

Issues pointed out in the implementation plan concerning the change in the operation structure and the selection of nuclides to be measured and assessed for the discharge of ALPS treated water into the sea

No.	Category	Issues pointed out	Answer	Updated in	Page number
1	Operation framework	The number of member for Operation Shift Team (Water Treatment System) will be increased by 2 persons per team to 10 persons per team. Regarding the current Operation Shift Team, please add the division of roles and the number of shifts per day to the supplementary explanation material.	In the supplementary explanation material, the division of roles of the members of Operation Shift Team (Water Treatment System) and the number of shifts per day were added. With additional members of 2 persons per team, 10 persons per team will be assigned to Operation Shift Team (Water Treatment System). With this number, we plan to manage the operation of facilities related to the discharge of ALPS treated water into the sea, in addition to the operation management of facilities they are currently in charge of.	[Material 1-1-1] Supplementary explanation Attachment-1 Reference-1	P 17 – 18
2	Nuclide analysis	Regarding this additional analysis, there is a description indicating "less than 1/100 of the regulatory concentration limit and less than the lower limit of detection." However, this additional analysis includes some difficult-to-measure nuclides. Is it correct to understand that the lower limit of detection is less than 1/100 of the regulatory concentration limit for all nuclides?	In this additional analysis, we asked each external analysis organization to conduct an analysis, aiming for 1/100 or less of the regulatory concentration limit as much as possible. As a result, the targets were achieved in all nuclides. With this, the analysis result for the lower detection limit value was 1/100 or less of the regulatory concentration limit.	[Material 1-1-1] Supplementary explanation Attachment-2 2.5	P 24 – 33
3	Nuclide analysis	The regulatory concentration limit of iron 55 is 17 Bq/L, which can be interpreted as being below 1/100 of the regulatory concentration limit of 2000 Bq/L. However, the value of the filtrate is < 4.1 Bq/L, and the sum of the residue and the filtrate is 21.1 Bq/L, exceeding 20 Bq/L, i.e., 1/100 of the regulatory concentration limit. We understand TEPCO's view that just adding values is not enough, but it is also difficult to discuss the analytical values presented here without indicating how fluctuating the range is, so this should be explained in the future.	Regarding the samples analyzed separating the filtrate and residue, the analysis results of the filtrate and the residue are reported separately. The concept behind the analysis results of the samples is as follows: when there are detected values for both, the total of the results of the filtrate and the residue is used as the analysis value of the samples. When either is detected, only the detected value is used. If neither is detected, the higher value of the detection limit is used as the analysis value of the entire sample. This is based on the approach that has been implemented in the past when presenting a probable value for the analysis of an entire sample. In the external analysis, uncertainties were calculated only for the detected values. It was confirmed that there were uncertainties of ± 1 Bq/L for the residue of Fe-55 in the stagnant water, ± 0.7 Bq/L for the filtrate of the stagnant water in Ni-59, and ± 0.3 Bq/L for the strontium-treated water.	[Material 1-1-1] Supplementary explanation Attachment-2 2.5	P24,28
4	Inventory assessment	The reactor internals have been activated based on the knowledge of decommissioning and burial in Japan. For these results, an explanation of the degree of uncertainty should also be added to the supplementary explanatory material.	As input conditions for the evaluation of activation products in the inventory assessment, uncertainties exist in the target equipment to be assessed and equipment weights, element concentration conditions, setting of the amount of irradiation/neutron flux, and irradiation period. These conditions are set so that the inventory assessment can be conservative. For example, as other structural materials, core support plates and upper grid plates are evaluated by neutron flux at the center of the equipment. Compared with neutron flux at a point 1/2 in the radial direction, the inventory amount of radioactive materials generated by (n, γ) per unit weight is approximately 1.3 times more conservative. Regarding the other conditions (especially the element concentration), it is difficult to quantify the extent of conservativeness as a whole because the actual equipment condition is unknown. However, by setting these assumptions, there is uncertainty on the conservative side regarding the amount of inventory generated.	[Material 1-1-1] Supplementary explanation Attachment-3 2.4	P 51 – 52
