

**Results of ALPS Treated Water Marine Monitoring:
Seawater survey (other related nuclides) (September, 2023)**

1. Outline of survey

(1) Date of sampling

September 13-15, 2023

(2) Sampling points

3 sampling points on the coastal waters in the Fukushima Prefecture.

(3) Detail of the survey

- Measurements of radioactive material concentration (total 54 nuclides consisting of 11 alpha-ray emitting nuclides such as plutonium 238, 8 beta-ray emitting nuclides such as carbon 14, and 35 nuclides that emit gamma-ray or are evaluated assuming radioactive equilibrium) in seawater.

*1 Rhodium 103m, Rhodium 106, Tellurium 125m, Barium 137m, Praseodymium 144, Praseodymium 144m and Yttrium 90 are nuclides evaluated assuming radioactive equilibrium with the parent nuclides.

*2 Plutonium 239 and plutonium 240 are evaluated by the total value of plutonium 239 + 240 because alpha-ray energies are close to each other and alpha-ray peaks can not be separated.

*3 Americium 243, Curium 243 and Curium 244 are evaluated by gross alpha measurement.

- The target lower limits of detection of each nuclide*4 are shown below.

Nuclides	Target lower limits of detection (Bq/L)
Barium 137m	0.001
Other gamma-ray emitting nuclides	- *5
Plutonium 238 Plutonium 239 + 240 Americium 241 Curium 242	0.00002
Americium 243 Curium 243 Curium 244 Uranium 234 Uranium 238 Neptunium 237	0.002
Iron 55	20

Strontium 89	0.005
Yttrium 90	0.001
Technetium 99	0.0004
Cadmium 113m	0.2
Nickel 63	20
Selenium 79	2
Carbon 14	0.0005

*4 A target lower limit of detection means a value that is set for quality control to assure at least the detection up to the value when analysis is conducted. Each actual lower limit of detection differs according to samples, and is equal to or lower than a target lower limit of detection.

*5 The target lower limits of detection of other gamma-ray emitting nuclides are obtained through simultaneous measurements under a condition of satisfying the target lower limits of detection (in parentheses) for the following nuclides:

Ruthenium 106 (<1.2 Bq/L), Antimony 125 (<0.5 Bq/L) and Cobalt 60 (<0.3 Bq/L)

2. Outline of results

(1) Seawater survey (3 sampling points [6 samples])

- Concentrations of Plutonium 239 + 240 range from 0.0000022 Bq/L to 0.0000074 Bq/L.
- Concentrations of Americium 241 range from below the lower limit of detection to 0.0000064 Bq/L.
- Concentrations of Uranium 234 range from 0.040 Bq/L to 0.044 Bq/L.
- Concentrations of Uranium 238 range from 0.036 Bq/L to 0.040 Bq/L.
- Concentrations of Yttrium 90 range from 0.00067 Bq/L to 0.0079 Bq/L.
- Concentrations of Carbon 14 range from 0.0051 Bq/L to 0.0060 Bq/L.

*6 The above results excluding Uranium 234 and Uranium 238 are determined to be within the range of concentration fluctuations prior to the discharge of ALPS treated water into the sea.

*7 Although it could not be confirmed the concentrations of Uranium 234 and Uranium 238 in seawater close to sampling points prior to the discharge of ALPS treated water into the sea, the results were comparable to the general seawater.

- All alpha-ray and beta-ray emitting nuclides other than the above seven were below the lower limit of detection.
- Gamma-ray emitting nuclides were announced on December 21, 2023.

(Detailed are attached)

Attachement

Analysis results for other related nuclides (alpha-ray and beta-ray emitting nuclides) in seawater

