Investigation Report of Fish and Shellfish Sampled in the Ocean Area Within 20km Radius of Fukushima Daiichi NPS*

(Sampling period: January – March, 2014)

Tokyo Electric Power Company

June 13, 2014

東京電力 TEPCO

* Exclude the data obtained in the port of Fukushima Daiichi NPS

1. Purpose of the Investigation of Fish and Shellfish Sampled in the Ocean Area Within 20km Radius of Fukushima Daiichi NPS

(1) To understand radioactive cesium density by fish species

- Comparison with the food standard value (total cesium amount: 100Bq/kg)

(2) To understand the geographical distribution of radioactive cesium density of fish and shellfish

- Sampling at fixed measurement points (gill net fishing, trawl net fishing)

(3) To understand the change of radioactive cesium density of fish and shellfish over time

- Accumulating basic data in order to forecast trends

2-1. Investigation Results (Radioactive Cesium Density by Fish Species)

- **Approx. 90% of all the measurement results were below the standard value.**

Standard value: 100 Bq/kg of total amount of radioactive cesium

	Sampling period: January to March , 2014		Sampling period: October to November , 2013	
Number of fish species	32 (cesium exceeding the standard value: 6)	[Top 3 Density Levels] (Unit: Bq/kg (Raw)) 1. Common skete 2. Schlegel's black rockfish 3. Sebastes cheni [Samples below the detection limit]	39 (cesium exceeding the standard value: 9)	[Top 3 Density Levels] (Unit: Bq/kg (Raw)) 1. Banded houndshark 2. Schlegel's black rockfish 3. Marbled sole [Samples below the detection limit]
Number of measurements ()	241 (cesium exceeding the standard value:18)	1. Blue crab 2. Yellow goosefish 3. Snailfish 4. Dwarf Squid 5. Japanese Flying Squid 6. Octopus (Enteroctopus) dofleini 7. Spear Squid	271 (cesium exceeding the standard value: 26)	1. Blue crab 2. Roundnose flounder 3. Japanese amberjack 4. Snailfish 5. White croaker 6. Common octopus 7. Salmon

- (Remark) Sampling region of fish and octopuses (except for salangichthys ishikawae, sand eel and lophius litilon): Muscle, Others: Whole
- **Samples with tendency to exceed the standard value:Sebastes cheni, Schlegel's black rockfish, Microstomus achne, Common skete, etc.**
- **Samples with tendency to fall below the standard value: Pacific cod, Flatfish, Marbled sole, Stone flounder, Greenling, etc.**

2-2. Investigation Results

(Geographical Distribution of Radioactive Cesium Density of Fish and Shellfish)

The proportion of samples exceeding the standard value is tend to be declined. The proportion of samples obtained at the trawl net measurement points (offshore) exceeding the standard value was lower than that of samples obtained at the gill net measurement points (coast).

However, there are some points at the gill net measurement points (coast) with the proportion exceeding the standard value is low, such as T-S1 ,T-S2 and T-S3 (North of 1F).

		Sampling period: January to March, 2014			Sampling period: October to December, 2013		
		Number of measurements	Number of measurement results exceeding the standard value	Proportion (%)	Number of measurements	Number of measurement results exceeding the standard value	Proportion (%)
Trawl Net	T-B1	27	0	0	35	1	3
	T-B2	39	0	0	44	0	0
	T-B3	28	0	0	19	0	0
	T-B4	28	0	0	21	1	5
Gill Net	T-S1	18	1	6	20	3	15
	T-S2	16	1	6	21	1	5
	T-S3	15	1	7	24	1	4
	T-S4	23	3	13	33	6	18
	T-S5	18	6	33	12	5	42
	T-S7	11	3	27	12	5	42
	T-S8	18	3	17	30	3	10

2-3. Investigation Results

(Change of Radioactive Cesium Density of Fish and Shellfish Over Time)

[Tendency of Radioactive Cesium Level of Fish and Shellfish Sampled within a 20km Radius of Fukushima Daiichi NPS]

- The radioactive cesium levels of fish and shellfish sampled in 20km radius of Fukushima Daiichi NPS were almost similar to those sampled outside of 20km radius (measurement performed by Fukushima Prefecture), however they tend to be slightly higher. Some of the radioactive cesium levels of samples have been decreasing.

