Appendix

Countermeasures to outflow of radioactive water off the site near water intake of Unit 3 at Fukushima Daiichi Nuclear Power Station (overview)

1. Overview of the event

At around 12:30 pm on May 11, 2011, a worker, who was working to block the vertical shaft near the intake canal, heard the water flowing into the pit and understood the situation by opening the lid of the pit. However, at that time we were not aware of the outflow to the screen area.

Later, when we checked the site again we opened the cover hatch to the screen room and observed the inside by CCD camera. We confirmed that the water in the pit was flowing into the screen area at around 4:05pm on the same day.

Seeing that the inflow water contains highly radioactive materials, we assume that drainage water in the turbine building of Unit 3 flew out into the power cable pit on the ocean side of the turbine building through the trench for sea water pipes, the connection point to the trench for power cables, and the duct, the connection points to the power cable pit, and ducts for electric wires, and it further flew out into the screen area of the intake canal of Unit 3 through the penetration created on the concrete wall between the power cable pit to the north of such pit and the screen pump room.

After we confirmed the outflow from such pit into the screen area, we immediately cut the duct for the electric wires in the pit and stuffed fabrics, and blocked the pit by concrete. As a result, we confirmed by CCD camera that the outflow was stopped at 6:45pm on May 11, 2011.

2. Estimation of amount of flow

(1) Estimation of amount of flow

We estimated the amount of flow based on the observation of the status of flow into the power cable pit from ducts and into the screen area through the wall of the pit.

a. Status of flow into power cable pit

The water flew into the pit through the void part in ducts where electric wires were laid out. Based on the data (diameter of a duct: 10cm, number of ducts: 4, and the photo of void part (taken at around 10:30am on May 11), we assumed the details of the outflow as follows – width of the flow: 6cm, drop: 1.27m, flying distance: 0.5m. As a result, the

estimated amount of flow is approx. 6m^3/h (approx. 100 litters/min).

b. Status of flow into screen area from power cable pit

We observed the water flew into the screen area from the pit cylindrically. Based on the photo taken (at around 6:30pm on May 11) after fabrics were stuffed into the duct, we assumed as follows – diameter: 5cm, drop: 1.4m, flying distance: 0.3m. The estimated amount of flow is approx. 4.3 m^3/h (approx. 72 litters/min)

However, in an interview on the status of the flow into the screen area from the pit, a worker answered that the amount of flow before fabrics were stuffed into the duct was larger than that after the stuff, thus we assumed approx. 6m^3/h.

(2)Duration of flow

The record of the water level in the vertical shaft at Unit 3, which is the upstream of the power cable pit where the outflow was found, shows;

from 7:00am on May 4 (o.p. +3,140mm) to 7:00am on May 10 (o.p. +3,240mm): the water level was increased by 10 to 30 mm per day, whereas

from 7:00am on May 10 to 5:00pm on May 11: the water level was decreased by 20 mm per day.

By calculating correlations using the least square method to each increase period and decrease period, we estimated that the increase turned to the decrease at 2:00am on May 10. Based on the above, we assumed the water started to flow out at 2:00am on May 10 when the water level turned to decrease.

Separately, we conduct surveys of radioactive doses of sea water at the south of the intakes of Units 1 to 4 and near the bar screen of Unit 2 at Fukushima Daiichi Nuclear Power Station to monitor periodically the radioactive materials contained in the sea water near the intake of Unit 3. The study of the monitoring results showed that generally the doses were decreasing until 7:00am on May 10, whereas it turned to increase after 7:00am on May 11. In addition, the record of radioactive doses at the north of intakes for Units 1 to 4 which is a little to the north from the screen area of Unit 3 showed the same trend. Judging from the above, we estimate that the outflow started at 7:00am on May 10 and we consider that the estimation of starting time based on the change of the water level in the vertical shaft is conservative.

We confirmed the outflow was stopped at 6:45pm on May 11. Therefore, we estimated that the duration of the outflow is approx 41 hours from 2:00am on May 10 to 7:00pm on May 11.

In conclusion, based on (1) and (2) above, the estimated amount of outflow is approx. 250m^3

(6 m^3/h, and lasted for 41 hours).

(3) Amount of radioactive materials flowed out

a. Radioactive dose of inflow water

The radioactive doses of the water into the power cable pit sampled at 1:30 pm on May 11 are as follows;

Cesium 137 :3.9×10^4Bq/ cm^3

Cesium 134 :3.7×10^4Bq/ cm^3

Iodine131 :3.4×10^3Bq/cm^3

We calculated the amount of radioactive materials flowed into the screen area using the amount of outflow water in (2) and radioactive doses above as follows;

Cesium 137	:3.9×10^4Bq/cm^3 × 250m^3	=9.8×10^{12}Bq
Cesium 134	:3.7×10^4Bq/cm^3 × 250m^3	=9.3×10^{12}Bq
Iodine 131	:3.4×10^3Bq/cm^3 × 250m^3	=8.5×10^{11}Bq
Total	:	2.0×10^{13}Bq

3. Preventive measures and plans to prevent scattering to the outside of harbor

(1) Blocking pits the water might flow out from

Before May 15 we completed all the work to block the pits the radioactive water might flow out from. Furthermore, as an additional measure, we will block 27 pits which are connected to the trenches for sea water pipes by concrete etc.

(2) Isolation of screen pump rooms at Units 1 to 4

We will install waterstop etc. in front of each screen pump room until the end of June.

(3) Installation of sandbags which contains zeolite

As a first step countermeasure, we will install sandbags which contains zeolie inside the intake.

(4) Installation of circulating water purification equipment

We will install circulating water purification equipment in the screen area. By circulating the sea water in the intake, we will remove radioactive cesium (installment: by the end of May, commencement of operation: early June).

(5) Continuance and reinforcement of monitoring

We will continue monitoring of sea water inside and outside of the harbor to check whether there is any significant difference in radioactive doses.

As for Units 1, 3 and 4, we will analyze sea water inside the silt fence as we do for Unit 2, to reinforce the monitoring system.

END