

Implementation Guides on Sea Area Monitoring in FY2013

1 April, 2013

Monitoring organizations: Secretariat of Nuclear Regulation Authority (Headquarters)
Fisheries Agency
Ministry of Land, Infrastructure, Transport and Tourism
Japan Coast Guard
Japan Meteorological Agency
Ministry of the Environment
Fukushima Prefectural Government
Tokyo Electric Power Co. Inc.

Since the accident at the Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Station (hereinafter referred to as "TEPCO's Fukushima Daiichi NPS") occurred on 11 March 2011, relevant organizations have monitored sea areas (sea area close to TEPCO's Fukushima Daiichi NPS, coastal area, off-shore area, outer sea area and others) by measuring the concentrations of radioactive materials in seawater, sediment and marine biota.

Monitoring has been conducted originally on the basis of the "Future Plan of Sea Area Monitoring" developed on 20 October 2011, and the Plan was revised and retitled "Sea Area Monitoring in FY2012" on 30 March 2012. In FY2013, sea area monitoring is to be conducted in line with this document "Implementation Guides on Sea Area Monitoring in FY2013" that was made on the basis of "Sea Area Monitoring in FY2012". The document describes the implementation of sea area monitoring which is expected to figure out radiation effects caused by the accident at TEPCO's Fukushima Daiichi NPS. The contents here are subject to being reviewed and revised taking into consideration the monitoring results and on the demand of social circumstances.

The monitoring results are disclosed promptly by each monitoring organization. The Headquarters (the S/NRA) has responsibility to summarize monitoring results of seawater and post them on the NRA website periodically.

1. Tasks of sea area monitoring

The distribution of radioactive materials is different respectively in seawater, sediment and marine biota. Taking into account the difference, the tasks of sea area monitoring are as follows:

Sample	Tasks of sea area monitoring	Objectives* of Comprehensive Radiation Monitoring Plan
Seawater	To measure concentrations of radioactive materials including Cs-134/137.	(f)
Sediment	To figure out distribution and time-dependent migration of radioactive materials.	(f)
Marine biota	To measure concentrations and figure out their pathways.	(b), (c), (e) and (f)

*The objectives of Comprehensive Radiation Monitoring Plan revised on 1 April, 2013:

- (a) To figure out a distribution of radiation doses and radioactive materials on a mid- and long-term basis mainly in residential areas;
- (b) To estimate the current exposure doses (external and internal exposure doses) of people who are living and lived near TEPCO's Fukushima Daiichi NPS and their potential exposure doses in the future;
- (c) To develop and evaluate procedures for reducing exposure doses including decontamination activities to be taken;
- (d) To review the current designation of evacuation areas by means of estimating future exposure and to decide changing it as necessary;
- (e) To develop reference data for the health management of people who are living and lived near TEPCO's Fukushima Daiichi NPS and the assessment of effects to their health;
- (f) To figure out a dispersion, deposition and migration of radioactive materials that were released into the environment.

The tasks of monitoring in seawater and sediment lead to an assessment of desposition and migration of radioactive materials in the sea, which have been dispersing from the land via rivers to the sea. Sea area monitoring is expected to figure out the pathways of radioactive materials from the land via rivers to the sea, and the migration and accumulation of radioactive materials from seawater/sediment to prey organisms/marine biota.

2. Monitoring organizations involved

Organizations involved in sea area monitoring in FY2013 are as follows:

- Secretariat of Nuclear Regulation Authority (S/NRA);
- Fisheries Agency;
- Ministry of Land, Infrastructure, Transport and Tourism (MLIT);
- Japan Coast Guard;
- Ministry of the Environment (MOE);
- Fukushima Prefectural Government;
- Tokyo Electric Power Co., Inc. (TEPCO);
- Local governments;
- Local fishery unions; and
- Research institutes (as necessary).

The Secretariat of Nuclear Regulation Authority (S/NRA) plays a role as headquarters of monitoring organizations.