[Tendency of Radioactive Cesium Density]

- Fish species whose radioactive cesium levels have been decreasing over time: Flatfish, Greenling, etc
- Fish species whose radioactive cesium levels are exceed over standard are restrictive: Common skete, Schlegel's black rockfish, and Sebastes cheni etc.

*** Further accumulation of the measurement results of fish and shellfish sampled within a 20km radius of Fukushima Daiichi NPS is needed.**

*** Though the cause of change in the radioactive cesium levels of fish and shellfish over time is estimated to be related to food, environment (seawater, marine soil, etc.) and ecological characteristics, the mechanism of the change needs to be clarified**

(Reference) Change of Radioactive Cesium Density of Flatfish and Greenling Over Time

Figure 1: Flatfish measurement Results (Cs 134+137, Bottom Layer Fish)

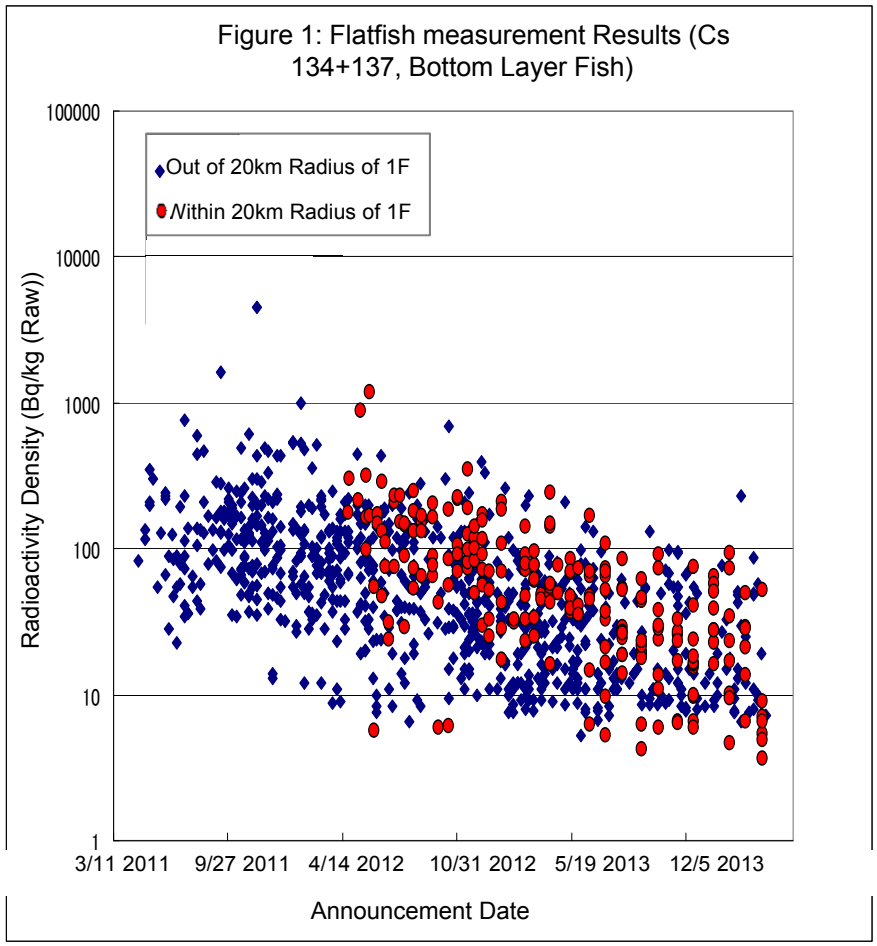
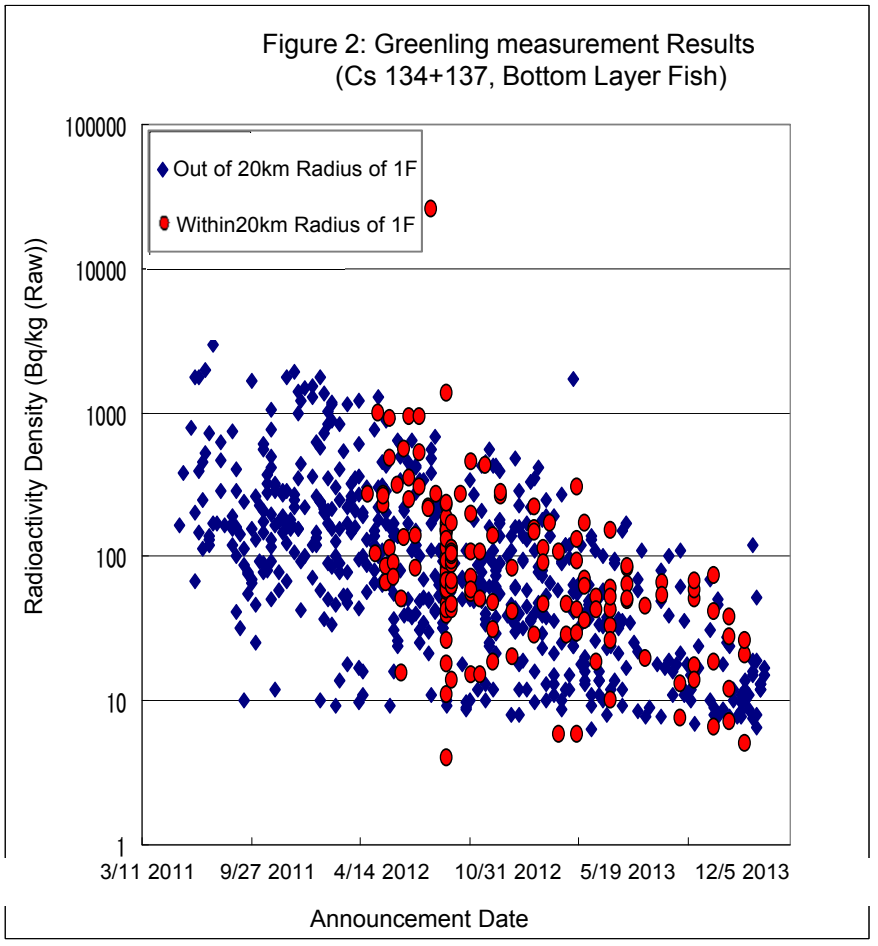


