Radiation Dose Statistics for Nuclear Workers in FY 2020

Radiation Dose Registration Center

1. Publication of radiation dose statistics

The Radiation Dose Registration Center (RADREC) of the Radiation Effects Association assigns a unique registration number for each worker engaged in radiation works at nuclear power plants and nuclear facilities, and these radiation doses are centrally managed by the "Radiation Dose Registration System for Nuclear Workers" (hereinafter refered to as "Nuclear Registration System"). Therefore, even if the worker move from one nuclear facility to other facilities to engage in other radiation work, the Nuclear Registration System enables previous radiation doses of each worker at all work sites accurately.

Using the registered data, the RADREC publishes the statistics for fiscal year (FY, April–March) 2020 that represent the management status of radiation doses for the workers engaged in radiation work at the nuclear sites.

Since the contributions of radiation doses due to decommissioning of Fukushima-Daiichi Nuclear Power Plant operated by Tokyo Electric Power Company was significantly large, radiation management status of the other facilities under normal operation are difficult to understand. Therefore, the statistics excluding Fukushima-Daiichi Power Plant are also published.

As the radiation doses for emergency works due to the accident at Fukushima-Daiichi Nuclear Power Plant after the Great East Japan Earthquake which occurred on March 11, 2011 were not registered in FY 2016, the dose statistics of emergency workers since FY 2017 is not published.

2. List of nuclear licensees registered in Nuclear Registration System

The statistical data were based on the radiation doses registered in Nuclear Registration System by the following nuclear licensees. Names of the work sites are shown in parentheses.

(1) Japan Atomic Energy Agency (Nuclear Science Research Institute, Nuclear Fuel Cycle Engineering Labs, Oarai, Tono, Ningyo-toge, Fugen, Monju, Mutsu)
(2) Japan Nuclear Fuel Ltd. (Enrichment and Disposal Plants, Reprocessing Plant)
(3) Hokkaido Electric Power Co., Inc. (Tomari)
(4) Tohoku Electric Power Co., Inc. (Onagawa, Higashidori)
(5) Tokyo Electric Power Co.Holdings, Inc. (Fukushima-Daiichi, Fukushima-Daini, Kashiwazaki-Kariwa)
(6) Chubu Electric Power Co., Inc. (Hamaoka)
(7) Hokuriku Electric Power Co. (Shika)
(8) The Kansai Electric Power Co., Inc. (Mihama, Takahama, Ohi)
(9) The Chugoku Electric Power Co., Inc. (Shimane)

(10) Shikoku Electric Power Co., Inc. (Ikata)

(11) Kyushu Electric Power Co., Inc. (Genkai Sendai)

(12) The Japan Atomic power Company (Tokai, Tokai No2, Tsuruga)

(13) Nuclear Fuel Industries, Ltd. (Kumatori, Tokai)

(14) Sumitomo Metal Mining Co., Ltd. (Tokai)

(15) Global Nuclear Fuel Japan Co., Ltd. (Yokosuka)

(16) Mitsubishi Nuclear Fuel (Tokai)

(17) JCO Co., Ltd. (Tokai)

3. Data compilation method

The statistical data are based on the radiation doses of the workers engaged in radiation work of the nuclear licensees that have registered in the Nuclear Registration System operated by the RADREC.

(1) These statistical data are based on registered data provided by the nuclear licensees as of June 29, 2021

(2) The doses compiled are the effective doses, sum of external and internal exposure.

(3) "Maximum dose," "collective dose," "average dose," and "%" were rounded to one decimal place. Some discrepancy which total percent values are other than 100% may be caused by this procedure.

(4) The age of the workers were based on the time of March 31, 2021.

(5) The "Total number" of radiation workers were compiled based on distinct individuals, so that workers who worked at more than one nuclear site were counted as one.

【Dose Limits for radiation workers】

The statutory dose limits for radiation workers is 100 millisieverts (mSv) over five years and 50 mSv in one year, the dose limit for female workers, excluding those who indicate no pregnancy and those who are pregnant, is 5 mSv per 3 months with the dose limit above. Five-year period refers to the statutory period that started on April 1, 2001 and has been renewed every subsequent five years.

[Definition of terminology]

(1) Radiation Worker: Worker who is designated by nuclear licensees as a radiation worker based on the "Law for the Regulation of Nuclear Source Material, Nuclear Fuel Material, and Reactors "whose core occupation is in radiation control areas, excluding people who enter radiation control areas occasionally.

(2) Exposure doses: Exposure doses of workers engaged in nuclear facilities registered in RADREC are compiled as fiscal year data.