5	Inventory assessment	We believe the inventory assessment results are somewhat reliable as a relative trend. However, regarding activation products, we believe there is a great deal of uncertainty about the total amount of activation materials. When the results of the calculations include both fuel-derived activation materials and activation products, we cannot tell the degree of uncertainty, leading to a vague discussion with inconclusive results. When considering Step 4, it is necessary to understand how that uncertainty spreads.	As described in No. 4, in the inventory assessment, there is uncertainty on the conservative side in the activation calculation of structural materials compared with the calculation of fuel. This works conservatively until Step 3. On the other hand, in the transfer assessment in Step 4, regarding the nuclides without analysis results, nuclides with the same properties (isotopes, radioactive equilibrium, etc.) are grouped to calculate the ease of transfer to contaminated water (analysis value/inventory amount) of representative nuclides in the group. When FPs and APs are mixed in the group, and if AP nuclides are treated as representative nuclides, FP nuclides may be unconservative. Because of this, FP nuclides were identified in the assessment method as representative nuclides for groups with a mixture of FPs and APs. Regarding the nuclides that may result in unconservative assessment, there are no nuclides to be measured and evaluated. Thus, we consider there is little actual effect.	[Material 1-1-1] Supplementary explanation Attachment-4 2.4	P81,87
6	Nuclides to be measured and assessed	Regarding the criteria used in Steps 3 and 4, which are 1/100 of the regulatory concentration limits, it is difficult to judge whether they are valid based on the current description. Thus, first, the sum of the ratios to regulatory concentrations limits for the nuclides to be excluded in each step should be indicated before discussing whether it is valid.	In Step 3 and Step 4, we added the sum of the ratios to regulatory concentrations limits for the nuclides that proceed to the next step and for those to be excluded and explained that the criteria are valid.	[Material 1-1-1] Supplementary explanation Attachment-4 2.3, 2.4.1	P60,63
7	Nuclides to be measured and assessed	In setting the transfer coefficient, the past maximum is used for the analysis value, and the minimum of the detection limit is used for those that have not been detected before. Please explain the reason for this.	Using the maximum value among analyzed values, the detected nuclides are evaluated based on the concentration when they are most transferred to the contaminated water. On the other hand, as an approach to the lower detection limit, it indicates that there is a possibility that the nuclide exists at a concentration lower than that value but guarantees that the concentration is not higher than that value. Therefore, we consider it sufficiently conservative if we assess nuclides that have never been detected in the past with the smallest detection limit value in the analysis results.	[Material 1-1-1] Supplementary explanation Attachment-4 2.4.2	P65

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8	Nuclides to be measured and assessed	Regarding the grouping of nuclides with similar properties, such as isotopes, you should first explain that the grouping is valid and then explain that the representative nuclides are to be measured. In addition, you should explain the nuclides that could not be grouped by the process of measurement based on individual properties.	In the previous supplementary explanation material, there was no description of isotopes in the grouping of nuclides. Therefore, after explaining four nuclides: (1) radioactive equilibrium, (2) decay series, (3) isotopes, and (4) nuclides with similar underwater characteristics, nuclides were grouped, and then the representative nuclides of the group and the measured values of nuclides that are individually measured were explained. For Sn, the result of Sn-121 m, which has been confirmed to have the lowest analysis result among these groups, is applied. For the platinum group and Cf, etc., the similarity was explained in (4), and only the ease of transfer of other nuclides to contaminated water (transfer coefficient) was evaluated by referring to other nuclides. However, as a result of examining these results, it was determined that grouping is possible, and because of this, we reviewed the assessment again. In particular, since Cf behaves in the same way as Am and Cm, as a result of grouping them, it is valid to exclude Cm-243, which had been included in the nuclides to be measured and assessed.	[Material 1-1-1] Supplementary explanation Attachment-4 2.4.3	P 69 – 86
9	Nuclides to be measured and assessed	In the nuclide grouping, Cs and Tl are classified as the same, but Tl is on the right side of the periodic table, so it seems the intent is to make the transfer coefficient the same, but the reason for the same grouping should be explained.	Cs belongs to Group 1, and Tl belongs to Group 13. As a result of literature research this time, we confirmed that Tl is a monovalent cation like Cs, that the ionic radius is the same as that of the alkali metals Cs and K, and that the feature of adsorption to other zeolites and other materials are the same as those of the alkali metals. Based on this result, Tl is handled as part of the same group as Cs.	[Material 1-1-1] Supplementary explanation Attachment-4 2.4.3	P78
