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 2021. 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 April was 5.99 mSv, and regarding the internal exposure dose, no significant value was measured.

Attachment

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 2021			March 2021			April 2021		
	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	0	0	0	0	0
5-10	1	45	46	0	55	55	0	7	7
1-5	21	517	538	40	654	694	25	379	404
1 or less	909	5328	6237	957	5032	5989	944	4587	5531
Total	931	5892	6823	997	5741	6738	969	4973	5942
Maximum (mSv)	6.10	12.40	12.40	3.42	8.90	8.90	2.19	5.99	5.99
Average (mSv)	0.13	0.39	0.36	0.16	0.44	0.40	0.11	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 2021. Table 2: from April 1, 2021 to April 30, 2021, and Table 3: from April 1, 2021 to April 30, 2021.

Table 2. Cumulative Exposure Dose for Five Years

Dose Ranges (mSv)	April 2021		
	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	7	7
1-5	25	379	404
1 or less	944	4587	5531
Total	969	4973	5942
Maximum (mSv)	2.19	5.99	5.99
Average (mSv)	0.11	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.

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

Table 3. Cumulative Exposure Dose in the Fiscal Year of 2021

Dose Ranges (mSv)	April 2021		
	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	7	7
1-5	25	379	404
1 or less	944	4587	5531
Total	969	4973	5942
Maximum (mSv)	2.19	5.99	5.99
Average (mSv)	0.11	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.

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 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 2021			March 2021			April 2021		
	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	11	11	0	10	10	0	0	0
5-10	1	72	73	0	81	81	0	16	16
1-5	22	614	636	43	727	770	26	407	433
1 or less	908	5195	6103	954	4923	5877	943	4550	5493
Total	931	5892	6823	997	5741	6738	969	4973	5942
Maximum (mSv)	6.10	19.90	19.90	3.42	16.30	16.30	2.19	8.16	8.16
Average (mSv)	0.13	0.49	0.44	0.17	0.54	0.48	0.11	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 Eyes

Dose Ranges (mSv)	February 2021			March 2021			April 2021		
	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	1	1	0	0	0
5-10	1	48	49	0	61	61	0	16	16
1-5	22	535	557	42	659	701	26	407	433
1 or less	908	5307	6215	955	5020	5975	943	4550	5493
Total	931	5892	6823	997	5741	6738	969	4973	5942
Maximum (mSv)	6.10	14.50	14.50	3.42	10.50	10.50	2.19	8.16	8.16
Average (mSv)	0.13	0.41	0.37	0.16	0.46	0.42	0.11	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 is 300 mSv).

・The equivalent dose to the lens of the eyes is measured at depth of 1 centimeter for neutron, 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 depth of 1 centimeter or 70 micrometer when deemed appropriate with consideration for radiation type and energy type (since April, 2021).

・The equivalent dose to the lens of the eyes was measured at an appropriate depth of 1 centimeter or 70 micrometers from the skin surface using one of the following method (until March, 2021):

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 from April 1, 2021 to April 30, 2021.

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

Table 7. Equivalent Dose to the Skin

Dose Ranges (mSv)	April 2021		
	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	16	16
1-5	26	407	433
1 or less	943	4550	5493
Total	969	4973	5942
Maximum (mSv)	2.19	8.16	8.16
Average (mSv)	0.11	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 8. Equivalent Dose to the Lens of the Eyes

Dose Ranges (mSv)	April 2021		
	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	16	16
1-5	26	407	433
1 or less	943	4550	5493
Total	969	4973	5942
Maximum (mSv)	2.19	8.16	8.16
Average (mSv)	0.11	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 to the lens of the eyes is measured at depth of 1 centimeter for neutron, 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 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 Eyes: Cumulative Exposure Dose for Five Years

Dose Ranges (mSv)	April 2021		
	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	16	16
1-5	26	407	433
1 or less	943	4550	5493
Total	969	4973	5942
Maximum (mSv)	2.19	8.16	8.16
Average (mSv)	0.11	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 to the lens of the eyes is measured at depth of 1 centimeter for neutron, 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 depth of 1 centimeter or 70 micrometer when deemed appropriate with consideration for radiation type and energy type.