

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 July 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 July was 8.17 mSv, and regarding the internal exposure dose, no significant value was measured.

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)	May 2020			June 2020			July 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	0	0	0	0	0	0	0	0
5-10	0	25	25	0	52	52	0	46	46
1-5	9	561	570	18	692	710	15	683	698
1 or less	773	4762	5535	929	4920	5849	958	4948	5906
Total	782	5348	6130	947	5664	6611	973	5677	6650
Maximum (mSv)	1.81	8.80	8.80	3.00	9.30	9.30	2.90	8.17	8.17
Average (mSv)	0.09	0.38	0.34	0.13	0.46	0.41	0.11	0.41	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 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 June 30, 2020 and from April 1, 2016 to July 31, 2020, and Table 3: from April 1, 2020 to June 30, 2020 and from April 1, 2020 to July 31, 2020 for comparison.

Table 2. Cumulative Exposure Dose for Five Years

Dose Ranges (mSv)	April 2016 - June 2020			April 2016 - July 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	23	23	0	25	25	0	2	2
50-75	0	255	255	0	270	270	0	15	15
20-50	72	1839	1911	73	1861	1934	1	22	23
10-20	141	2313	2454	144	2333	2477	3	20	23
5-10	192	2454	2646	192	2447	2639	0	-7	-7
1-5	596	4587	5183	595	4619	5214	-1	32	31
1 or less	1338	9699	11037	1349	9767	11116	11	68	79
Total	2339	21170	23509	2353	21322	23675	14	152	166
Maximum (mSv)	48.64	82.70	82.70	48.84	85.26	85.26	-	-	-
Average (mSv)	3.00	6.53	6.17	3.03	6.59	6.23	-	-	-

• 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 - June 2020			April 2020 - July 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	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	33	33	0	99	99	0	66	66
5-10	0	370	370	5	520	525	5	150	155
1-5	88	1061	1149	117	1248	1365	29	187	216
1 or less	937	4939	5876	968	4935	5903	31	-4	27
Total	1025	6403	7428	1090	6802	7892	65	399	464
Maximum (mSv)	4.96	17.20	17.20	6.78	17.28	17.28	-	-	-
Average (mSv)	0.27	1.04	0.93	0.35	1.32	1.19	-	-	-

• 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)	May 2020			June 2020			July 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	0	0	0	0	0	0	0	0
20-50	0	1	1	0	1	1	0	0	0
10-20	0	1	1	0	5	5	0	0	0
5-10	0	46	46	0	66	66	0	46	46
1-5	9	596	605	19	759	778	16	703	719
1 or less	773	4704	5477	928	4833	5761	957	4928	5885
Total	782	5348	6130	947	5664	6611	973	5677	6650
Maximum (mSv)	2.00	21.80	21.80	3.00	22.70	22.70	2.90	8.17	8.17
Average (mSv)	0.09	0.44	0.39	0.13	0.52	0.47	0.11	0.42	0.37

• 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)	May 2020			June 2020			July 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	1	1	0	0	0	0	0	0
5-10	0	26	26	0	58	58	0	46	46
1-5	9	564	573	18	699	717	16	703	719
1 or less	773	4757	5530	929	4907	5836	957	4928	5885
Total	782	5348	6130	947	5664	6611	973	5677	6650
Maximum (mSv)	1.81	14.40	14.40	3.00	9.30	9.30	2.90	8.17	8.17
Average (mSv)	0.09	0.39	0.35	0.13	0.47	0.42	0.11	0.42	0.37

• 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 June 30, 2020 and from April 1, 2020 to July 31, 2020 for comparison.

Table 7. Equivalent Dose to the Skin

Dose Ranges (mSv)	April 2020 - June 2020			April 2020 - July 2020			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	0	0	0	0	0	0	0	0
20-50	0	4	4	0	4	4	0	0	0
10-20	0	79	79	0	160	160	0	81	81
5-10	0	393	393	5	525	530	5	132	137
1-5	92	1127	1219	121	1321	1442	29	194	223
1 or less	933	4800	5733	964	4792	5756	31	-8	23
Total	1025	6403	7428	1090	6802	7892	65	399	464
Maximum (mSv)	4.96	31.30	31.30	6.78	31.90	31.90	-	-	-
Average (mSv)	0.28	1.20	1.08	0.36	1.48	1.33	-	-	-

• 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 - June 2020			April 2020 - July 2020			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	0	40	40	0	114	114	0	74	74
5-10	0	379	379	5	520	525	5	141	146
1-5	91	1086	1177	121	1295	1416	30	209	239
1 or less	934	4898	5832	964	4873	5837	30	-25	5
Total	1025	6403	7428	1090	6802	7892	65	399	464
Maximum (mSv)	4.96	17.20	17.20	6.78	17.28	17.28	-	-	-
Average (mSv)	0.27	1.07	0.96	0.35	1.36	1.22	-	-	-

• 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)