3. Sea areas to be monitored

The sea area around TEPCO's Fukushima Daiichi NPS is divided into the following four areas in terms of their distance from the NPS:

- (a) Sea area close to TEPCO's Fukushima Daiichi NPS;
- (b) Coastal area: The area within approximately 30km from the coastline (including river outlets) of Aomori (a part of Aomori), Iwate, Miyagi, Fukushima and Ibaraki Prefectures;
- (c) Off-shore area: The area between approximately 30km and 90km from the coastline;
- (d) Outer sea area: The area approximately 90km and more far from the coastline.

In addition to the above-described sea areas, Tokyo Bay is the concerned area to be monitored.

- (e) Tokyo Bay: The area where radioactive materials are highly likely to flow in via rivers and be deposited.

4. Monitoring materials and methods

Radionuclides that must be measured are Cs-134 and Cs-137. Other radionuclides are to be analyzed as necessary. The detection limits are decided up to the aspects of each sea area monitoring.

Seawater

Monitoring of seawater (i.e., measuring concentrations of radioactive materials including Cs-134/137 in seawater) is conducted by TEPCO for the following two purposes:

To watch if a leakage of contaminated water from TEPCO’s Fukushima Daiichi NPS occurred. When a leakage of contaminated water is doubted, TEPCO and the central governmental organizations work together to obtain more seawater samplings as necessary in a prompt way.

To figure out a dispersion, deposition and migration of radioactive materials released into the environment. Monitoring of seawater is conducted by TEPCO and central/local governments with lower detection limits.

(a) Sea area close to TEPCO’s Fukushima Daiichi NPS

Frequent (once a day) analysis is conducted for seawater which is taken from sea surface layer (i.e., 2m below sea level) at the sampling points T-1 (north from the outlet for Reactor Units 5 and 6) and T-2-1 (south from the outlet of Reactor Units 1 to 4) in order to watch if a leakage of contaminated water occurred.

Radionuclide	Detection limit (Approx.; Bq/L)	Monitoring frequency	Monitoring organization
Cs-134	1 (0.001Bq/L (* 2))	Once /day (Once/week (*2))	TEPCO
Cs-137			
I-131			
Sb-125 (*1)	2	Once/month	
H-3	3		
Sr-90	0.01		
Pu-238 (* 3)	0.006 x 10 ⁻³		
Pu-239+Pu-240			

*1: At the sampling points T-1 and T-2-1.

*2: Analysis is conducted in terms of Cs-134 and Cs-137 once a week with higher sensitivity by lowering the detection limit.

*3: U-234, U-235, U-238, Am-241, Cm-242 and Cm243+Cm244 should be measured when Pu-238 is detected.

(b) Coastal area

Water samples are obtained from the surface layer (i.e., 2m below sea level) and the bottom layer (i.e., 2-3m above sea bottom) of the sea at the following sampling points:

- Points that are located approximately 1km far from the outlets of major rivers in Miyagi, Fukushima and Ibaraki Prefectures;
- Points in major ship ports, fishing ports and shoreline of Fukushima Prefecture;
- Points in shallow water fishing fields that are located within approximately 30km off the coasts of Aomori, Iwate, Miyagi, Fukushima and Ibaraki Prefectures; and
- Points requested by local governments and fishery unions, which are located within approximately 30km off the coasts of Aomori, Iwate, Miyagi, Fukushima and Ibaraki Prefectures.

