Surveys on radioactive substances

<Reference material>
Tokyo Electric Power Company
July 23, 2013

○ As some objects (a total of 4 pieces) contaminated with high amounts of radiation were collected during the decontamination work, etc., carried out by the Fukushima Environmental Reconstruction Office of the Ministry of the Environment in Naraba-Cho, Futaba County of Fukushima Prefecture (Evacuation Directive Lift Prepared Area (note: suggest 'Area Preparing to Lift Evacuation Restrictions')), our company was requested by the Ministry to analyze and survey the objects.

○Based on the possibility that the relevant objects could have been generated by the accident at the Fukushima Daiichi Nuclear Power Station, we have conducted analyses and surveys on the relevant objects transferred to the Fukushima Daiichi Nuclear Power Station at the request of the Ministry. We'd like to let you know that we have summarized the results of our analyses and surveys, and reported them to the parties concerned.

○As a result of the qualitative gamma ray nuclide analysis on the relevant objects (4 pieces) in the Fukushima Daiichi Nuclear Power Station, we confirmed that cesium 134 and cesium 137 were the major components of the gamma ray nuclide detected in all of them. Therefore, though the details of the process of contamination of these objects with high amounts of radiation were undefined, we estimated that the objects had been contaminated by the adhesion of some radioactive substances originating from the accident at the Fukushima Daiichi Nuclear Power Station.

○We will coordinate a detailed investigation of these objects in collaboration with the parties concerned.

Radioactive substances requested to be surveyed by the Ministry of the Environment

	Date of detection	Location	Size	Outward appearance	Properties
Substance (1)	June 20, 2013	Near the mouth of the Ide River in Naraba-Cho	Length: about 3cm Width: about 1.5cm Thickness: about 0.5cm		Nonmetal Elastic Property similar to that of rubber
Substance (2)	July 2, 2013	Near the mouth of the Ide River in Naraba-Cho	Length: about 4cm Width: about 3cm Thickness: about 1cm		Nonmetal Elastic Property similar to that of tree bark
Substance (3)	July 5, 2013	Near the mouth of the Ide River in Naraba-Cho	Length: about 2cm Width: about 2cm Thickness: about 0.1cm		Nonmetal Non-elastic Fragile
Substance (4)	July 5, 2013	Near the mouth of the Ide River in Naraba-Cho	Length: about 16cm Width: about 2cm Thickness: about 0.5cm		Nonmetal Non-elastic Wood chip

Measurement results of the surface dose rate of radioactive substances

	【At the time of sampling】 Surface dose rate (μSv／hour) ※1		【Re-evaluation】 Surface dose rate (μSv／hour) ※2	
Substance (1)	β＋γ (Reference value)	3,400	β＋γ ※3	1,000
	γ	105	γ ※4	85
Substance (2)	β＋γ (Reference value)	-	β＋γ ※3	2,400
	γ	110	γ ※4	300
Substance (3)	β＋γ (Reference value)	12,000	β＋γ ※3	36,000
	γ	250	γ ※4	400
Substance (4)	β＋γ (Reference value)	4,700	β＋γ ※3	780
	γ	105	γ ※4	180

:Measured on July 13, 2013

※1

We used a wide-range ionization chamber-type survey meter (ICS-323C) to take measurements. As this meter doesn't calibrate the β-rays, the measured values of β＋γ-rays are meant for reference only.

※2

We used a shallow ionization chamber-type survey meter (AE-133B) to take measurements. As this meter calibrates the β-rays, the β-rays can be evaluated.

※3

70μm dose equivalent (used to control the exposure to the skin and the crystalline lens) was measured with the cap of the shallow ionization chamber-type survey meter taken off.

※4

1cm dose equivalent (used to control exposure based on effective dose) was measured without taking off the cap of the shallow ionization chamber-type survey meter.

Result of the (qualitative) γ-ray nuclide analysis of radioactive substances

Measured on July 13, 2013

Measuring instrument:
Germanium semiconductor detector
measuring time: 300 seconds

	Major nuclide	Ratio※ (%)
Substance (1)	Cesium 134	38
	Cesium 137	62
Substance (2)	Cesium 134	37
	Cesium 137	63
Substance (3)	Cesium 134	38
	Cesium 137	62
Substance (4)	Cesium 134	38
	Cesium 137	62

※The ratio of each nuclide was calculated from the peak area of the detected nuclide.
(Due to the difference in the geometry of the samples and measuring locations, the peak areas of the samples cannot be compared with each other.)

○The cesium peak was confirmed by γ-ray nuclide analysis (The ratio between cesium 134 and cesium 137 is nearly 1:2, and considering the half-life of cesium 134 (about 2 years) as well as the fact that more than 2 years have passed since the accident, the ratios almost follow the theoretical values.)

Result of analysis/Summary

Analysis items	Analysis result	Interpretation
γ–ray nuclide analysis (qualitative)	・The cesium peak, a major nuclide, was confirmed. ・The ratio between cesium 134 and cesium 137 is 1:2.	The ratio between cesium 134 and cesium 137 is nearly 1:2, and considering the half-life of cesium 134 (about 2 years) as well as the fact that more than 2 years have passed since the accident, the ratios almost follow the theoretical values. → ***The objects could have been contaminated by the adhesion of some radioactive substances originating from the accident at the Fukushima Daiichi Nuclear Power Station.***
Dose rate	The dose rate of β + γ-rays is larger than that of γ-rays.	Contribution of β-ray was large. → ***It is unclear whether the contribution was made only by cesium, or to what extent other nuclides could have contributed.***

Summary

●Although the process of contamination with high amounts of radiation is unknown, we estimated that the objects had been contaminated by the adhesion of some radioactive substances originating from the accident at the Fukushima Daiichi Nuclear Power Station.

●It will be necessary for us to carry out detailed studies on the contribution of β-ray by nuclides other than cesium. We will coordinate a detailed investigation, etc., of these objects in collaboration with the parties concerned.