Evaluation of the exposure dose of workers engaged in radiation work at the Fukushima Daiichi Nuclear Power Station

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TEPCO has been evaluating the exposure dose of workers who engaged in radiation work at the Fukushima Daiichi Nuclear Power Station under two types, internal and external exposure to radiation, and has submitted the evaluation results to the Ministry of Health, Labour and Welfare regularly.

TEPCO today submitted to the Ministry of Health, Labour and Welfare a report on the exposure dose evaluation the data of which are those we collected until the end of April 2020. Here is part of the report: the maximum value of the external exposure dose among the workers who engaged in the work at the power station in April was 9.73mSv, and regarding the internal exposure dose, no significant value was measured.

Attachment

Exposure Dose Distribution

1. Effective Dose from External Exposure

Table 1 shows the distribution of external exposure dose of workers who were involved in radiation work at the Fukushima Daiichi Nuclear Power Station for the past three month.

Table 1. External Exposure Dose

Dose Ranges (mSv)	February 2020			March 2020			April 2020		
	TEPCO Employees	Contractors	Total	TEPCO Employees	Contractors	Total	TEPCO Employees	Contractors	Total
Above 100	0	0	0	0	0	0	0	0	0
75-100	0	0	0	0	0	0	0	0	0
50-75	0	0	0	0	0	0	0	0	0
20-50	0	0	0	0	0	0	0	0	0
10-20	0	10	10	0	4	4	0	0	0
5-10	0	61	61	0	46	46	0	29	29
1-5	15	740	755	17	765	782	18	598	616
1 or less	918	5208	6126	900	5252	6152	807	4726	5533
Total	933	6019	6952	917	6067	6984	825	5353	6178
Maximum (mSv)	2.96	11.07	11.07	1.86	14.30	14.30	3.37	9.73	9.73
Average (mSv)	0.11	0.49	0.44	0.12	0.47	0.42	0.11	0.37	0.34

・The values of the exposure dose and the number of the workers in the table above are subject to change, because there are cases that APD data are replaced with monthly dose data measured by integral dosimeters. Or dose data of workers who wore only an integral dosimeter (ex., workers who entered only the Seismic Isolation Building) need to be updated in the table after the publication of the data.

2. Sum of External and Internal Exposure Dose (Effective Dose)

Table 2 shows the distribution of cumulative exposure dose of workers who are involved in radiation work at Fukushima Daiichi for five years, starting on April 1, 2016. Table 3 shows the distribution of cumulative exposure dose in the fiscal year of 2019. Two different periods of time are shown in the Table 2: from April 1, 2016 to March 31, 2020 and from April 1, 2016 to April 30, 2020 for comparison, and Table 3: from April 1, 2020 to April 30, 2020.

Table 2. Cumulative Exposure Dose for Five Years

Dose Ranges (mSv)	April 2016 - March 2020			April 2016 - April 2020			Difference		
	TEPCO Employees	Contractors	Total	TEPCO Employees	Contractors	Total	TEPCO Employees	Contractors	Total
Above 100	0	0	0	0	0	0	0	0	0
75-100	0	13	13	0	18	18	0	5	5
50-75	0	222	222	0	236	236	0	14	14
20-50	67	1743	1810	68	1772	1840	1	29	30
10-20	140	2320	2460	144	2315	2459	4	-5	-1
5-10	182	2375	2557	185	2375	2560	3	0	3
1-5	594	4550	5144	594	4571	5165	0	21	21
1 or less	1299	9445	10744	1294	9519	10813	-5	74	69
Total	2282	20668	22950	2285	20806	23091	3	138	141
Maximum (mSv)	46.61	79.90	79.90	46.82	80.22	80.22	-	-	-
Average (mSv)	2.96	6.36	6.02	2.99	6.42	6.08	-	-	-

・The values of the exposure dose and the number of the workers in the table above are subject to change, because there are cases that APD data are replaced with monthly dose data measured by integral dosimeters. Or dose data of workers who wore only an integral dosimeter (ex., workers who entered only the Seismic Isolation Building) need to be updated in the table after the publication of the data.

・No significant internal exposure has been reported since October 2011.

Table 3. Cumulative Exposure Dose in the Fiscal Year of 2020

Dose Ranges (mSv)	April 2020		
	TEPCO Employees	Contractors	Total
Above 100	0	0	0
75-100	0	0	0
50-75	0	0	0
20-50	0	0	0
10-20	0	0	0
5-10	0	29	29
1-5	18	598	616
1 or less	807	4726	5533
Total	825	5353	6178
Maximum (mSv)	3.37	9.73	9.73
Average (mSv)	0.11	0.37	0.34

・The values of the exposure dose and the number of the workers in the table above are subject to change, because there are cases that APD data are replaced with monthly dose data measured by integral dosimeters. Or dose data of workers who wore only an integral dosimeter (ex., workers who entered only the Seismic Isolation Building) need to be updated in the table after the publication of the data.