Sampling point	Sampling date (yyyy/mm/dd)	Sampling layer	Sampling depth (m)	Nuclide	Radioactivity concentration ^{*1*2}	Unit
E-S3	2023/09/13	Surface layer	1.5	Pu-238	< 0.000005	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Pu-239+240	0.0000042 ± 0.0000012	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Am-241	0.0000043 ± 0.0000011	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Cm-242	< 0.000003	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Am-243	< 0.002	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Cm-243	< 0.002	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Cm-244	< 0.002	Bq/L
E-S3	2023/09/13	Surface layer	1.5	U-234	0.043 ± 0.0020	Bq/L
E-S3	2023/09/13	Surface layer	1.5	U-238	0.037 ± 0.0018	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Np-237	< 0.0000007	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Fe-55	< 0.8	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Sr-89	< 0.004	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Y-90	0.0079 ± 0.00053	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Tc-99	< 0.00008	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Cd-113m	< 0.2	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Ni-63	< 10	Bq/L
E-S3	2023/09/13	Surface layer	1.5	Se-79	< 0.4	Bq/L
E-S3	2023/09/13	Surface layer	1.5	C-14	0.0051 ± 0.00008	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Pu-238	< 0.000003	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Pu-239+240	0.0000074 ± 0.0000013	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Am-241	0.0000064 ± 0.0000013	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Cm-242	< 0.000003	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Am-243	< 0.002	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Cm-243	< 0.002	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Cm-244	< 0.002	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	U-234	0.042 ± 0.0019	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	U-238	0.036 ± 0.0016	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Np-237	< 0.0000006	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Fe-55	< 0.8	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Sr-89	< 0.002	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Y-90	0.00092 ± 0.00015	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Tc-99	< 0.0002	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Cd-113m	< 0.2	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Ni-63	< 10	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	Se-79	< 0.3	Bq/L
E-S3	2023/09/13	Bottom layer	6.3	C-14	0.0060 ± 0.00009	Bq/L

*1 Radioactivity concentrations are presented as radioactivity concentration ± combined standard uncertainty.

*2 Values below detection limit are shown by lower limit of detection (e.g., “<10 Bq/L” indicates a value below 10 Bq/L).

Analysis results for other related nuclides (alpha-ray and beta-ray emitting nuclides) in seawater

Sampling point	Sampling date (yyyy/mm/dd)	Sampling layer	Sampling depth (m)	Nuclide	Radioactivity concentration ^{*1*2}	Unit
E-S10	2023/09/14	Surface layer	1.5	Pu-238	< 0.000003	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Pu-239+240	0.0000022 ± 0.00000071	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Am-241	< 0.000004	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Cm-242	< 0.000003	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Am-243	< 0.002	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Cm-243	< 0.002	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Cm-244	< 0.002	Bq/L
E-S10	2023/09/14	Surface layer	1.5	U-234	0.042 ± 0.0018	Bq/L
E-S10	2023/09/14	Surface layer	1.5	U-238	0.036 ± 0.0016	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Np-237	< 0.0000003	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Fe-55	< 0.8	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Sr-89	< 0.002	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Y-90	0.00095 ± 0.00018	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Tc-99	< 0.00007	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Cd-113m	< 0.2	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Ni-63	< 10	Bq/L
E-S10	2023/09/14	Surface layer	1.5	Se-79	< 0.3	Bq/L
E-S10	2023/09/14	Surface layer	1.5	C-14	0.0060 ± 0.00009	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Pu-238	< 0.000004	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Pu-239+240	0.0000044 ± 0.0000010	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Am-241	< 0.000004	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Cm-242	< 0.000003	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Am-243	< 0.002	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Cm-243	< 0.002	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Cm-244	< 0.002	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	U-234	0.044 ± 0.0020	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	U-238	0.038 ± 0.0017	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Np-237	< 0.0000004	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Fe-55	< 0.8	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Sr-89	< 0.002	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Y-90	0.00067 ± 0.00015	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Tc-99	< 0.0002	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Cd-113m	< 0.2	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Ni-63	< 10	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	Se-79	< 0.3	Bq/L
E-S10	2023/09/14	Bottom layer	11.7	C-14	0.0060 ± 0.00009	Bq/L

*1 Radioactivity concentrations are presented as radioactivity concentration ± combined standard uncertainty.

*2 Values below detection limit are shown by lower limit of detection (e.g., “<10 Bq/L” indicates a value lower than 10 Bq/L).

