

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 May 2023. 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 May was 9.89 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 months.

Table 1. External Exposure Dose

Dose Ranges (mSv)	March 2023			April 2023			May 2023		
	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	4	4	0	1	1	0	0	0
5-10	0	39	39	0	76	76	0	42	42
1-5	19	638	657	18	613	631	9	454	463
1 or less	1062	6139	7201	1034	5797	6831	1019	5961	6980
Total	1081	6820	7901	1052	6487	7539	1028	6457	7485
Maximum (mSv)	3.44	13.42	13.42	3.10	10.10	10.10	3.13	9.89	9.89
Average (mSv)	0.08	0.35	0.32	0.09	0.41	0.36	0.06	0.28	0.25

• 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, 2021. Table 3 shows the distribution of cumulative exposure dose in the fiscal year of 2023. Two different periods of time are shown in the Table 2: from April 1, 2021 to April 30, 2023 and from April 1, 2021 to May 31, 2023, and Table 3: from April 1, 2023 to April 30, 2023 and from April 1, 2023 to May 31, 2023 for comparison.

Table 2. Cumulative Exposure Dose for Five Years

Dose Ranges (mSv)	April 2021 - April 2023			April 2021 - May 2023			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	4	529	533	6	580	586	2	51	53
10-20	48	1392	1440	48	1399	1447	0	7	7
5-10	96	1229	1325	98	1258	1356	2	29	31
1-5	307	2456	2763	311	2439	2750	4	-17	-13
1 or less	1123	6619	7742	1126	6772	7898	3	153	156
Total	1578	12225	13803	1589	12448	14037	11	223	234
Maximum (mSv)	22.12	39.92	39.92	23.64	43.09	43.09	-	-	-
Average (mSv)	1.51	4.11	3.81	1.54	4.18	3.88	-	-	-

• 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 2023

Dose Ranges (mSv)	April 2023			April 2023 - May 2023			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	1	1	0	23	23	0	22	22
5-10	0	76	76	0	184	184	0	108	108
1-5	18	613	631	39	899	938	21	286	307
1 or less	1034	5797	6831	1094	6061	7155	60	264	324
Total	1052	6487	7539	1133	7167	8300	81	680	761
Maximum (mSv)	3.10	10.10	10.10	3.63	14.89	14.89	-	-	-
Average (mSv)	0.09	0.41	0.36	0.13	0.62	0.56	-	-	-

• 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 (100 mSv), 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 0.1 mSv/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 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 eye 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)	March 2023			April 2023			May 2023		
	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	0	0	0	0	0	0	0	0
10-20	0	6	6	0	10	10	0	0	0
5-10	0	64	64	0	88	88	0	43	43
1-5	20	719	739	19	678	697	9	503	512
1 or less	1061	6031	7092	1033	5711	6744	1019	5911	6930
Total	1081	6820	7901	1052	6487	7539	1028	6457	7485
Maximum (mSv)	4.40	13.42	13.42	3.10	16.00	16.00	3.13	9.89	9.89
Average (mSv)	0.09	0.41	0.37	0.09	0.47	0.41	0.06	0.30	0.27

• 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 500 mSv/year (the emergency exposure dose limit is 1 Sv).

• 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, and the maximum measurement value is counted as the equivalent dose.

Table 6. Equivalent Dose to the Lens of the Eye

Dose Ranges (mSv)	March 2023			April 2023			May 2023		
	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	4	4	0	11	11	0	0	0
5-10	0	47	47	0	94	94	0	43	43
1-5	18	651	669	18	613	631	9	503	512
1 or less	1063	6118	7181	1034	5769	6803	1019	5911	6930
Total	1081	6820	7901	1052	6487	7539	1028	6457	7485
Maximum (mSv)	3.44	13.00	13.00	3.10	12.00	12.00	3.13	9.89	9.89
Average (mSv)	0.08	0.37	0.33	0.09	0.44	0.39	0.06	0.30	0.27

• 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 50 mSv/year and 100 mSv/5 years (the emergency exposure dose limit is 300 mSv). The equivalent dose limit to the lens of the eye before April 1, 2021 was 150mSv/year (the emergency exposure dose limit was 300 mSv).