Figure 2: Greenling measurement Results (Cs 134+137, Bottom Layer Fish)



(Remark) The measurement results of "Out of 20km radius of 1F" were obtained from the Japan Meteorological Agency website.

The measurement values below the detection limit are not plotted in these graphs.

東京電力 TEPCO

2-4. Radioactive Density Measurement Results of Nuclide other Than Cesium

Unit: Bq/kg (Raw)

Nuclide (Half-life)	Sampling period: January to March 2014		Sampling period: October to November 2013	
	Number of samples	Measurement results	Number of samples	Measurement results
*1 Ag-110m (Approx. 250 days)	0	Maximum：— Minimum：— Average：—	2 [Ovalipes punctatus:2]	Maximum：8.2 Minimum：4.9 Average：6.6
*2 Sr-90 (Approx. 29 years)	5 [Common skete:1, Schlegel‘s black rockfish:1, Sebastes cheni:1, Microstomus achne:2〕	Maximum：1.2 Minimum：0.1 Average：0.5	5 〔Banded houndshark、Schlegel‘s black rockfish, Marbled sole, Japanese angel shark,Microstomus achne: each 1]	Maximum：1.3 Minimum：0.2 Average：0.7

- No sample in which Ag-110m was detected.
- The density ratio of Sr-90 was extremely lower than that of Cs-137 (approx. 1/400 to 1/900).

