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Japan Atomic Energy Agency

Analysis Results of ALPS Treated Water (Sampling at June 26, 2023, 11:28 JST)

Analysis was performed on the ALPS treated water in K4-C tank group in measurement and confirmation facility sampled at June 26, 2023, 11:28 JST.

The analysis results of ^{3}H and other nuclides are as follows:

- The confirmation of nuclides other than ^{3}H which have been purified to below the regulatory limit by ALPS treatment:
  The sum of ratios to the regulatory concentrations limits of nuclides other than ^{3}H (29 nuclides*1) was 0.21 (less than 1), confirming that regulatory standard is satisfied.
  The nuclides that confirmed not to be significantly present in ALPS treated water (39 nuclides*2): All targeted radionuclides were confirmed not to significantly present.
- The confirmation of ^{3}H concentration in ALPS treated water:
  ^{3}H concentration was 1.4E+05 Bq/L*3.
  The analyzed 68 radionuclides other than ^{3}H are shown in Fig.1

The nuclides which confirmed to be less than regulatory limit (29 nuclides)

^{14}C	^{90}Y	^{137}Cs	^{238}U	^{244}Cm
^{54}Mn	^{99}Tc	^{144}Ce	^{237}Np	
^{55}Fe	^{106}Ru	^{147}Pm	^{238}Pu	
^{60}Co	^{125}Sb	^{151}Sm	^{239}Pu	
^{63}Ni	^{125m}Te	^{154}Eu	^{240}Pu	
^{79}Se	^{129}I	^{155}Eu	^{241}Pu	
^{90}Sr	^{134}Cs	^{234}U	^{241}Am	

The nuclides which confirmed not to be significantly present (39 nuclides)

^{59}Fe	^{103}Ru	^{123}Sn	^{129m}Te	^{144m}Pr	^{242m}Am
^{58}Co	^{103m}Rh	^{126}Sn	^{135}Cs	^{146}Pm	^{243}Am
^{65}Zn	^{106}Rh	^{124}Sb	^{136}Cs	^{148}Pm	^{242}Cm
^{86}Rb	^{110m}Ag	^{123m}Te	^{137m}Ba	^{148m}Pm	^{243}Cm
^{89}Sr	^{113m}Cd	^{127}Te	^{140}Ba	^{152}Eu	
^{91}Y	^{115m}Cd	^{127m}Te	^{141}Ce	^{153}Gd	
^{95}Nb	^{119m}Sn	^{129}Te	^{144}Pr	^{160}Tb	

Fig.1 Classification of radionuclides other than ^{3}H

*1: The nuclides that should be confirmed to satisfy the discharge standards (below the regulatory standards) , as defined in the implementation plan.

*2: From the view point of preventing the adverse impacts on reputation, the nuclides which independently confirmed by TEPCO HD not to significantly present in ALPS treated water.

***3: Dilute more than 100 times so that the ^{3}H concentration after seawater dilution is less than** the maximum tritium concentration, **1,500 Bq/L/**

1. The confirmation of nuclides other than ^{3}H which have been purified to below the regulatory limit by ALPS treatment

Analysis results for the sum of ratios to the regulatory concentrations limits of nuclides other than ^{3}H (29 nuclides) that are confirmed to be less than regulatory limit (sum total of 1) are shown in Table 1. As the result of analysis, the sum of ratios to the regulatory concentrations limits of nuclides other than ^{3}H was 2.1E-01 (less than 1),confirming that regulatory standard is satisfied.

Table 1 Analysis results of nuclides other than ^{3}H in ALPS treated water
(The nuclides which confirmed to be less than regulatory limit)

(Sampled at June 26, 2023, 11:28 JST)