(3) Five-year exposure doses: Exposure doses accumulated in the statutory five-year period to control long-term dose limit. The first period started on April 1, 2001, with exposure doses accumulating every subsequent five years.

(4) Number of work sites in a year: Number of work sites in a year means the number of nuclear sites where workers were engaged in radiation work during the fiscal year when the statistical data

were compiled. The total number of work sites in FY 2020 is 34. Even if the worker was engaged in radiation work at one nuclear site in several times in a year, that counted as one work site.

(5) Number of work sites in five years：Number of work sites in five years means the number of nuclear sites where workers were engaged in radiation works during the period of statistical data compilation (FY 2016 and 2020).

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1. Dose Distribution of Workers by Age {FY 2020}

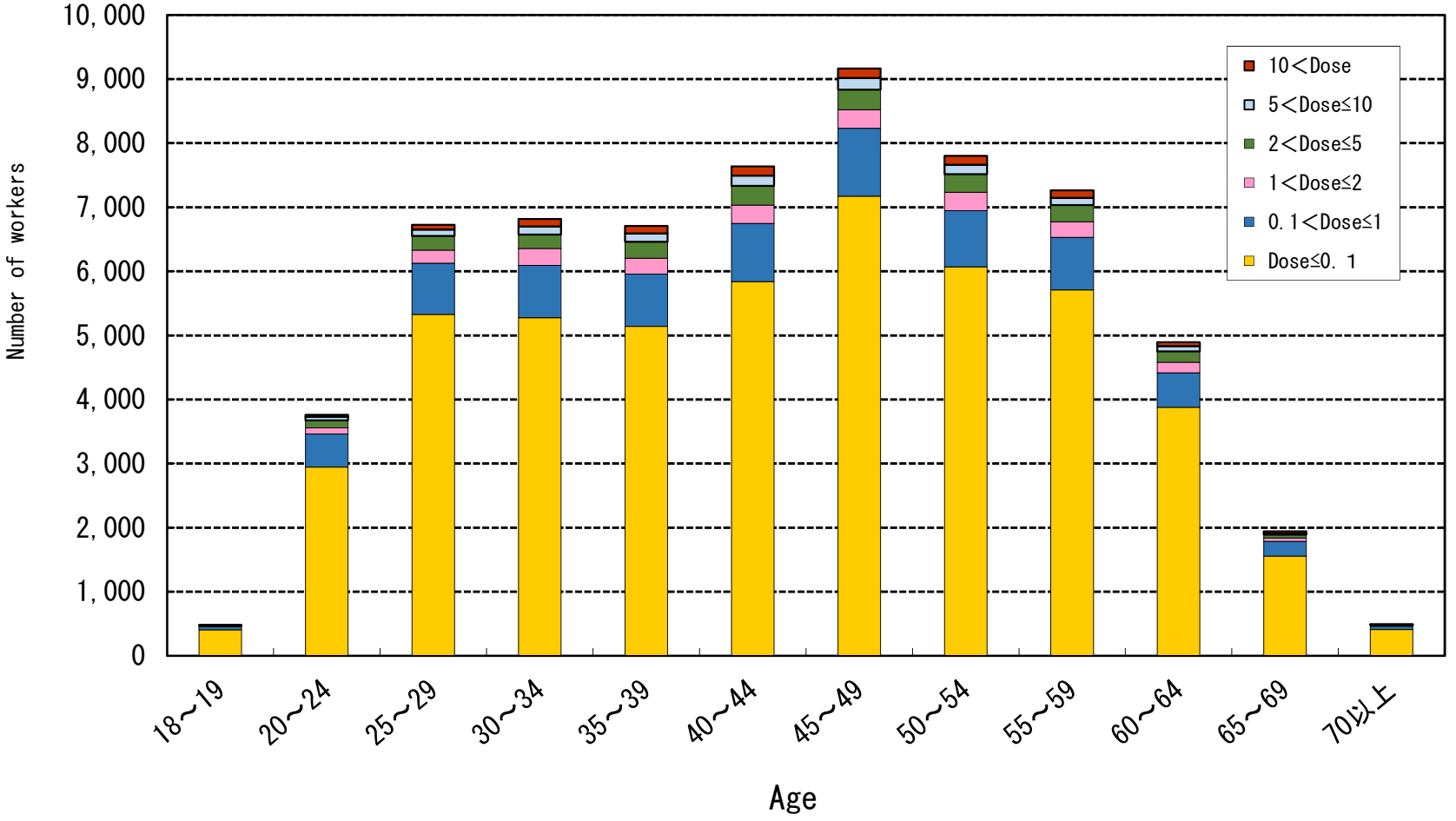
Dose (mSv) / Age	Number of workers									Dose		
	Dose≤0.1	0.1＜Dose ≤1	1＜Dose ≤2	2＜Dose ≤5	5＜Dose ≤10	10＜Dose ≤15	15＜Dose ≤20	20＜ Dose	Total No. of workers (%)	Collective dose (person・mSv)	Mean (mSv)	Max (mSv)
18～19	408	45	11	11	2	0	0	0	477 (0.7)	85.3	0.2	9.7
20～24	2,947	514	97	117	57	24	7	0	3,763 (5.9)	1,575.0	0.4	17.8
25～29	5,330	798	204	218	101	63	13	0	6,727 (10.6)	3,096.4	0.5	18.7
30～34	5,277	817	264	217	123	88	33	0	6,819 (10.7)	3,994.2	0.6	18.7
35～39	5,141	815	251	255	128	86	31	0	6,707 (10.5)	4,073.3	0.6	19.3
40～44	5,840	907	287	300	158	106	38	0	7,636 (12.0)	4,880.0	0.6	19.3
45～49	7,173	1,058	293	309	184	111	36	0	9,164 (14.4)	5,207.5	0.6	19.3
50～54	6,069	877	288	280	151	89	46	0	7,800 (12.2)	4,709.2	0.6	19.1
55～59	5,709	820	245	262	112	78	39	0	7,265 (11.4)	4,005.3	0.6	19.3
60～64	3,879	537	165	171	81	41	19	0	4,893 (7.7)	2,460.2	0.5	19.0
65～69	1,557	231	50	51	18	25	11	0	1,943 (3.1)	978.7	0.5	18.7
70以上	413	50	14	9	1	3	2	0	492 (0.8)	150.3	0.3	18.8
Total No. of workers (%)	49,743 (78.1)	7,469 (11.7)	2,169 (3.4)	2,200 (3.5)	1,116 (1.8)	714 (1.1)	275 (0.4)	0 (0.0)	63,686 (100.0)	—	—	—
Collective Dose (person・mSv)	340.5	3,222.6	3,154.9	7,007.9	8,101.1	8,759.9	4,628.7	0.0	—	35,215.4	0.6	19.3

