysis of contaminated and treated water but subject to continuous check.

Cl-36 Chlorine	**Nb-93m** Niobium	**Nb-94** Niobium	**Mo-93** Molybdenum	**Cd-113m** Cadmium	**Ba-133** Barium

: Nuclides added in the revised application, based on the selection flow

※：Fe-55 was selected as a nuclide to be measured and assessed

[Reference] The reason for changes to the nuclides targeted for measurement/assessment

Newly added

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- The following chart shows the nuclides targeted for measurement/assessment that were changed in light of discussions during the Technical Meeting to Review the Implementation Plan for the Specified Nuclear Facility, etc. and the reasons for such changes.

	Application in November 2022	Revised application （This submission）
Fe-55 Iron	**Monitoring target** Due to the analysis results of accumulated water residue from buildings and filtrate that were subject to additional analysis, only the analysis values from detected residue (less than 1/100 of legally required concentrations) were subject to review.	**Measurement/assessment target** In order to be more conservative in our assessment, the analysis of values for filtrate that was below detectable levels was added to the detected residue analysis values and reviewed. This review found concentrations that exceeded 1/100 of legally required concentrations.
Cd-113m Cadmium	**Measurement/assessment target** This nuclide has never been detected during analysis prior to, or after, ALPS treatment, but it was targeted for measurement/assessment just in case since theoretically it is highly soluble.	**Monitoring target** This nuclide has been selected for monitoring in accordance with the selection flow used for other nuclides since we have found past records that show that concentrations of cadmium below 1/100 of the legally required concentrations have been found during the analysis of Sr removed water prior to ALPS treatment.
Cm-243 Curium	**Measurement/assessment target** During the assessment of transferred contaminated water in step 4, only curium isotopes were grouped, and curium 243 and curium 244, which are nuclides in this group that have a high impact on dose rate, were selected	Excluded at step 4 Nuclide groupings were revised, and curium and americium, which have similar attributes in water, were put in the same group. As a result, the impact on dose that curium 243 was thought to have turned out to be less.

[Reference] Comparison with nuclides to be removed with ALPS (62 nuclides) and carbon-14

Updated

Underlined parts: Major areas of updated

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- The nuclides that have been changed in this method are as follows.
- (a) In previous measurements, there was no discrepancy that would suggest the presence of Selenium-79 in total beta analysis of ALPS treated water, (b) Uranium-234, Uranium-238, and Neptunium-237 had not been detected by total alpha analysis in ALPS treated water, (c) in this additional analyses, these nuclides were not detected, and (d) Iron-55 existed in contaminated water mainly as a solid. From the foregoing, these nuclides are not considered to be present in significant concentrations in ALPS treated water, though they will be measured and assessed voluntarily just in case.
- Among the nuclides subject to be removed by ALPS, **there is no possibility that the 39 nuclides that were not selected are present in the contaminated water. However, we will voluntarily measure them and confirm that their concentrations are below the detection limit prior to the discharge**.

Nuclides to be measured and assessed : 29 Nuclides (=24+5)

※ In addition to the nuclides in the table below, tritium will be also measured.

C-14 Carbon	**Y-90** Yttrium	**Cs-137** Cesium	**U-238** Uranium	**Cm-244** Curium
Mn-54 Manganese	**Tc-99** Technetium	**Ce-144** Cerium	**Np-237** Neptunium	
Fe-55 Iron	**Ru-106** Ruthenium	**Pm-147** Promethium	**Pu-238** Plutonium	
Co-60 Cobalt	**Sb-125** Antimony	**Sm-151** Samarium	**Pu-239** Plutonium	
Ni-63 Nickel	**Te-125m** Tellurium	**Eu-154** Europium	**Pu-240** Plutonium	
Se-79 Selenium	**I-129** Iodine	**Eu-155** Europium	**Pu-241** Plutonium	
Sr-90 Strontium	**Cs-134** Cesium	**U-234** Uranium	**Am-241** Americium	

