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 January 2021. 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 January was 6.72 mSv, 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)	November 2020			December 2020			January 2021		
	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	2	2	0	0	0	0	0	0
5-10	0	48	48	0	26	26	0	13	13
1-5	25	579	604	36	485	521	20	544	564
1 or less	1039	5056	6095	975	5242	6217	885	5226	6111
Total	1064	5685	6749	1011	5753	6764	905	5783	6688
Maximum (mSv)	4.84	11.00	11.00	2.29	9.00	9.00	2.53	6.72	6.72
Average (mSv)	0.12	0.42	0.37	0.13	0.33	0.30	0.11	0.33	0.30

・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 2020. Two different periods of time are shown in the Table 2: from April 1, 2016 to December 31, 2020 and from April 1, 2016 to January 31, 2021, and Table 3: from April 1, 2020 to December 31, 2020 and from April 1, 2020 to January 31, 2021 for comparison.

Table 2. Cumulative Exposure Dose for Five Years

Dose Ranges (mSv)	April 2016 - December 2020			April 2016 - January 2021			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	49	49	0	51	51	0	2	2
50-75	2	314	316	2	321	323	0	7	7
20-50	83	1973	2056	86	1998	2084	3	25	28
10-20	151	2411	2562	151	2431	2582	0	20	20
5-10	198	2490	2688	197	2493	2690	-1	3	2
1-5	610	4680	5290	614	4711	5325	4	31	35
1 or less	1400	10141	11541	1397	10254	11651	-3	113	110
Total	2444	22058	24502	2447	22259	24706	3	201	204
Maximum (mSv)	58.07	87.50	87.50	58.72	87.83	87.83	-	-	-
Average (mSv)	3.14	6.81	6.44	3.18	6.84	6.47	-	-	-

・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 - December 2020			April 2020 - January 2021			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	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	5	517	522	5	628	633	0	111	111
5-10	32	854	886	43	858	901	11	4	15
1-5	226	1889	2115	225	2073	2298	-1	184	183
1 or less	1049	4919	5968	1044	4955	5999	-5	36	31
Total	1312	8179	9491	1317	8514	9831	5	335	340
Maximum (mSv)	12.98	19.31	19.31	13.27	19.31	19.31	-	-	-
Average (mSv)	0.71	2.29	2.07	0.78	2.43	2.21	-	-	-

・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)	November 2020			December 2020			January 2021		
	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	0	0	0	0	0	0	0	0
20-50	0	1	1	0	0	0	0	0	0
10-20	0	15	15	0	4	4	0	0	0
5-10	0	67	67	0	36	36	0	19	19
1-5	26	648	674	37	608	645	20	630	650
1 or less	1038	4954	5992	974	5105	6079	885	5134	6019
Total	1064	5685	6749	1011	5753	6764	905	5783	6688
Maximum (mSv)	4.89	25.80	25.80	2.35	17.10	17.10	2.53	7.92	7.92
Average (mSv)	0.12	0.51	0.45	0.14	0.40	0.36	0.12	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 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)	November 2020			December 2020			January 2021		
	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	2	2	0	0	0	0	0	0
5-10	0	52	52	0	27	27	0	19	19
1-5	26	595	621	38	500	538	20	630	650
1 or less	1038	5036	6074	973	5226	6199	885	5134	6019
Total	1064	5685	6749	1011	5753	6764	905	5783	6688
Maximum (mSv)	4.84	11.00	11.00	2.29	9.00	9.00	2.53	7.92	7.92
Average (mSv)	0.12	0.43	0.38	0.13	0.34	0.31	0.12	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 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 during two different periods of time, from April 1, 2020 to December 31, 2020 and from April 1, 2020 to January 31, 2021 for comparison.

Table 7. Equivalent Dose to the Skin

Dose Ranges (mSv)	April 2020 - December 2020			April 2020 - January 2021			Difference		
	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	4	4	0	5	5	0	1	1
20-50	0	34	34	0	43	43	0	9	9
10-20	5	625	630	5	734	739	0	109	109
5-10	33	852	885	47	871	918	14	19	33
1-5	230	1907	2137	227	2049	2276	-3	142	139
1 or less	1044	4757	5801	1038	4812	5850	-6	55	49
Total	1312	8179	9491	1317	8514	9831	5	335	340
Maximum (mSv)	13.26	61.04	61.04	13.91	66.58	66.58	-	-	-
Average (mSv)	0.73	2.65	2.39	0.81	2.80	2.54	-	-	-

・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 - December 2020			April 2020 - January 2021			Difference		
	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	5	547	552	5	666	671	0	119	119
5-10	29	853	882	42	873	915	13	20	33
1-5	232	1932	2164	229	2103	2332	-3	171	168
1 or less	1046	4847	5893	1041	4872	5913	-5	25	20
Total	1312	8179	9491	1317	8514	9831	5	335	340
Maximum (mSv)	13.26	20.00	20.00	13.91	20.00	20.00	-	-	-
Average (mSv)	0.72	2.36	2.13	0.79	2.52	2.29	-	-	-

・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)