• The equivalent dose to the lens of the eye is measured at a depth of 1 centimeter for neutron ray, 3 millimeters for X-ray, gamma ray and beta ray from the skin surface. However, as for X-ray, gamma ray and beta ray, it is measured at a depth of 1 centimeter or 70 micrometer when deemed appropriate with consideration for radiation type and energy type (since April, 2021).

5. Cumulative Equivalent Dose

Table 7 and Table 8 show the distribution of cumulative equivalent dose to the skins and the lens of the eye 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, 2023 to April 30, 2023 and from April 1, 2023 to May 31, 2023 for comparison.

Table 9 shows the distribution of cumulative exposure dose for five years, starting on April 1, 2021: from April 1, 2021 to April 30, 2023 and from April 1, 2021 to May 31, 2023 for comparison.

Table 7. Equivalent Dose to the Skin

Dose Ranges (mSv)	April 2023			April 2023 - May 2023			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	0	0	0	0	0	0	0	0
10-20	0	10	10	0	40	40	0	30	30
5-10	0	88	88	0	202	202	0	114	114
1-5	19	678	697	41	942	983	22	264	286
1 or less	1033	5711	6744	1092	5983	7075	59	272	331
Total	1052	6487	7539	1133	7167	8300	81	680	761
Maximum (mSv)	3.10	16.00	16.00	3.63	16.40	16.40	-	-	-
Average (mSv)	0.09	0.47	0.41	0.14	0.69	0.61	-	-	-

- 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 500 mSv/year (the emergency exposure dose limit is 1 Sv).

- 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, and the maximum measurement value is counted as the equivalent dose.

Table 8. Equivalent Dose to the Lens of the Eye

Dose Ranges (mSv)	April 2023			April 2023 - May 2023			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	11	11	0	40	40	0	29	29
5-10	0	94	94	0	184	184	0	90	90
1-5	18	613	631	39	926	965	21	313	334
1 or less	1034	5769	6803	1094	6017	7111	60	248	308
Total	1052	6487	7539	1133	7167	8300	81	680	761
Maximum (mSv)	3.10	12.00	12.00	3.63	14.59	14.59	-	-	-
Average (mSv)	0.09	0.44	0.39	0.13	0.67	0.59	-	-	-

• 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 50 mSv/year and 100 mSv/5 years (the emergency exposure dose limit is 300 mSv).

• The equivalent dose to the lens of the eye is measured at a depth of 1 centimeter for neutron ray, 3 millimeters for X-ray, gamma ray and beta ray from the skin surface. However, as for X-ray, gamma ray and beta ray, it is measured at a depth of 1 centimeter or 70 micrometer when deemed appropriate with consideration for radiation type and energy type.

Table 9. Equivalent Dose to the Lens of the Eye: Cumulative Exposure Dose for Five Years

Dose Ranges (mSv)	April 2021 - April 2023			April 2021 - May 2023			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	7	609	616	9	666	675	2	57	59
10-20	44	1373	1417	44	1373	1417	0	0	0
5-10	98	1219	1317	102	1241	1343	4	22	26
1-5	311	2440	2751	313	2433	2746	2	-7	-5
1 or less	1118	6584	7702	1121	6735	7856	3	151	154
Total	1578	12225	13803	1589	12448	14037	11	223	234
Maximum (mSv)	22.21	38.85	38.85	23.64	42.36	42.36	-	-	-
Average (mSv)	1.53	4.24	3.93	1.56	4.32	4.01	-	-	-

• 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 50 mSv/year and 100 mSv/5 years (the emergency exposure dose limit is 300 mSv).

• The equivalent dose to the lens of the eye is measured at a depth of 1 centimeter for neutron ray, 3 millimeters for X-ray, gamma ray and beta ray from the skin surface. However, as for X-ray, gamma ray and beta ray, it is measured at a depth of 1 centimeter or 70 micrometer when deemed appropriate with consideration for radiation type and energy type.