

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 February 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 February was 10.71 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)	December 2022			January 2023			February 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	0	0	0	0	0	0	1	1
5-10	0	32	32	0	13	13	0	27	27
1-5	16	501	517	10	431	441	18	585	603
1 or less	1031	6169	7200	1025	6143	7168	1013	6038	7051
Total	1047	6702	7749	1035	6587	7622	1031	6651	7682
Maximum (mSv)	2.03	9.91	9.91	2.80	9.30	9.30	2.45	10.71	10.71
Average (mSv)	0.09	0.30	0.27	0.07	0.26	0.23	0.08	0.32	0.29

• 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 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 2022. Two different periods of time are shown in the Table 2: from April 1, 2021 to January 31, 2023 and from April 1, 2021 to February 28, 2023, and Table 3: from April 1, 2022 to January 31, 2023 and from April 1, 2022 to February 28, 2023 for comparison.

Table 2. Cumulative Exposure Dose for Five Years

Dose Ranges (mSv)	April 2021 - January 2023			April 2021 - February 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	2	322	324	3	380	383	1	58	59
10-20	40	1314	1354	41	1342	1383	1	28	29
5-10	86	1206	1292	90	1231	1321	4	25	29
1-5	295	2434	2729	300	2441	2741	5	7	12
1 or less	1132	6258	7390	1127	6350	7477	-5	92	87
Total	1555	11534	13089	1561	11744	13305	6	210	216
Maximum (mSv)	21.22	33.09	33.09	21.26	33.62	33.62	-	-	-
Average (mSv)	1.36	3.73	3.45	1.41	3.84	3.56	-	-	-

• 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.

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

Table 3. Cumulative Exposure Dose in the Fiscal Year of 2022

Dose Ranges (mSv)	April 2022 - January 2023			April 2022 - February 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	4	411	415	5	528	533	1	117	118
5-10	36	964	1000	44	1000	1044	8	36	44
1-5	209	2127	2336	212	2206	2418	3	79	82
1 or less	1142	5877	7019	1137	5889	7026	-5	12	7
Total	1391	9379	10770	1398	9623	11021	7	244	251
Maximum (mSv)	11.84	17.60	17.60	11.84	17.60	17.60	-	-	-
Average (mSv)	0.69	2.00	1.83	0.74	2.16	1.98	-	-	-

• 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)	December 2022			January 2023			February 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	2	2	0	0	0	0	0	0
10-20	0	3	3	0	3	3	0	1	1
5-10	1	38	39	0	36	36	0	33	33
1-5	18	581	599	10	509	519	18	634	652
1 or less	1028	6078	7106	1025	6039	7064	1013	5983	6996
Total	1047	6702	7749	1035	6587	7622	1031	6651	7682
Maximum (mSv)	5.90	25.40	25.40	3.60	16.20	16.20	2.45	10.71	10.71
Average (mSv)	0.10	0.35	0.32	0.07	0.32	0.28	0.08	0.34	0.31

• 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)	December 2022			January 2023			February 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	0	0	0	0	0	0	1	1
5-10	0	34	34	0	15	15	0	30	30
1-5	16	506	522	6	431	437	18	627	645
1 or less	1031	6162	7193	1029	6141	7170	1013	5993	7006
Total	1047	6702	7749	1035	6587	7622	1031	6651	7682
Maximum (mSv)	2.03	10.00	10.00	2.90	8.70	8.70	2.45	10.71	10.71
Average (mSv)	0.09	0.30	0.27	0.07	0.27	0.24	0.08	0.34	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 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, 2022 to January 31, 2023 and from April 1, 2022 to February 28, 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 January 31, 2023 and from April 1, 2021 to February 28, 2023 for comparison.

Table 7. Equivalent Dose to the Skin

Dose Ranges (mSv)	April 2022 - January 2023			April 2022 - February 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	2	2	0	3	3	0	1	1
20-50	0	41	41	0	46	46	0	5	5
10-20	5	579	584	6	723	729	1	144	145
5-10	41	956	997	49	947	996	8	-9	-1
1-5	213	2055	2268	217	2137	2354	4	82	86
1 or less	1132	5746	6878	1126	5767	6893	-6	21	15
Total	1391	9379	10770	1398	9623	11021	7	244	251
Maximum (mSv)	13.91	62.50	62.50	13.91	62.50	62.50	-	-	-
Average (mSv)	0.73	2.35	2.14	0.78	2.53	2.31	-	-	-

- 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 2022 - January 2023			April 2022 - February 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	4	470	474	5	619	624	1	149	150
5-10	38	944	982	45	957	1002	7	13	20
1-5	212	2106	2318	216	2198	2414	4	92	96
1 or less	1137	5859	6996	1132	5849	6981	-5	-10	-15
Total	1391	9379	10770	1398	9623	11021	7	244	251
Maximum (mSv)	11.84	19.00	19.00	11.84	19.00	19.00	-	-	-
Average (mSv)	0.69	2.05	1.88	0.75	2.23	2.05	-	-	-

• 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 - January 2023			April 2021 - February 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	2	398	400	3	465	468	1	67	68
10-20	42	1296	1338	44	1313	1357	2	17	19
5-10	85	1193	1278	88	1226	1314	3	33	36
1-5	301	2415	2716	305	2425	2730	4	10	14
1 or less	1125	6232	7357	1121	6315	7436	-4	83	79
Total	1555	11534	13089	1561	11744	13305	6	210	216
Maximum (mSv)	21.22	32.60	32.60	21.26	33.04	33.04	-	-	-
Average (mSv)	1.38	3.84	3.55	1.43	3.96	3.66	-	-	-

• 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.