Prefectures Sampling points		Radionuclide	Detection limit (Approx.; Bq/L)	Monitoring frequency	Remarks (*1)	Monitoring organization
Aomori	E-21, E-22, E-23	Cs-134 Cs-137	0.001	2-3 times/year	Surface and bottom layers	MOE
Iwate	E-31, E-32	Cs-134 Cs-137	1	Once /6 months	Surface and bottom layers	MOE
	E-34, E-35, E-36	Cs-134 Cs-137	0.001	2-3 times/year	Surface and bottom layers	MOE
Miyagi	T-MG0, T-MG1, T-MG2, T-MG3, T-MG4, T-MG5, T-MG6	Cs-134 Cs-137	0.001	Twice/month	Surface, middle and bottom layers	TEPCO
		Sr-90	0.01	Once/2 months (*2)	Surface layer	TEPCO
	E-41, E-42, E-43, E-44, E-45, E-46, E-47, E-48, E-49, E-4A, E-4B, E-4C	Cs-134 Cs-137	1	Once/1-6 months	Surface and bottom layers	MOE
	E-4F, E-4G, E-4H	Cs-134 Cs-137	0.001	2-3 times/year	Surface and bottom layers	MOE
Fukushima	T-3, T-4-2, T-5, T-11, T-14, T-D1, T-D5, T-D9	Cs-134 Cs-137	0.001	Once/week	Surface and bottom layers	TEPCO
	T-S1, T-S8, T-B1, T-B2, T-B3, T-B4, T-13-1, T-7, T-18, T-12, T-17-1, T-20, T-22, T-MA, T-M10	Cs-134 Cs-137	0.001	Once/month	Surface and bottom layers	TEPCO
	T-5, T-D1, T-D5, T-D9	H-3	3	Once/month	Surface layer	TEPCO
		Sr-90	0.01			
	Pu-238	0.006×10^{-3}				

		Pu-239+ Pu-240				
	E-71, E-72, E-73, E-74, E-75, E-76, E-77, E-78, E-79, E-7A, E-7B, E-7F	Cs-134 Cs-137	1	Once /1-2 months	Surface and bottom layers	MOE
	E-7C, E-7D, E-7E	Cs-134 Cs-137	0.001	2-3 times/year	Surface and bottom layers	MOE
	34 points off the coast of Fukushima Prefecture (major ports, fishing ports, shoreline and shallow water fishing fields)	I-131 Cs-134 Cs-137	1	Twice/week to once/month	2-7m above sea level	Fukushima Prefectural Government
Ibaraki	T-A, T-B, T-C, T-D, T-E, T-Z	Cs-134 Cs-137	1	Once/month	Surface and bottom layers	TEPCO
		Sr-90	0.01	Once/2 months (*3)	Surface layer	
	E-81, E-82, E-83, E-84, E-85	Cs-134 Cs-137	1	Once /3-4 months	Surface and bottom layers	MOE

*1: Surface and bottom layers are defined as 2m below sea level and 2-3m above the sea bottom, respectively. Middle layer is defined as between 2m below sea level and 2-3m above the sea bottom.

*2: Only at the sampling point T-MG5

*3: Only at the sampling point T-C

(c) Off-shore area

Monitoring in off-shore areas is conducted considering the tidal current in coastal areas and the Japan Current and with the reference of the past monitoring results.

Sampling points	Radionuclide	Detection limit (Approx.; Bq/L)	Monitoring frequency	Remarks (*1)	Monitoring organization
M-A1, M-A3, M-MI4, M-B1, M-B3, M-B5 (former M-2) , M-C1, M-C3, M-D1, M-D3,	Cs-134 Cs-137 (*2)	0.001	Once/3months	Surface, middle and bottom layers	S/NRA

M-E1, M-E3, M-E5, M-F1, M-F3, M-G0, M-G1, M-G3, M-G4, M-H1, M-H3, M-I0, M-I1, M-I3, M-J1, M-IB2, M-J3, M-K1, M-IB4, M-L1, M-L3, M-M1 (former M-24)					
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*1: Surface and bottom layers are defined as 2m below sea level and 2-3m above the sea bottom, respectively. Middle layer is defined as between 2m below sea level and 2-3m above the sea bottom.

*2: Sr-90 is additionally measured at some sampling points considering the concentration for Cs-134/137 and the past monitoring results.

(d) Outer sea area

Monitoring is conducted in outer sea area with the reference of the past monitoring results.

Sampling points	Radionuclide	Detection limit (Approx.; Bq/L)	Monitoring frequency	Remarks	Monitoring organization
M-10, M-11, M-14, M-15, M-19, M-20, M-21, M-25, M-26, M-27	Cs-134 Cs-137	0.001	Once/6 months	Surface(2m), 100m, 200m, 300m and 500m below sea level	S/NRA

(e) Tokyo Bay

Sampling points are specified, considering the river inflow in Tokyo Bay and the tidal currents and with the reference of the past monitoring data.