: Nuclides added to be on the conservative side based on the selection flow (5 nuclides)

Nuclides excluded from those to be measured and assessed among the nuclides to be removed with ALPS : 39 nuclides (=13+10+16)

Fe-59 Iron	Te-129m Tellurium	Co-58 Cobalt	Te-123m Tellurium	Zn-65 Zinc	Ba-137m Barium	Cm-242 Curium
Rb-86 Rubidium	Cs-136 Cesium	Y-91 Yttrium	Te-127 Tellurium	Rh-106 Rhodium	Pr-144 Praseodymium	Cm-243 Curium
Sr-89 Strontium	Ba-140 Barium	Nb-95 Niobium	Te-127m Tellurium	Ag-110m Silver	Pr-144m Praseodymium	
Ru-103 Ruthenium	Ce-141 Cerium	Sn-123 Tin	Gd-153 Gadolinium	Cd-113m Cadmium	Pm-146 Promethium	
Rh-103m Rhodium	Pm-148 Promethium	Sb-124 Antimony	Tb-160 Terbium	Sn-119m Tin	Eu-152 Europium	
Cd-115m Cadmium	Pm-148m Promethium			Sn-126 Tin	Am-242m Americium	
Te-129 Tellurium				Cs-135 Cesium	Am-243 Americium	

: Nuclides whose inventory volume decreased and excluded from selection in step 1 (13 nuclides)

: Nuclides whose inventory volume decreased and excluded from selection in step 3 (10 nuclides)

All nuclides Half-life less than 1 year

: Nuclides excluded from selection in step 4 and 5 as a result of reviewing the state of transition to contaminated water from nuclear reactors, etc. according to the actual situation. (16 nuclides)

[Reference] 69 nuclides will be measured prior to every discharge (29+39+1)

Newly added

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Nuclides to be measured/assessed : 29 nuclides

C-14 Carbon	Sr-90 Strontium	I-129 Iodine	Eu-154 Europium	Pu-239 Plutonium
Mn-54 Manganese	Y-90 Yttrium	Cs-134 Cesium	Eu-155 Europium	Pu-240 Plutonium
Fe-55 Iron	Tc-99 Technetium	Cs-137 Cesium	U-234 Uranium	Pu-241 Plutonium
Co-60 Cobalt	Ru-106 Ruthenium	Ce-144 Cerium	U-238 Uranium	Am-241 Americium
Ni-63 Nickel	Sb-125 Antimony	Pm-147 Promethium	Np-237 Neptunium	Cm-244 Curium
Se-79 Selenium	Te-125m Tellurium	Sm-151 Samarium	Pu-238 Plutonium	

: Newly selected nuclides

Assessed as the sum of the ratios of legally required concentrations to check that it is less than 1

H-3 Tritium

Measured in order to determine that the volume of water with which to dilute the treated water so that the tritium concentration after dilution is less than 1,500 Bq/liter

Measured every time

Nuclides targeted for removal by ALPS that are not subject to be measured/assessed : 39 nuclides

Fe-59 Iron	Rh-103m Rhodium	Sb-124 Antimony	Ba-137m Barium	Eu-152 Europium
Co-58 Cobalt	Rh-106 Rhodium	Te-123m Tellurium	Ba-140 Barium	Gd-153 Gadolinium
Zn-65 Zinc	Ag-110m Silver	Te-127 Tellurium	Ce-141 Cerium	Tb-160 Terbium
Rb-86 Rubidium	Cd-113m Cadmium	Te-127m Tellurium	Pr-144 Praseodymium	Am-242m Americium
Sr-89 Strontium	Cd-115m Cadmium	Te-129 Tellurium	Pr-144m Praseodymium	Am-243 Americium
Y-91 Yttrium	Sn-119m Tin	Te-129m Tellurium	Pm-146 Promethium	Cm-242 Curium
Nb-95 Niobium	Sn-123 Tin	Cs-135 Cesium	Pm-148 Promethium	Cm-243 Curium
Ru-103 Ruthenium	Sn-126 Tin	Cs-136 Cesium	Pm-148m Promethium	