Analysis results for other related nuclides (alpha-ray and beta-ray emitting nuclides) in seawater

Sampling point	Sampling date (yyyy/mm/dd)	Sampling layer	Sampling depth (m)	Nuclide	Radioactivity concentration ^{*1*2}	Unit
E-S15	2023/09/15	Surface layer	1.5	Pu-238	< 0.000003	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Pu-239+240	0.0000037 ± 0.00000091	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Am-241	< 0.000003	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Cm-242	< 0.000003	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Am-243	< 0.002	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Cm-243	< 0.002	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Cm-244	< 0.002	Bq/L
E-S15	2023/09/15	Surface layer	1.5	U-234	0.040 ± 0.0018	Bq/L
E-S15	2023/09/15	Surface layer	1.5	U-238	0.036 ± 0.0017	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Np-237	< 0.0000004	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Fe-55	< 0.8	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Sr-89	< 0.002	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Y-90	0.0012 ± 0.00018	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Tc-99	< 0.0002	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Cd-113m	< 0.2	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Ni-63	< 10	Bq/L
E-S15	2023/09/15	Surface layer	1.5	Se-79	< 0.4	Bq/L
E-S15	2023/09/15	Surface layer	1.5	C-14	0.0059 ± 0.00009	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Pu-238	< 0.000004	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Pu-239+240	0.0000048 ± 0.0000011	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Am-241	0.0000037 ± 0.0000011	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Cm-242	< 0.000003	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Am-243	< 0.002	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Cm-243	< 0.002	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Cm-244	< 0.002	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	U-234	0.042 ± 0.0020	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	U-238	0.040 ± 0.0019	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Np-237	< 0.0000003	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Fe-55	< 0.8	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Sr-89	< 0.002	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Y-90	0.0012 ± 0.00017	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Tc-99	< 0.0002	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Cd-113m	< 0.2	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Ni-63	< 10	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	Se-79	< 0.3	Bq/L
E-S15	2023/09/15	Bottom layer	6.0	C-14	0.0059 ± 0.00009	Bq/L

*1 Radioactivity concentrations are presented as radioactivity concentration ± combined standard uncertainty.

*2 Values below detection limit are shown by lower limit of detection (e.g., “<10 Bq/L” indicates a value lower than 10 Bq/L).

(Attachment)

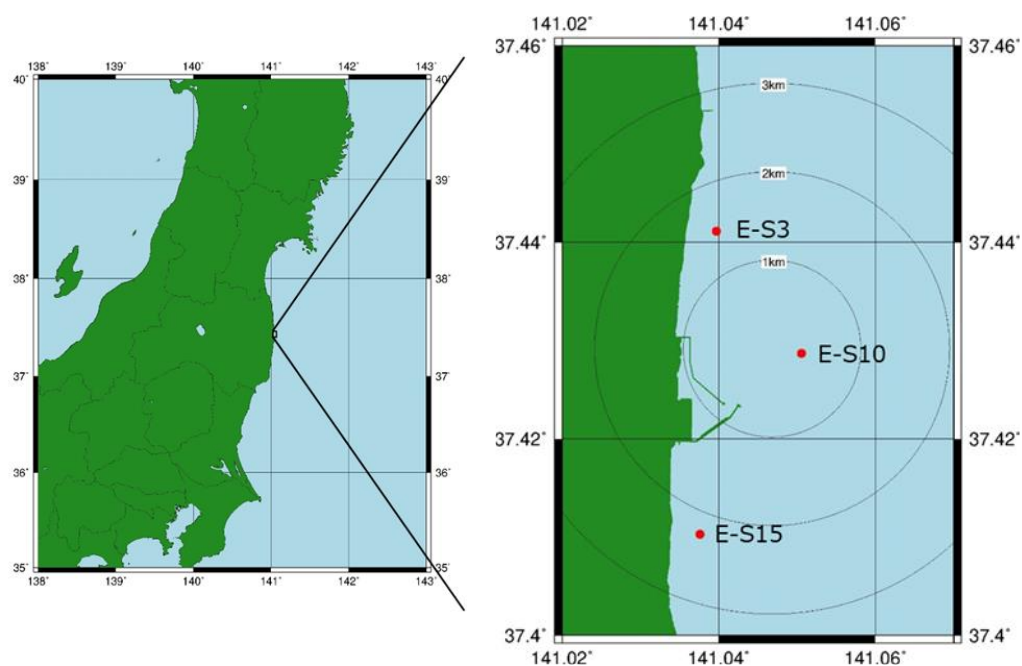


Fig. 1: Sampling points for other related nuclides in seawater