

**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 April 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 April was 6.82mSv, 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)	February 2019			March 2019			April 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	2	2	0	1	1	0	0	0
5-10	1	58	59	1	32	33	0	6	6
1-5	28	676	704	34	613	647	23	489	512
1 or less	974	5575	6549	960	5532	6492	898	4778	5676
Total	1003	6311	7314	995	6178	7173	921	5273	6194
Maximum (mSv)	5.38	12.60	12.60	5.70	11.41	11.41	2.66	6.82	6.82
Average (mSv)	0.15	0.44	0.40	0.16	0.39	0.35	0.14	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 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 March 31, 2019 and from April 1, 2016 to April 30, 2019, and Table 3: from April 1, 2019 to April 30, 2019.

Table 2. Cumulative Exposure Dose for Five Years

Dose Ranges (mSv)	April 2016 - March 2019			April 2016 - April 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	6	6	0	6	6	0	0	0
50-75	0	81	81	0	90	90	0	9	9
20-50	35	1377	1412	36	1417	1453	1	40	41
10-20	129	2068	2197	132	2068	2200	3	0	3
5-10	172	2185	2357	170	2188	2358	-2	3	1
1-5	534	4445	4979	540	4450	4990	6	5	11
1 or less	1238	8513	9751	1251	8569	9820	13	56	69
Total	2108	18675	20783	2129	18788	20917	21	113	134
Maximum (mSv)	35.21	79.90	79.90	35.80	79.90	79.90	-	-	-
Average (mSv)	2.55	5.66	5.34	2.59	5.71	5.39	-	-	-

- 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 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 2019

Dose Ranges (mSv)	April 2019		
	TEPCO Employees	Contractors	Total
Above 100	0	0	0
75-100	0	0	0
50-75	0	0	0
20-50	0	0	0
10-20	0	0	0
5-10	0	6	6
1-5	23	489	512
1 or less	898	4778	5676
Total	921	5273	6194
Maximum (mSv)	2.66	6.82	6.82
Average (mSv)	0.14	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 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)	February 2019			March 2019			April 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	3	3	0	0	0	0	0	0
10-20	0	16	16	0	14	14	0	0	0
5-10	1	106	107	1	65	66	0	10	10
1-5	35	825	860	39	763	802	23	549	572
1 or less	967	5361	6328	955	5336	6291	898	4714	5612
Total	1003	6311	7314	995	6178	7173	921	5273	6194
Maximum (mSv)	5.38	33.30	33.30	6.80	14.30	14.30	2.66	6.82	6.82
Average (mSv)	0.16	0.60	0.54	0.17	0.51	0.46	0.14	0.35	0.32

- 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)	February 2019			March 2019			April 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	2	2	0	3	3	0	0	0
5-10	1	67	68	1	47	48	0	10	10
1-5	34	736	770	34	634	668	23	549	572
1 or less	968	5506	6474	960	5494	6454	898	4714	5612
Total	1003	6311	7314	995	6178	7173	921	5273	6194
Maximum (mSv)	5.38	14.40	14.40	6.80	11.41	11.41	2.66	6.82	6.82
Average (mSv)	0.15	0.48	0.43	0.16	0.42	0.38	0.14	0.35	0.32

- 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 April 1, 2019 to April 30, 2019.

Table 7. Equivalent Dose to the Skin

Dose Ranges (mSv)	April 2019		
	TEPCO Employees	Contractors	Total
Above 500	0	0	0
300-500	0	0	0
250-300	0	0	0
200-250	0	0	0
150-200	0	0	0
100-150	0	0	0
75-100	0	0	0
50-75	0	0	0
20-50	0	0	0
10-20	0	0	0
5-10	0	10	10
1-5	23	549	572
1 or less	898	4714	5612
Total	921	5273	6194
Maximum (mSv)	2.66	6.82	6.82
Average (mSv)	0.14	0.35	0.32

- 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		
	TEPCO Employees	Contractors	Total
Above 150	0	0	0
100-150	0	0	0
75-100	0	0	0
50-75	0	0	0
20-50	0	0	0
10-20	0	0	0
5-10	0	10	10
1-5	23	549	572
1 or less	898	4714	5612
Total	921	5273	6194
Maximum (mSv)	2.66	6.82	6.82
Average (mSv)	0.14	0.35	0.32

- 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)