[Notes]

・ How to read the numbers in table above:The number "204" in the box for the age row of "25～29" and the dose column of "1<Dose≤2" means that there were 204 workers between age 25 and 29 inclusive whose radiation doses were in the range of greater than 1 and less than or equal to 2 millisieverts in FY 2020.

・ The workers' ages are calculated as of March 31, 2021.

2. Dose Distribution of Workers by Age {FY 2020}



* This figure is based on the data in the Table 1 "Dose Distributin of Workers by Age {FY 2020}".

3. Dose Distribution of Workers by Age{FY 2020}

(Excluding the Data for Fukushim-Daiichi Nuclear Power Plant)

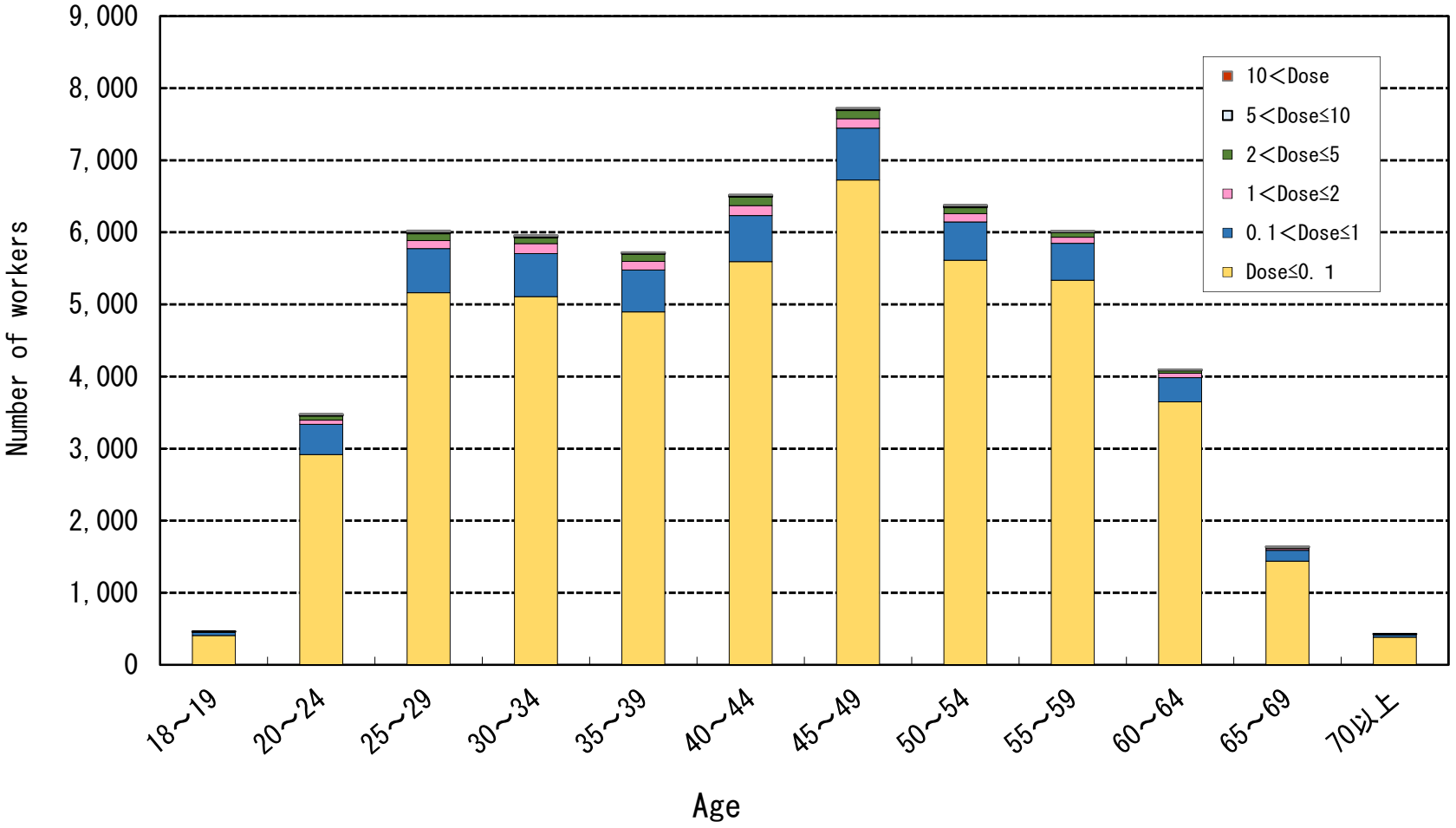
Dose (mSv) / Age	Number of workers										Dose		
	Dose≤0.1	0.1＜Dose ≤1	1＜Dose ≤2	2＜Dose ≤5	5＜Dose ≤10	10＜Dose ≤15	15＜Dose ≤20	20＜ Dose	Total No. of workers	(%)	Collective dose (person・mSv)	Mean (mSv)	Max (mSv)
18～19	407	41	6	5	1	0	0	0	460	(0.8)	53.7	0.1	9.7
20～24	2,917	419	60	62	16	6	0	0	3,480	(6.4)	655.2	0.2	13.4
25～29	5,164	609	114	98	28	10	0	0	6,023	(11.1)	1,053.3	0.2	14.8
30～34	5,110	594	139	86	26	5	1	0	5,961	(10.9)	1,021.1	0.2	15.4
35～39	4,895	583	120	103	21	2	2	0	5,726	(10.5)	958.7	0.2	17.2