Sampling points		Radionuclide	Detection limit (Approx.; Bq/L)	Monitoring frequency	Remarks (*)	Monitoring organization
River outlet	E-T1, E-T2, E-T3, E-T4, E-T5, E-T6, E-T7, E-T8	Cs-134 Cs-137	1	2-6 times/year	Surface and bottom layers	MOE
	E-T1, E-T2, E-T3, E-T4	Cs-134 Cs-137	0.001	Once/year	Surface layer	S/NRA
Center of the bay	K-T1, K-T2	Cs-134 Cs-137	0.001	6 times/year	Surface layer	S/NRA
	M-C6, M-C9	Cs-134 Cs-137	0.001	Once/year	Surface layer	S/NRA
Around the center of bay-mouth	KK-U1	I-131 Cs-134 Cs-137	>5	Once/2weeks	Surface layer	MLIT
		Cs-134 Cs-137	0.001	Once/year	Surface layer	S/NRA
Other	TBD	Cs-134 Cs-137	1	Once/3 months	Surface layer	Local governments

*: Surface and bottom layers are defined as 2m below sea level and 2-3m above the sea bottom, respectively. Middle layer is defined as between 2m below sea level and 2-3m above the sea bottom.

Sediment

Monitoring is conducted for sediment in order to figure out a distribution and time-dependent movement of radioactive materials in sediment, and a migrating of radioactive materials from the land via rivers to the sea.

(a) Sea area close to TEPCO's Fukushima Daiichi NPS

Monitoring is conducted for sediment at the sampling points T-1 (north from the outlet for Reactor Units 5 and 6) and T-2-1 (south from the outlet of Reactor Units 1 to 4). As high levels of Cs-134/137 were found in the previous monitoring, Sr-90, Pu-238 and Pu-239+240 in sediments are measured.

Radionuclide	Detection limit (Approx.; Bq/kg dry)	Monitoring frequency	Monitoring organization
Cs-134	1	Once/2 months	TEPCO
Cs-137			
Sr-90	10		
Pu-238 (*)			
Pu-239+Pu-240			

*: U-234, U-235, U-238, Am-241, Cm-242 and Cm243+244 should be measured when Pu-238 is detected..

(b) Coastal area

Monitoring is conducted for sediment at around river outlets in the similar way to monitoring for seawater.

Prefectures Sampling points		Radionuclide	Detection limit (Approx.; Bq/kg dry)	Monitoring frequency	Monitoring organization
Aomori	E-21, E-22, E-23	Cs-134 Cs-137	1	2-3 times/year	MOE
		Sr-90	0.12		
Iwate	E-34, E-35, E-36	Cs-134 Cs-137	1	2-3 times/year	MOE
		Sr-90	0.12		
	E-31, E-32	Cs-134 Cs-137	10	2-6 times/year	MOE
	Miyagi	E-4F, E-4G, E-4H	Cs-134 Cs-137	1	2-3 times/year
		Sr-90	0.12		
	E-41, E-42, E-43, E-44, E-45, E-46, E-47, E-48, E-49, E-4A, E-4B, E-4C	Cs-134 Cs-137	10	2-6 times/year	MOE
	Fukushima	T-3, T-4-2, T-5, T-11, T-14, T-B1, T-B2, T-B3, T-B4, T-D1, T-D5, T-D9, T-S1, T-S2, T-S3, T-S4, T-S5, T-S8, T-①, T-②, T-③, T-④, T-⑤, T-⑥, T- ⑦, T-⑧, T-⑨, T-⑩, T- ⑪, T-⑫, T-⑬	Cs-134 Cs-137	1	Once/month
T-7, T-12, T-13-1, T-17-1, T-18, T-20, T-22, T-M10, T-MA, T-S7		Cs-134 Cs-137	1	Once/2 months	TEPCO
E-7C, E-7D, E-7E		Cs-134 Cs-137	1	2-3 times/year	MOE
		Sr-90	0.12		
E-71, E-72, E-73, E-74, E-75, E-76, E-77, E-78, E-79, E-7A, E-7B, E-7F		Cs-134 Cs-137	10	2-6 times/year	MOE
	Sr-90	2			
42 points off the coast of Fukushima (sea bottom)	I-131 Cs-134 Cs-137	10	Once/month to twice/year	Fukushima Prefectural Government	
Ibaraki	E-81, E-82, E-83, E-84, E-85	Cs-134 Cs-137	10	2-6 times/year	MOE

(c) Off-shore area

Monitoring is conducted for sediment in off-shore areas in the similar way to monitoring of seawater.