Nuclide	Concentrations [Bq/L]	Expanded Uncertainty※1 [Bq/L]	Detection Limit [Bq/L]	Ratios to Regulatory Concentration Limit [-]	Regulatory Concentration Limit※2 [Bq/L]	Measurement/ Evaluation method※4
^{14}C	1.1E+01	± 2.4E+00	5.8E-01	5.5E-03	2,000	Measurement
^{54}Mn	ND	-	1.2E-02	1.2E-05	1,000	Measurement
^{55}Fe	ND	-	8.2E-01	4.1E-04	2,000	Measurement
^{60}Co	2.3E-01	± 3.6E-02	9.6E-03	1.2E-03	200	Measurement
^{63}Ni	ND	-	1.1E+01	1.8E-03	6,000	Measurement
^{79}Se	ND	-	2.0E+00	1.0E-02	200	Measurement
^{90}Sr	ND	-	3.2E-02	1.1E-03	30	Measurement
^{90}Y	ND	-	3.2E-02	1.1E-04	300	Radiative equilibrium evaluation
^{99}Tc	ND	-	1.0E-01	1.0E-04	1,000	Measurement
^{106}Ru	ND	-	1.2E-01	1.2E-03	100	Measurement
^{125}Sb	5.7E-02	± 3.3E-02	4.8E-02	7.1E-05	800	Measurement
^{125m}Te	1.3E-02	-	1.1E-02	1.4E-05	900	Radiative equilibrium evaluation
^{129}I	1.6E+00	± 2.0E-01	7.0E-03	1.8E-01	9	Measurement
^{134}Cs	ND	-	4.2E-02	7.0E-04	60	Measurement
^{137}Cs	4.1E-01	± 6.5E-02	1.2E-02	4.6E-03	90	Measurement
^{144}Ce	ND	-	1.4E-01	7.0E-04	200	Measurement
^{147}Pm	ND	-	1.7E-01	5.7E-05	3,000	Relative ratio evaluation
^{151}Sm	ND	-	7.8E-03	9.8E-07	8,000	Relative ratio evaluation

^{154}Eu	ND	-	3.7E-02	9.3E-05	400	Measurement
^{155}Eu	ND	-	4.3E-01	1.4E-04	3,000	Measurement
^{234}U	ND	-	1.4E-02	3.5E-03※3	20	Measurement, Total α (U, Np group)
^{238}U					20	Measurement, Total α (U, Np group)
^{237}Np					9	Measurement, Total α (U, Np group)
^{238}Pu	ND	-	8.4E-03	2.1E-03※3	4	Measurement, Total α (Pu, Am, Cm group)
^{239}Pu					4	Measurement, Total α (Pu, Am, Cm group))
^{240}Pu					4	Measurement, Total α (Pu, Am, Cm group)
^{241}Am					5	Measurement, Total α (Pu, Am, Cm group)
^{244}Cm					7	Measurement, Total α (Pu, Am, Cm group)
^{241}Pu	ND	-	2.6E-01	1.3E-03	200	Relative ratio evaluation
Sums of the Ratios to Regulatory Concentrations Limits				2.1E-01		less than 1

- ○.○E±○ means ○.○×10$^{±○}$
- The results shown in two significant digits.
- Due to rounding of values, the sums may not exactly match with the actual value.
- ND (Not Detected) in the table indicates that the value is below the detection limit.
- The reference value for decay correction is the date and time of sampling.

※1: The uncertainty is the degree of variation in analytical value. Uncertainty is determined by combined all the variations of each step of the analytical procedure from sample collection to measurement. Here, the expanded uncertainty (U = 2 x u) is attached to the analyzed value by doubling the combined standard uncertainty (u).

※2: Legally required activity concentrations limit established in the Ordinance for Operational Safety and Protection of Specified Nuclear Fuel Materials of the Nuclear Reactors at TEPCO's Fukushima Daiichi (Appendix of first and sixth column: The concentration limit in water outside the peripheral surveillance zone [In this table, Bq/cm^3 was converted to Bq/L]).

※3: The ratio to the regulatory concentrations limits of α nuclides (U-234, U-238, Np-237, Pu-238, Pu-239, Pu-240, Am-241, and Cm-244) was calculated by dividing the total alpha value by the lowest required activity concentrations limit (4 Bq/L) of the selected alpha nuclides.

※4: Details of the measurement and evaluation methodology are described below.

Measurement: The radiation of samples is measured then the results are converted into the concentrations of each nuclide.

Total α (U, Np group): U and Np derived α rays of the samples were measured and the results are converted to total α concentration.

Total α (Pu, Am, Cm group): Pu, Am, Cm derived α rays of the samples were measured and the results are converted to total α concentration.

Radiative equilibrium evaluations: The state in which the ratio of the number of atoms of the parent nuclide to that of its progeny nuclides in a decay series is nearly constant is called radiative equilibrium. The concentration of each nuclide was evaluated based on this radiative equilibrium relationship and the measurement results of the parent (or progeny) nuclide.

Relative ratio evaluation: The ratio of each nuclide present in the reactor is evaluated by taking into account the generation, decay, impairment loss, etc. of the nuclides. The concentration of each nuclide is calculated by multiplying the measurement results of the reference nuclide by its existence ratio.

2. Analysis results of ^{3}H in ALPS treated water

Analysis results for the ^{3}H concentration in ALPS treated water are shown in Table 2. As the result of analysis, ^{3}H concentration was confirmed to be 1.4E+05 Bq/L.