Voluntarily measured to confirm that concentrations are below detectable levels

Nuclides to be monitored : 6 nuclides

Cl-36 Chlorine	Nb-93m Niobium	Nb-94 Niobium	Mo-93 Molybdenum
Cd-113m Cadmium	Ba-133 Barium		

Checked once a year to confirm that there are no significant concentrations

4-7. Summary of the selection of nuclides to be measured and assessed other than tritium

Updated

Underlined parts: Major areas of updated

TEPCO

- Based on the discussions at previous review meetings related to the ALPS treated water, first IAEA review report, and the requirements from the Fukushima Prefecture Technical Discussion Committee Report, TEPCO thoroughly reverified the nuclides to be confirmed before ALPS treated water is diluted and discharged into the environment.
- TEPCO has continued to measure radioactive materials in ALPS treated water. We confirm that nuclides other than the major 7 nuclides*, Carbon-14, and Technechim-99 do not exist in significant concentrations in ALPS treated water by total beta and total alpha measurements. Furthermore, additional analysis of nuclides selected based on existing knowledge detected no new nuclides (including alpha nuclides) in ALPS treated water.
- Given the above, regarding the nuclides to be measured and assessed before ALPS treated water is diluted and discharged, we selected 29 nuclides considering the nuclides may exist in significant concentrations in contaminated water before purified and treated by ALPS regardless of whether exist in the ALPS treated water or not. This selection has been reviewed in the second IAEA Safety Reviews for ALPS-treated Water Discharge.
- Among the 62 nuclides subject to be removed by ALPS, there is no possibility that the 39 nuclides that were not selected for measurement and assessment this time are significantly present in the contaminated water. However, we will voluntarily measure them and confirm that their concentrations are below the detection limit prior to the discharge from the viewpoint of suppressing adverse impacts of reputation.

※ Cesium-134, Cesium-137, Strontium-90, Iodine-129, Cobalt-60, Antimony-125, Ruthenium-106 that were found in significant concentrations compared to the regulatory concentration in the analysis of the 62 nuclides conducted in the past.

5-1. Approach to any abnormalities found during sea area monitoring after the commencement of discharge ①