3. Sum of External and Internal Exposure Dose of Workers Exposed to Especially High Radiation (Effective Dose)

Table 4 shows the distribution of cumulative exposure dose of workers exposed to especially high radiation.*1

Table 4. Cumulative Exposure Dose (workers exposed to especially high radiation)

Dose Ranges (mSv)	March 2011 - September 2015
Above 100	1
75-100	191
50-75	233
20-50	267
10-20	186
5-10	129
1-5	145
1 or less	51
Total	1203
Maximum (mSv)	102.69
Average (mSv)	36.49

(Since October 2015, TEPCO Holdings has opted not to report to the Labour Standards Inspection Office about workers exposed to especially high radiation.)

*1. Workers exposed to especially high radiation means workers who are involved in operations in which they could be exposed to the emergency exposure dose limit (100mSv), which is stipulated in "Ordinance on Prevention of Ionizing Radiation Hazards, Chapter 7." In more detail, they are workers engaged in the work to maintain the function of the cooling facility to cool down the reactor facility or the spent fuel tank in the reactor facility, the steam turbine and its related facilities or the surrounding area where the radiation doses exceed 0.1mSv/h. Or they are workers who would engage in keeping running the function to control or prevent the release of a large number of radioactive materials should it be likely to occur due to malfunction or damage of the reactor facility.

So far workers who have worked as “workers exposed to especially high radiation” are all TEPCO employees.

*2. The number of “workers exposed to especially high radiation” each month is the number of the workers who reported working as such

workers in a given month and were engaged in that work. The figures in the cumulative data during the period from March 2011 to September 2015 in Table 4 above include the numbers of workers who have been reported to work as “workers exposed to especially high radiation” at least once.

*3. The values of the exposure dose and the number of the workers in the table above are subject to change, because there are cases that APD data are replaced with monthly dose data measured by integral dosimeters. Or the dose data of workers who wore only an integral dosimeter (ex., workers who entered only the Seismic Isolation Building) need to be updated in the table after the publication of the data.

*4. The figure shown in the dose range, “Above 100mSv,” in the cumulative data during the period from March 2011 to September 2015 is the figure when the March 2011 data of the internal exposure dose were reevaluated in July 2013.

4. Equivalent Dose

Table 5 and Table 6 show equivalent dose to the skin and the lens of the eyes of the workers, respectively, who were involved in radiation work at the Fukushima Daiichi Nuclear Power Station for the past three months.

Table 5. Equivalent Dose to the Skin

Dose Ranges (mSv)	February 2020			March 2020			April 2020		
	TEPCO Employees	Contractors	Total	TEPCO Employees	Contractors	Total	TEPCO Employees	Contractors	Total
Above 500	0	0	0	0	0	0	0	0	0
300-500	0	0	0	0	0	0	0	0	0
250-300	0	0	0	0	0	0	0	0	0
200-250	0	0	0	0	0	0	0	0	0
150-200	0	0	0	0	0	0	0	0	0
100-150	0	0	0	0	0	0	0	0	0
75-100	0	0	0	0	0	0	0	0	0
50-75	0	1	1	0	0	0	0	0	0
20-50	0	2	2	0	3	3	0	0	0
10-20	0	30	30	0	10	10	0	0	0
5-10	0	78	78	0	83	83	0	33	33
1-5	18	871	889	22	860	882	19	657	676
1 or less	915	5037	5952	895	5111	6006	806	4663	5469
Total	933	6019	6952	917	6067	6984	825	5353	6178
Maximum (mSv)	2.96	63.50	63.50	3.98	24.40	24.40	3.37	9.82	9.82
Average (mSv)	0.11	0.63	0.56	0.14	0.58	0.52	0.11	0.40	0.36

・The values of the exposure dose and the number of the workers in the table above are subject to change, because there are cases that APD data are replaced with monthly dose data measured by integral dosimeters. Or the dose data of workers who wore only an integral dosimeter (ex., workers who entered only the Seismic Isolation Building) need to be updated in the table after the publication of the data.

・Equivalent dose is a measure of the radiation dose to organs and tissues, and the equivalent dose limit to the skin is 500mSv/year (the emergency exposure dose limit is 1Sv).

・Equivalent dose to the skin is measured at a depth of 70 micrometers from the skin surface. When the equivalent dose is measured with a dosimeter other than the one put on around the chest and the abdomen, for example, a finger dosimeter, the maximum measurement value is counted as the equivalent dose.