Table 2 Analysis results of ^{3}H in ALPS treated water (sampled at June 26, 2023 11:28 JST)

Nuclide	Activity Concentrations [Bq/L]	Expanded Uncertainty※1 [Bq/L]	Detection Limit [Bq/L]	Regulatory Concentration Ratio	Regulatory Limit※2 [Bq/L]	Measurement/ Evaluation method※4
^{3}H	1.4E+05	±1.2E+04	7.7E+01	2.3E+00	60,000	Measurement

- ○.○E±○ means ○.○×10$^{±○}$
- The results shown in two significant digits.
- The reference value for decay correction is the date and time of sampling.

※1: The uncertainty is the degree of variation in analytical value. Uncertainty is determined by combined all the variations of each step of the analytical procedure from sample collection to measurement. Here, the expanded uncertainty (U = 2 x u) is attached to the analyzed value by doubling the combined standard uncertainty (u).

※2: Legally required activity concentrations limit established in the Ordinance for Operational Safety and Protection of Specified Nuclear Fuel Materials of the Nuclear Reactors at TEPCO's Fukushima Daiichi (Appendix of first and sixth column: The concentration limit in water outside the peripheral surveillance zone [In this table, Bq/cm^3 was converted to Bq/L]).

※3: Measurement: The radiation of samples is measured then the results are converted into the concentrations of each nuclide.

3. Nuclides other than ^{3}H to be confirmed as not significantly present in ALPS treated water

Analysis results for the target nuclides (39 nuclides) other than ^{3}H which to be confirmed as not significantly present in ALPS treated water are shown in Table 3. As the result of analysis, all targeted radionuclides were confirmed not to significantly present. Furthermore, the sum of ratios to the regulatory concentrations limits for the 68 nuclides in Tables 1 and 3 is also less than 1.

Table 3 Analysis results of nuclides other than ^{3}H in ALPS treated water
(Nuclides which confirmed not to be significantly present) (sampling time: June 26, 2023 11:28 JST)

Nuclide	Activity Concentrations [Bq/L]	Regulatory Concentration Ratio [-]	Regulatory Limit※1 [Bq/L]	Evaluation※3	Measurement/ Evaluation method※4
^{59}Fe	2.4E-02	6.0E-05	400	○	Measurement
^{58}Co	1.3E-02	1.3E-05	1,000	○	Measurement
^{65}Zn	1.9E-02	9.5E-05	200	○	Measurement
^{86}Rb	2.7E-01	9.0E-04	300	○	Measurement
^{89}Sr	3.2E-02	1.1E-04	300	○	Measurement
^{91}Y	5.0E+00	1.7E-02	300	○	Measurement
^{95}Nb	1.7E-02	1.7E-05	1,000	○	Measurement
^{103}Ru	2.0E-02	2.0E-05	1,000	○	Measurement
^{103m}Rh	1.9E-02	9.5E-08	200,000	○	Radiative equilibrium evaluation
^{106}Rh	1.2E-01	4.0E-07	300,000	○	Radiative equilibrium evaluation
^{110m}Ag	1.1E-02	3.7E-05	300	○	Measurement
^{113m}Cd	1.5E-01	3.8E-03	40	○	Measurement
^{115m}Cd	7.4E-01	2.5E-03	300	○	Measurement
^{119m}Sn	5.4E-03	2.7E-06	2,000	○	Relative ratio evaluation
^{123}Sn	1.8E+00	4.5E-03	400	○	Measurement
^{126}Sn	6.9E-02	3.5E-04	200	○	Measurement
^{124}Sb	2.5E-02	8.3E-05	300	○	Measurement
^{123m}Te	2.1E-02	3.5E-05	600	○	Measurement
^{127}Te	1.4E+00	2.8E-04	5,000	○	Measurement
^{127m}Te	1.5E+00	5.0E-03	300	○	Relative ratio evaluation
^{129}Te	2.7E-01	2.7E-05	10,000	○	Measurement
^{129m}Te	5.5E-01	1.8E-03	300	○	Measurement