10	Nuclides to be measured and assessed	Please provide details of the analytical results used in the assessment of transfer to contaminated water in Step 4.	The details of the analysis used to evaluate the transfer to contaminated water are described in Reference 1 of Attachment-4.	[Material 1-1-1] Supplementary explanation Attachment-4 Reference-1	P 98 – 102
11	Nuclides to be measured and assessed	Of the analytical data used in the assessment of transfer to contaminated water in Step 4, for nuclides with a small number of data, the validity of using that data should be explained. In addition, the validity of supplementing with data before treatment by ALPS should be explained.	Among the nuclides requiring individual evaluation, there are five nuclides that have been analyzed less than 10 times: Fe-55, Zr-93, Nb-93m, Mo-93, and Ba-133. All of these were not detected at 1/100 or less of the regulatory concentration limit in the stagnant water in the buildings and the strontium-treated water. Therefore, we believe the effect on the ALPS treated water is negligible. Of these, Fe-55, Nb-93 m, Mo-93, and Ba-133 were selected as the nuclides to be monitored to check changes with the progress of future decommissioning. On the other hand, since Zr-93 was measured by ICP-MS and had a long half-life, it was not detected in 2 samples of stagnant water in the building and strontium-treated water and 3 samples of ALPS treated water with measurements up to about 1/1000 of the regulatory concentration limit. With this, it is considered to have barely transferred to contaminated water. Moreover, even considering conservativeness in the evaluation, it is excluded in Step 4. Thus, it is not selected as a nuclide to be monitored. In Step 4, the data before treatment by ALPS was used to supplement the data. However, the concentration of Cs, etc., in the stagnant water in buildings is high, and the lower detection limit of the nuclides that can be measured with the Ge semiconductor detector is high, which cannot be said to be representative of the actual situation. In addition, considering the effects of the exposure of the analyzers, many individual nuclides have not been investigated. Therefore, some of these nuclides were verified before treatment by ALPS. Qualitatively, as for the performance of the cesium adsorption device, the device can remove the nuclides with the same chemical properties and ionic radii as Cs and Sr. However, the other nuclides are mostly unable to be removed. In fact, as shown in Figure 1.1.4-4, we have confirmed that there is no significant difference between the results of I-129, Co-60, Ni-63, and Tc-99, which are individually evaluated this time, and the results of the analysis of the stagnant water in buildings in the concentrated Rw, etc. Therefore, we believe there will be no problem using the device.	[Material 1-1-1] Supplementary explanation Attachment-4 2.5	P 92 – 93 P 64 – 65
12	Nuclides to be measured and assessed	Regarding trending in contaminated water, where and how often each nuclide is currently measured and confirmed should be added to the supplementary explanation material.	For the details of trending at least once a month, we added the following to the material. • In the centralized Rw, Cs, Sr, total β, total α, and H-3 were confirmed. • At the ALPS inlet, 7 major nuclides, Tc-99, total β, total α, and H-3 were confirmed.	[Material 1-1-1] Supplementary explanation Attachment-4 3.2	P96
13	Nuclides to be measured and assessed	The concentration of α nuclides in the stagnant water of the centralized Rw is expected to increase due to fuel debris retrieval and other operations. However, even in such a situation, it is stated that there is no effect on the nuclides to be measured and assessed, and the radioactive concentration of contaminated water before treatment by ALPS is checked. Please explain this in more detail.	We added an explanation of the state of alpha nuclide control we aim for at T.P. 33.5 m at 1F. Further, for that purpose, an alpha nuclide removal facility will be installed at T.P. 8.5 m. Therefore, we explained that we are considering monitoring contaminated water before treatment by ALPS as water that affects the ALPS treated water at T.P. 33.5 m.	[Material 1-1-1] Supplementary explanation Attachment-4 3.2	P 96 – 97
14	Nuclides to be measured and assessed	On the identified 37 nuclides, to grasp the degree of effect on dose assessment, the nuclides detected in ALPS treated water, alpha nuclides, and the nuclides other than alpha nuclides should be classified into those with a sufficient number of analytical data, and those with a small number of data. In each classification, they should be arranged so that the measured values or the detection limit value can be compared to the sum of the ratios to regulatory concentrations limits. In addition, low-energy β nuclides that are not counted in the total β measurement should be indicated.	We have prepared a document describing the classification method for the 35 nuclides identified (excluding H-3, and Cm-243 that was excluded from this selection) and comparing the sum of the ratios to regulatory concentrations limits.	[Material 1-1-2] Comparison of a sum of the ratios to regulatory concentrations limits at ALPS inlet/outlet	-