

Evaluation of the exposure dose of workers engaged in radiation work at  
the Fukushima Daiichi Nuclear Power Station

September 30, 2019

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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 August 2019. Here is part of the report: the maximum value of the exposure dose among the workers who engaged in the work at the power station in August was 7.60mSv, 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)	June 2019			July 2019			August 2019		
	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	1	12	13	0	10	10	0	4	4
1-5	17	538	555	19	547	566	12	467	479
1 or less	1016	4993	6009	964	5048	6012	1005	5037	6042
Total	1034	5543	6577	983	5605	6588	1017	5508	6525
Maximum (mSv)	5.20	7.11	7.11	3.60	9.70	9.70	2.75	7.60	7.60
Average (mSv)	0.12	0.35	0.31	0.13	0.35	0.32	0.09	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, 2016. Table 3 shows the distribution of cumulative exposure dose in the fiscal year of 2019. Two different periods of time are shown in the Table 2: from April 1, 2016 to July 31, 2019 and from April 1, 2016 to August 31, 2019, and Table 3: from April 1, 2019 to July 31, 2019 and from April 1, 2019 to August 31, 2019 for comparison.

**Table 2. Cumulative Exposure Dose for Five Years**

Dose Ranges (mSv)	April 2016 - July 2019			April 2016 - August 2019			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	7	7	0	9	9	0	2	2
50-75	0	112	112	0	126	126	0	14	14
20-50	41	1509	1550	45	1518	1563	4	9	13
10-20	138	2106	2244	135	2127	2262	-3	21	18
5-10	171	2224	2395	175	2228	2403	4	4	8
1-5	560	4485	5045	560	4507	5067	0	22	22
1 or less	1307	8801	10108	1324	8850	10174	17	49	66
Total	2217	19244	21461	2239	19365	21604	22	121	143
Maximum (mSv)	38.14	79.90	79.90	39.17	79.90	79.90	-	-	-
Average (mSv)	2.66	5.88	5.54	2.68	5.92	5.58	-	-	-

• 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 2018**

Dose Ranges (mSv)	April 2019 - July 2019			April 2019 - August 2019			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	52	52	1	80	81	1	28	29
5-10	10	332	342	13	445	458	3	113	116
1-5	144	1425	1569	173	1599	1772	29	174	203
1 or less	1093	5062	6155	1102	5044	6146	9	-18	-9
Total	1247	6871	8118	1289	7168	8457	42	297	339
Maximum (mSv)	9.30	18.30	18.30	10.85	18.30	18.30	-	-	-
Average (mSv)	0.41	1.08	0.98	0.47	1.25	1.13	-	-	-

• 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)	June 2019			July 2019			August 2019		
	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	3	3	0	4	4	0	0	0
5-10	1	47	48	2	24	26	0	13	13
1-5	18	656	674	20	678	698	12	503	515
1 or less	1015	4837	5852	961	4899	5860	1005	4992	5997
Total	1034	5543	6577	983	5605	6588	1017	5508	6525
Maximum (mSv)	5.20	11.80	11.80	7.70	12.30	12.30	2.75	9.68	9.68
Average (mSv)	0.13	0.46	0.41	0.15	0.44	0.40	0.09	0.31	0.28

• 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)	June 2019			July 2019			August 2019		
	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	3	3	0	0	0
5-10	1	21	22	2	16	18	0	13	13
1-5	18	568	586	20	580	600	12	503	515
1 or less	1015	4953	5968	961	5006	5967	1005	4992	5997
Total	1034	5543	6577	983	5605	6588	1017	5508	6525
Maximum (mSv)	5.20	10.60	10.60	7.70	12.30	12.30	2.75	9.68	9.68
Average (mSv)	0.13	0.38	0.34	0.15	0.38	0.35	0.09	0.31	0.28

• 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, 2019 to July 31, 2019 and from April 1, 2019 to August 31, 2019 for comparison.

**Table 7. Equivalent Dose to the Skin**

Dose Ranges (mSv)	April 2019 - July 2019			April 2019 - August 2019			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	6	6	0	10	10	0	4	4
10-20	1	133	134	2	172	174	1	39	40
5-10	10	413	423	13	520	533	3	107	110
1-5	152	1503	1655	178	1635	1813	26	132	158
1 or less	1084	4816	5900	1096	4831	5927	12	15	27
Total	1247	6871	8118	1289	7168	8457	42	297	339
Maximum (mSv)	13.17	23.70	23.70	13.17	24.49	24.49	-	-	-
Average (mSv)	0.44	1.37	1.22	0.50	1.55	1.39	-	-	-

- 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 2019 - July 2019			April 2019 - August 2019			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	3	3	0	5	5	0	2	2
10-20	1	78	79	2	105	107	1	27	28
5-10	10	334	344	13	473	486	3	139	142
1-5	148	1506	1654	176	1665	1841	28	159	187
1 or less	1088	4950	6038	1098	4920	6018	10	-30	-20
Total	1247	6871	8118	1289	7168	8457	42	297	339
Maximum (mSv)	12.97	22.10	22.10	12.97	23.69	23.69	-	-	-
Average (mSv)	0.43	1.16	1.05	0.49	1.35	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 )