*1 Whole body measurement was done on the samples in which Ag-110m was detected, and all the results were below the food standard value (maximum radioactive cesium density: 10.2 Bq/kg (raw) in on the samples October to December, 2013 measured).

*2 As for the samples with top 5 density levels (top 2 density levels until FY2013 Q1), measurement was done after processing the whole fish into ash in the relevant sampling period

3. Future Investigation Plans

- Investigation will be continued in order to achieve the following 3 goals.

(1) Understanding of radioactive cesium density by fish species
(2) Understanding of the geographical distribution of radioactive cesium density of fish and shellfish
(3) Understanding of the change of radioactive cesium density of fish and shellfish over time

- Sampling and measurement of fish and shellfish will be conducted once a month at 11 sampling points for the time being. (Sometimes weather condition doesn't allow sampling.)

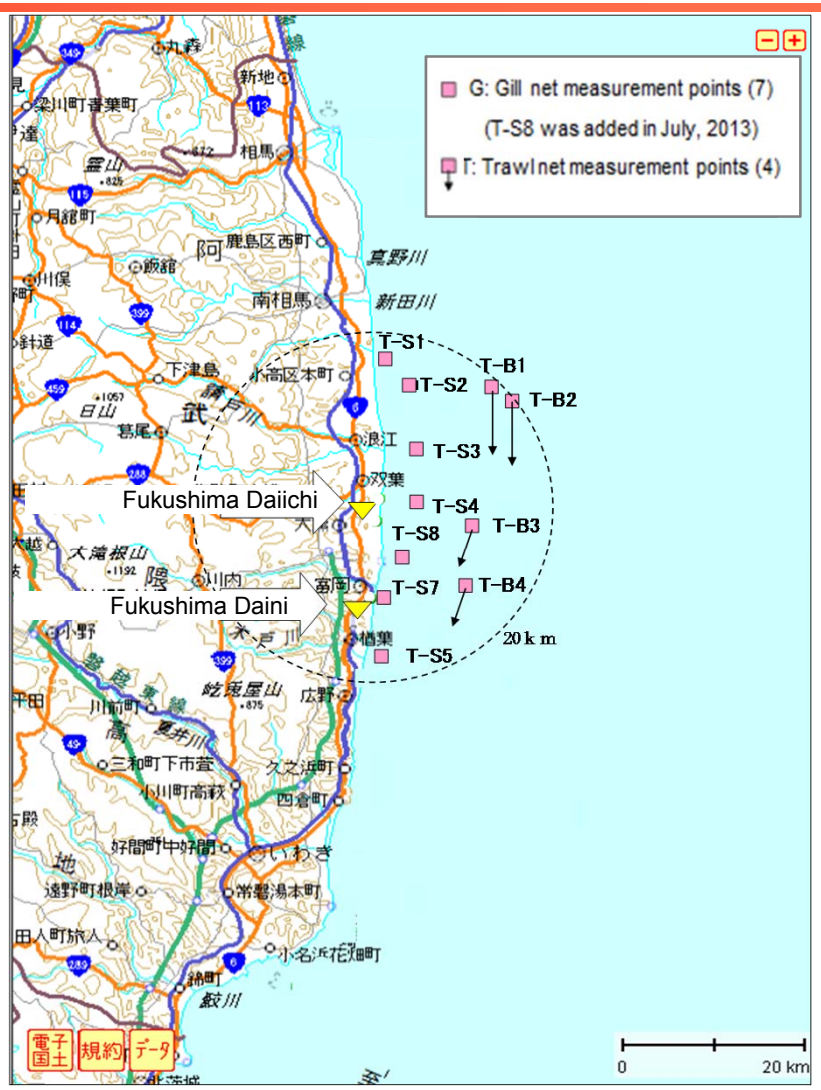


Figure 3. Fish and Shellfish Measurement Points (As of March 2014)