Sampling points	Radionuclide	Detection limit (Approx.; Bq/kg dry)	Monitoring frequency	Monitoring organization
M-A1, M-A3, M-MI4, M-B1, M-B3, M-B5 (former M-2), M-C1, M-C3, M-D1, M-D3, M-E1, M-E3, M-E5, M-F1, M-F3, M-G0, M-G1, M-G3, M-G4, M-H1, M-H3, M-I0, M-I1, M-I3, M-J1, M-IB2, M-J3, M-K1, M-IB4, M-L1, M-L3, M-M1 (former M-24)	Cs-134 Cs-137 (*)	1	Once/3 months	S/NRA

*: Sr-90, Pu-238, Pu-238+240, Am-241, Cm-242 and Cm-243+244 are measured in some sampling points (e.g., sampling points where high Cs levels were found) with the detection limits as follows;

- Sr-90: 0.3Bq/kg of dry sediment
- Pu-238 and Pu-239+Pu-240: 0.01BqBq/kg of dry sediment
- Am-241: 0.02Bq/kg of dry sediment
- Cm242 and Cm-243+244: 0.009Bq/kg of dry sediment

(d) Outer sea area

Monitoring is not conducted for sediment in outer sea area.

(e) Tokyo Bay

Monitoring is conducted for sediment in Tokyo Bay in the similar way to monitoring of seawater.

	Sampling points	Radionuclide	Detection limit (Approx.; Bq/kg dry)	Monitoring frequency	Monitoring organization
River outlets	E-T1, E-T2, E-T3, E-T4, E-T5, E-T6, E-T7, E-T8	Cs-134 Cs-137	10	2-6 times/year	MOE
	M-C1, M-C3, M-C4, M-C7, M-C8, M-C10, C-P1, C-P2, C-P3, C-P4, C-P5, C-P8	Cs-134 Cs-137	0.6	Once/3 months	S/NRA
Center of the bay	K-T1, K-T2,	Cs-134 Cs-137	0.6	Once/2 months	S/NRA
	M-C2, M-C5, M-C6, M-C9	Cs-134 Cs-137	0.6	Once/3 months	S/NRA
Others	to be determined	Cs-134 Cs-137	10	Once/3 months	Local governments

Marine biota

Monitoring is conducted for marine biota in the sea areas mainly facing to Fukushima Prefecture with reference of the previous monitoring results. The monitoring results lead to a reduction of harmful rumors. Prey organisms are monitored to investigate a deposition of radioactive materials into fish and shellfish.

Sea area to be monitored (Above-described paragraph 3)	Monitoring subject	Radionuclide	Detection limit (Approx.; Bq/kg wet)	Monitoring frequency	Monitoring organization
(b)	Fish and shellfish	Cs-134 Cs-137 (*)	10	once/month	TEPCO
(b), (c), (d) and (e)	Littoral fish (seaperch, flounder, flatfish and others); Migratory fish (bonito, saury pikes, mackerel, salmon and others); Shellfish (clams and others); and seaweed	Cs-134 Cs-137	Several	once/week	Fisheries Agency
(b)	Marine biota including fish, shellfish and prey organisms	Cs-134 Cs-137 (*)	0.001-0.01	once/3-4 months	MOE

*: The concentration of Sr-90 is measured as necessary with the detection limit of 0.001 to 0.01Bq/kg of wet weight.

Attachment: Sampling Points for Sea Area Monitoring in FY2013 (Figure No. 1 to 9)

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