40～44	5,595	637	138	125	21	6	1	0	6,523	(12.0)	1,107.4	0.2	15.6
45～49	6,725	719	131	123	22	7	0	0	7,727	(14.2)	1,145.4	0.1	13.2
50～54	5,613	530	118	86	27	3	0	0	6,377	(11.7)	918.5	0.1	14.7
55～59	5,337	511	84	71	14	2	1	0	6,020	(11.1)	702.5	0.1	16.8
60～64	3,650	334	61	40	12	3	0	0	4,100	(7.5)	504.9	0.1	14.1
65～69	1,437	151	25	19	5	1	0	0	1,638	(3.0)	218.1	0.1	12.2
70以上	384	33	7	1	1	0	0	0	426	(0.8)	33.7	0.1	7.4
Total No. of workers (%)	47,234 (86.7)	5,161 (9.5)	1,003 (1.8)	819 (1.5)	194 (0.4)	45 (0.1)	5 (0.0)	0 (0.0)	54,461	(100.0)	—	—	—
Collective Dose (person・mSv)	285.9	2,113.6	1,470.8	2,532.2	1,350.1	539.2	80.7	0.0	—		8,372.5	0.2	17.2

[Notes]

- This table was compiled by excluding the data for Fukushima-Daiichi Nuclear Power Plant. The exposure dose data of workers at Fukushima Daiichi Nuclear Power Plant are shown in website of Tokyo Electric Power Company Holdings,Inc.
- How to read the numbers in table above:The number "114" in the box for the age row of "25～29" and the dose column of "1<Dose≤2" means that there were 114 workers between age 25 and 29 inclusive whose radiation doses were in the range of greater than 1 and less than or equal to 2 millisieverts in FY 2020.
- The workers' ages are calculated as of March 31,2021.