^{135}Cs	7.7E-08	4.5E-09	600	○	Relative ratio evaluation
^{136}Cs	3.2E-02	1.1E-04	300	○	Measurement
^{137m}Ba	1.1E-02	4.9E-07	800,000	○	Radiative equilibrium evaluation
^{140}Ba	1.7E-01	5.7E-04	300	○	Measurement
^{141}Ce	9.0E-02	9.0E-05	1,000	○	Measurement
^{144}Pr	7.5E-01	3.8E-05	20,000	○	Radiative equilibrium evaluation
^{144m}Pr	1.4E-03	3.5E-08	40,000	○	Radiative equilibrium evaluations
^{146}Pm	1.9E-02	2.1E-05	900	○	Measurement
^{148}Pm	7.3E-01	2.4E-03	300	○	Measurement
^{148m}Pm	1.8E-02	3.6E-05	500	○	Measurement
^{152}Eu	5.8E-02	9.7E-05	600	○	Measurement
^{153}Gd	5.2E-02	1.7E-05	3,000	○	Measurement
^{160}Tb	3.8E-02	7.6E-05	500	○	Measurement
^{242m}Am	4.8E-05	9.6E-06	5	○	Relative ratio evaluation
^{243}Am			5	○	Measurement, Total α (Pu, Am, Cm group)
^{242}Cm	8.4E-03	2.1E-03※2	60	○	Measurement, Total α (Pu, Am, Cm group)
^{243}Cm			6	○	Measurement, Total α (Pu, Am, Cm group)

- ○.○E±○ means ○.○×10$^{\pm ○}$
- The results shown in two significant digits.
- Due to rounding of values, the sums of shown results in the table may not match.
- The reference value for decay correction is the date and time of sampling.

※1: Legally required activity concentrations limit established in the Ordinance for Operational Safety and Protection of Specified Nuclear Fuel Materials of the Nuclear Reactors at TEPCO's Fukushima Daiichi (Appendix of first and sixth column: The concentration limit in water outside the peripheral surveillance zone [In this table, Bq/cm^3 was converted to Bq/L]).

※2: The ratio to the regulatory concentrations limits of α nuclides (Am-243, Cm-242, and Cm-243) was calculated by dividing the total alpha value by the lowest required activity concentrations limit (4 Bq/L) of the selected alpha nuclides.

※3: If it is not significantly present, it is marked with a "○"; if it is significantly present, it is marked with an "×".
The evaluation is made as not significantly present ("○") if any of the following are satisfied:

- The measured nuclide concentration is below the detection limit.
- Nuclides evaluated by radiative equilibrium, etc.: When the evaluated nuclide is detected, the concentration is extremely low compared to the regulatory concentration limit, i.e., the evaluated value is less than the set

detection limit (less than 1/100 of the regulatory concentration limit), and can be judged to be equivalent to less than the detection limit.

Evaluated Nuclide	Evaluated Value [Bq/L]	Regulatory Concentration Ratio	Regulatory Limit※1 [Bq/L]
^{103m}Rh	ND	-	200,000
^{106}Rh	ND	-	300,000
^{119m}Sn	ND	-	2,000
^{127m}Te	ND	-	300
^{135}Cs	2.7E-06	4.5E-09	600
^{137m}Ba	3.9E-01	4.9E-07	800,000
^{144}Pr	ND	-	20,000
^{144m}Pr	ND	-	40,000
^{242m}Am	ND	-	5

・ ND (Not Detected) in the table indicates that the value is below the detection limit.

※4: Details of the measurement and evaluation methodology are described below.

Measurement: The radiation of samples is measured then the results are converted into the concentrations of each nuclide.

Total α (U, Np group): U and Np derived α rays of the samples were measured and the results are converted to total α concentration.

Total α (Pu, Am, Cm group): Pu, Am, Cm derived α rays of the samples were measured and the results are converted to total α concentration.

Radiative equilibrium evaluations: The state in which the ratio of the number of atoms of the parent nuclide to that of its progeny nuclides in a decay series is nearly constant is called radiative equilibrium. The concentration of each nuclide was evaluated based on this radiative equilibrium relationship and the measurement results of the parent (or progeny) nuclide.

Relative ratio evaluation: The ratio of each nuclide present in the reactor is evaluated by taking into account the generation, decay, impairment loss, etc. of the nuclides. The concentration of each nuclide is calculated by multiplying the measurement results of the reference nuclide by its existence ratio.

Reference: Measurement and evaluation methods for each nuclide in the third-party analysis of ALPS treated water

No.	Nuclide	Measurement and evaluation methods for each nuclide in the third-party analysis of ALPS treated water	
1	^{3}H	β-ray	Purify tritiated water by distillation and mixing sample and scintillator
			Liquid scintillation counter
2	^{14}C	β-ray	Isolation by collection on adsorbent, mixing sample and scintillator
			Liquid scintillation counter
3	^{54}Mn	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
4	^{55}Fe	X-ray	Isolation by resin and sedimentation
			Low-energy photon detector (Ge-LEPS)
5	^{59}Fe	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
6	^{58}Co	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
7	^{60}Co	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
8	^{63}Ni	β-ray	Isolation by resin, mixing sample and scintillator
			Liquid scintillation counter
9	^{65}Zn	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
10	^{79}Se	ICP-MS	Isolation by resin
			Inductively coupled plasma mass spectrometer
11	^{86}Rb	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
12	^{89}Sr	β-ray	Isolation by resin and sedimentation
			Beta-ray spectrometer (plastic scintillator)
13	^{90}Sr	β-ray	Isolation by resin and sedimentation
			Beta-ray spectrometer (plastic scintillator)
14	^{90}Y	Evaluation	Radiative equilibrium evaluation
15	^{91}Y	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
16	^{95}Nb	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
17	^{99}Tc	ICP-MS	Isolation by resin
			Inductively coupled plasma mass spectrometer
18	^{103}Ru	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector

19	^{106}Ru	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
20	^{103m}Rh	Evaluation	Radiative equilibrium evaluation
21	^{106}Rh	Evaluation	Radiative equilibrium evaluation
22	^{110m}Ag	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
23	^{113m}Cd	β-ray	Isolation by resin, mixing sample and scintillator Liquid scintillation counter
24	^{115m}Cd	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
25	^{119m}Sn	Evaluation	Relative ratio evaluation:
26	^{123}Sn	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
27	^{126}Sn	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
28	^{124}Sb	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
29	^{125}Sb	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
30	^{123m}Te	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
31	^{125m}Te	Evaluation	Radiative equilibrium evaluation
32	^{127}Te	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
33	^{127m}Te	Evaluation	Radiative equilibrium evaluation
34	^{129}Te	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
35	^{129m}Te	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
36	^{129}I	ICP-MS	Isolation by resin Inductively coupled plasma mass spectrometer
37	^{134}Cs	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
38	^{135}Cs	Evaluation	Relative ratio evaluation:
39	^{136}Cs	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector
40	^{137}Cs	γ-ray	A single sample was prepared in a Marinelli beaker. Gamma-ray spectrometry using high purity germanium (HPGe) detector

41	^{137m}Ba	Evaluation	Radiative equilibrium evaluation
42	^{140}Ba	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
43	^{141}Ce	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
44	^{144}Ce	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
45	^{144}Pr	Evaluation	Radiative equilibrium evaluation
46	^{144m}Pr	Evaluation	Radiative equilibrium evaluation
47	^{146}Pm	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
48	^{147}Pm	Evaluation	Relative ratio evaluation:
49	^{148}Pm	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
50	^{148m}Pm	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
51	^{151}Sm	Evaluation	Relative ratio evaluation:
52	^{152}Eu	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
53	^{154}Eu	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
54	^{155}Eu	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
55	^{153}Gd	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
56	^{160}Tb	γ-ray	A single sample was prepared in a Marinelli beaker.
			Gamma-ray spectrometry using high purity germanium (HPGe) detector
57	^{234}U	α-ray	Separated by resin and evaporated and solidified on a stainless plate
			α-ray scintillation counter (ZnS scintillator)
58	^{238}U	α-ray	Separated by resin and evaporated and solidified on a stainless plate
			α-ray scintillation counter (ZnS scintillator)
59	^{237}Np	α-ray	Separated by resin and evaporated and solidified on a stainless plate
			α-ray scintillation counter (ZnS scintillator)
60	^{238}Pu	α-ray	Separated by resin, collected as sedimentation, and evaporated to dryness
			α-ray scintillation counter (ZnS scintillator)
61	^{239}Pu	α-ray	Separated by resin, collected as sedimentation, and evaporated to dryness
			α-ray scintillation counter (ZnS scintillator)

62	^{240}Pu	α-ray	Separated by resin, collected as sedimentation, and evaporated to dryness
			α-ray scintillation counter (ZnS scintillator)
63	^{241}Pu	Evaluation	Relative ratio evaluation:
64	^{241}Am	α-ray	Separated by resin, collected as sedimentation, and evaporated to dryness
			α-ray scintillation counter (ZnS scintillator)
65	^{242m}Am	Evaluation	Relative ratio evaluation:
66	^{243}Am	α-ray	Separated by resin, collected as sedimentation, and evaporated to dryness
			α-ray scintillation counter (ZnS scintillator)
67	^{242}Cm	α-ray	Separated by resin, collected as sedimentation, and evaporated to dryness
			α-ray scintillation counter (ZnS scintillator)
68	^{243}Cm	α-ray	Separated by resin, collected as sedimentation, and evaporated to dryness
			α-ray scintillation counter (ZnS scintillator)
69	^{244}Cm	α-ray	Separated by resin, collected as sedimentation, and evaporated to dryness
			α-ray scintillation counter (ZnS scintillator)