

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 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 January was 8.82 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)	November 2022			December 2022			January 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	1	1	0	0	0	0	0	0
5-10	0	34	34	0	32	32	0	14	14
1-5	14	585	599	16	501	517	10	448	458
1 or less	1040	6091	7131	1031	6169	7200	1010	6125	7135
Total	1054	6711	7765	1047	6702	7749	1020	6587	7607
Maximum (mSv)	2.44	11.76	11.76	2.03	9.91	9.91	2.67	8.82	8.82
Average (mSv)	0.09	0.35	0.32	0.09	0.30	0.27	0.06	0.25	0.23

• 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.

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 December 31, 2022 and from April 1, 2021 to January 31, 2023, and Table 3: from April 1, 2022 to December 31, 2022 and from April 1, 2022 to January 31, 2023 for comparison.

Table 2. Cumulative Exposure Dose for Five Years

Dose Ranges (mSv)	April 2021 - December 2022			April 2021 - January 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	296	298	2	323	325	0	27	27
10-20	38	1267	1305	40	1312	1352	2	45	47
5-10	87	1187	1274	86	1204	1290	-1	17	16
1-5	288	2420	2708	295	2435	2730	7	15	22
1 or less	1132	6143	7275	1132	6260	7392	0	117	117
Total	1547	11313	12860	1555	11534	13089	8	221	229
Maximum (mSv)	21.12	32.86	32.86	21.17	33.09	33.09	-	-	-
Average (mSv)	1.32	3.65	3.37	1.36	3.73	3.44	-	-	-

• 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 - December 2022			April 2022 - January 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	331	335	4	414	418	0	83	83
5-10	31	900	931	36	965	1001	5	65	70
1-5	202	2071	2273	208	2124	2332	6	53	59
1 or less	1142	5816	6958	1143	5876	7019	1	60	61
Total	1379	9118	10497	1391	9379	10770	12	261	273
Maximum (mSv)	11.74	17.60	17.60	11.77	17.60	17.60	-	-	-
Average (mSv)	0.64	1.86	1.70	0.68	1.99	1.82	-	-	-

• 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)	November 2022			December 2022			January 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	1	1	0	2	2	0	0	0
10-20	0	12	12	0	3	3	0	0	0
5-10	1	48	49	1	38	39	0	23	23
1-5	16	659	675	18	581	599	10	486	496
1 or less	1037	5991	7028	1028	6078	7106	1010	6078	7088
Total	1054	6711	7765	1047	6702	7749	1020	6587	7607
Maximum (mSv)	8.00	20.10	20.10	5.90	25.40	25.40	2.67	8.82	8.82
Average (mSv)	0.10	0.42	0.38	0.10	0.35	0.32	0.06	0.27	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 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)	November 2022			December 2022			January 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	1	1	0	0	0	0	0	0
5-10	0	30	30	0	34	34	0	17	17
1-5	13	603	616	16	506	522	10	480	490
1 or less	1041	6077	7118	1031	6162	7193	1010	6090	7100
Total	1054	6711	7765	1047	6702	7749	1020	6587	7607
Maximum (mSv)	2.44	12.20	12.20	2.03	10.00	10.00	2.67	8.82	8.82
Average (mSv)	0.09	0.36	0.32	0.09	0.30	0.27	0.06	0.27	0.24

• 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 December 31, 2022 and from April 1, 2022 to January 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 December 31, 2022 and from April 1, 2021 to January 31, 2023 for comparison.

Table 7. Equivalent Dose to the Skin

Dose Ranges (mSv)	April 2022 - December 2022			April 2022 - January 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	2	2	0	0	0
20-50	0	30	30	0	36	36	0	6	6
10-20	5	504	509	5	578	583	0	74	74
5-10	37	896	933	40	948	988	3	52	55
1-5	209	2004	2213	213	2059	2272	4	55	59
1 or less	1128	5682	6810	1133	5756	6889	5	74	79
Total	1379	9118	10497	1391	9379	10770	12	261	273
Maximum (mSv)	13.91	62.50	62.50	13.91	62.50	62.50	-	-	-
Average (mSv)	0.68	2.19	1.99	0.72	2.32	2.11	-	-	-

- 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 - December 2022			April 2022 - January 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	393	397	4	474	478	0	81	81
5-10	32	889	921	37	953	990	5	64	69
1-5	206	2035	2241	211	2098	2309	5	63	68
1 or less	1137	5801	6938	1139	5854	6993	2	53	55
Total	1379	9118	10497	1391	9379	10770	12	261	273
Maximum (mSv)	11.74	19.00	19.00	11.77	19.00	19.00	-	-	-
Average (mSv)	0.65	1.92	1.75	0.69	2.05	1.88	-	-	-

• 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 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 - December 2022			April 2021 - January 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	359	361	2	394	396	0	35	35
10-20	39	1265	1304	42	1305	1347	3	40	43
5-10	87	1164	1251	85	1195	1280	-2	31	29
1-5	294	2407	2701	301	2411	2712	7	4	11
1 or less	1125	6118	7243	1125	6229	7354	0	111	111
Total	1547	11313	12860	1555	11534	13089	8	221	229
Maximum (mSv)	21.12	32.46	32.46	21.17	32.55	32.55	-	-	-
Average (mSv)	1.34	3.76	3.47	1.38	3.84	3.55	-	-	-

• 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.