Table 6. Equivalent Dose to the Lens of the Eyes (Including inside of full-face mask)

Dose Ranges (mSv)	February 2020			March 2020			April 2020		
	TEPCO Employees	Contractors	Total	TEPCO Employees	Contractors	Total	TEPCO Employees	Contractors	Total
Above 150	0	0	0	0	0	0	0	0	0
100-150	0	0	0	0	0	0	0	0	0
75-100	0	0	0	0	0	0	0	0	0
50-75	0	0	0	0	0	0	0	0	0
20-50	0	0	0	0	0	0	0	0	0
10-20	0	23	23	0	4	4	0	0	0
5-10	0	56	56	0	62	62	0	33	33
1-5	17	781	798	19	774	793	19	657	676
1 or less	916	5159	6075	898	5227	6125	806	4663	5469
Total	933	6019	6952	917	6067	6984	825	5353	6178
Maximum (mSv)	2.96	14.10	14.10	3.98	14.50	14.50	3.37	9.82	9.82
Average (mSv)	0.11	0.53	0.47	0.13	0.50	0.45	0.11	0.40	0.36

・The values of the exposure dose and the number of the workers in the table above are subject to change, because there are cases that APD data are replaced with monthly dose data measured by integral dosimeters. Or the dose data of workers who wore only an integral dosimeter (ex., workers who entered only the Seismic Isolation Building) need to be updated in the table after the publication of the data.

・Equivalent dose is a measure of the radiation dose to organs and tissues, and the equivalent dose limit to the lens of the eye is 150mSv/year (the emergency exposure dose limit is 300mSv).

・The equivalent dose to the lens of the eyes is measured at an appropriate depth of 1 centimeter or 70 micrometers from the skin surface using one of the following method:

① The case of using dosimeter put inside full face mask

② The case of using dosimeter put around the chest, the abdomen or the head and neck (excluding the case of ①)

5. Cumulative Equivalent Dose

Table 7 and Table 8 show the distribution of cumulative equivalent dose to the skins and the lens of the eyes of the workers, respectively, who were involved in radiation work at the Fukushima Daiichi Nuclear Power Station from April 1, 2020 to April 30, 2020.

Table 7. Equivalent Dose to the Skin

Dose Ranges (mSv)	April 2020		
	TEPCO Employees	Contractors	Total
Above 500	0	0	0
300-500	0	0	0
250-300	0	0	0
200-250	0	0	0
150-200	0	0	0
100-150	0	0	0
75-100	0	0	0
50-75	0	0	0
20-50	0	0	0
10-20	0	0	0
5-10	0	33	33
1-5	19	657	676
1 or less	806	4663	5469
Total	825	5353	6178
Maximum (mSv)	3.37	9.82	9.82
Average (mSv)	0.11	0.40	0.36

・The values of the exposure dose and the number of the workers in the table above are subject to change, because there are cases that APD data are replaced with monthly dose data measured by integral dosimeters. Or the dose data of workers who wore only an integral dosimeter (ex., workers who entered only the Seismic Isolation Building) need to be updated in the table after the publication of the data.

・Equivalent dose is a measure of the radiation dose to organs and tissues, and the equivalent dose limit to the skin is 500mSv/year (the emergency exposure dose limit is 1Sv).

・Equivalent dose to the skin is measured at a depth of 70 micrometers from the skin surface. When the equivalent dose is measured with a dosimeter other than the one put on around the chest and the abdomen, for example, a finger dosimeter, the maximum measurement value is counted as the equivalent dose.

Table 8. Equivalent Dose to the Lens of the Eyes (Including inside of full-face mask)

Dose Ranges (mSv)	April 2020		
	TEPCO Employees	Contractors	Total
Above 150	0	0	0
100-150	0	0	0
75-100	0	0	0
50-75	0	0	0
20-50	0	0	0
10-20	0	0	0
5-10	0	33	33
1-5	19	657	676
1 or less	806	4663	5469
Total	825	5353	6178
Maximum (mSv)	3.37	9.82	9.82
Average (mSv)	0.11	0.40	0.36

・The values of the exposure dose and the number of the workers in the table above are subject to change, because there are cases that APD data are replaced with monthly dose data measured by integral dosimeters. Or the dose data of workers who wore only an integral dosimeter (ex., workers who entered only the Seismic Isolation Building) need to be updated in the table after the publication of the data.

・Equivalent dose is a measure of the radiation dose to organs and tissues, and the equivalent dose limit to the lens of eyes is 150mSv/year (the emergency exposure dose limit is 300mSv).

・The equivalent dose to the lens of the eyes is measured at an appropriate depth of 1 centimeter or 70 micrometers from the skin surface using one of the following method:

① The case of using dosimeter put inside full face mask

② The case of using dosimeter put around the chest, the abdomen or the head and neck (excluding the case of ①)