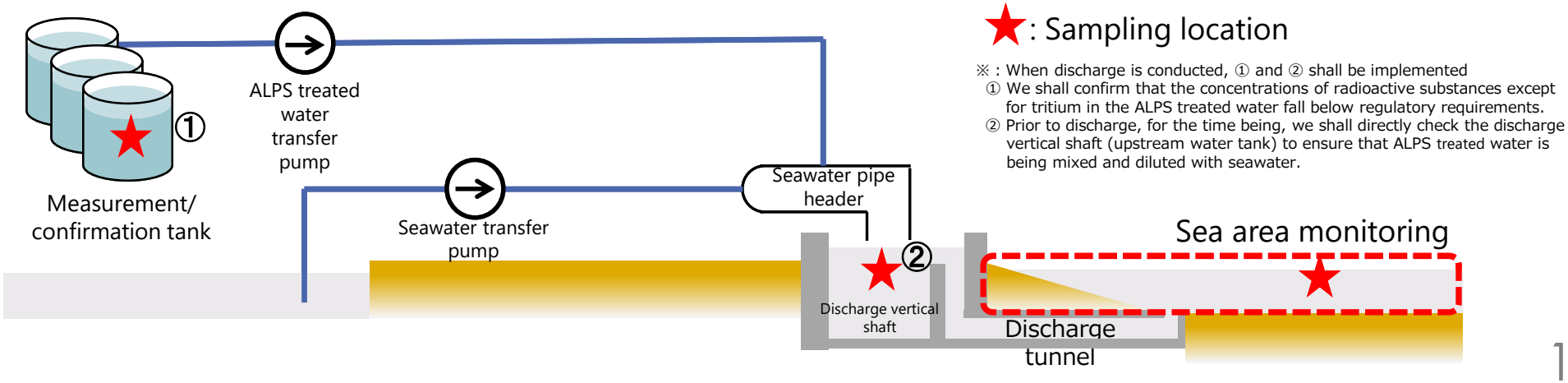
Newly added

TEPCO

- We announced “Sea Area Monitoring Plan for the Handling of ALPS Treated Water" on March 24, 2022 and increased the number of measurement points, measurement targets, and measurement frequency of monitoring. We started the operation of this plan since April, 2022 in order to assess the state of the environment before the commencement of discharge.
- Furthermore, we have stipulated in the implementation plan that was approved in July 2022 that we shall suspend the discharge of ALPS treated water into the sea if any abnormalities are detected in sea area monitoring.
- Following an instruction in the meeting of the NRA on February 1, 2023※ to add our approach to handling abnormalities found during sea area monitoring into the implementation plan currently being reviewed, we are adding our approach to handling abnormalities into the revised application.
- Furthermore, when discharging ALPS treated water into the sea, we shall:
  - ✓ Confirm that of the concentrations of radioactive substances, with the exception of tritium, meet regulatory requirements prior to dilution/discharge
  - ✓ Dilute the tritium with a large volume of seawater to ensure that concentrations are less than 1/40 the legal requirement of 60,000 Bq/liter, and less than 1/7 that of the WHO's drinking water guidelines (10,000 Bq/liter)

※ Technical Meeting to Review the Implementation Plan for the Specified Nuclear Facility

Because of this, we believe that this "diluted ALPS treated water" will be safe by the time it is discharged into the sea.

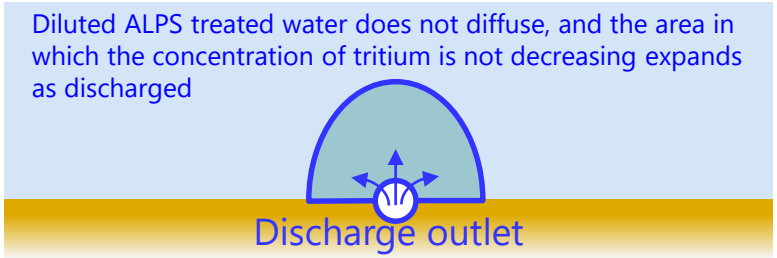


5-2. Approach to any abnormalities found during sea area monitoring after the commencement of discharge ②

Newly added

TEPCO

- The following approach to handling abnormalities has been added to determine if sea discharge should be suspended when abnormalities are discovered during sea area monitoring.

Item	Details	
Situation determined as abnormal	■ After the ALPS treated water has been diluted with a large volume of seawater and discharged from the outlet, if the discharge water does not diffuse into the seawater and the concentrations of tritium do not decrease, and the scope of the area in which these conditions persist enlarges  Concept diagram of area around discharge outlet	
Target location	In the vicinity of the discharge outlet	In the vicinity of the power station (outside of the area mentioned to the left)
If applicable	■ If discharge limits, which had been set to ensure that the concentrations of tritium do not exceed the upper limits stipulated by government policy (1,500Bq/L) even in consideration of uncertainty in facility or measurements, do not decrease, and the scope of the area in which these conditions persist enlarges	■ If clearly abnormal values are obtained during the analysis of tritium concentrations in seawater performed in order to quickly ascertain conditions
Procedures	■ Based on this approach, procedures, such as detailed sampling locations and values used to determine abnormalities, etc., will be added to internal manuals Furthermore, in addition to that mentioned above, necessary steps be taken if it is confirmed/determined that monitoring conditions differ from the normal conditions in the entire monitoring laid out in the comprehensive monitoring plan	