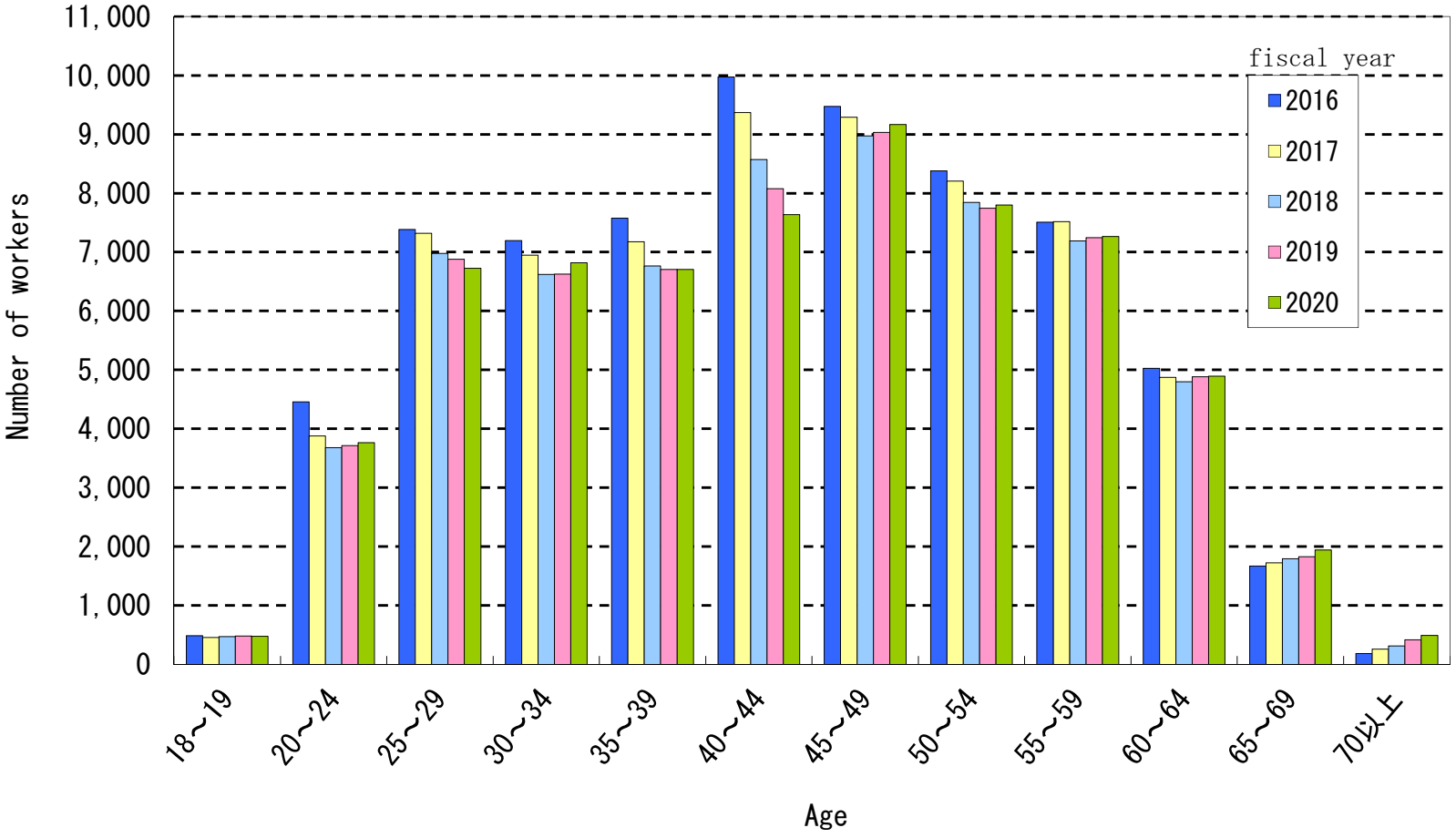
4. Dose Distribution of Workers by Age{FY 2020}

(Excluding the Data for Fukushima-Daiichi Nuclear Power Plant)



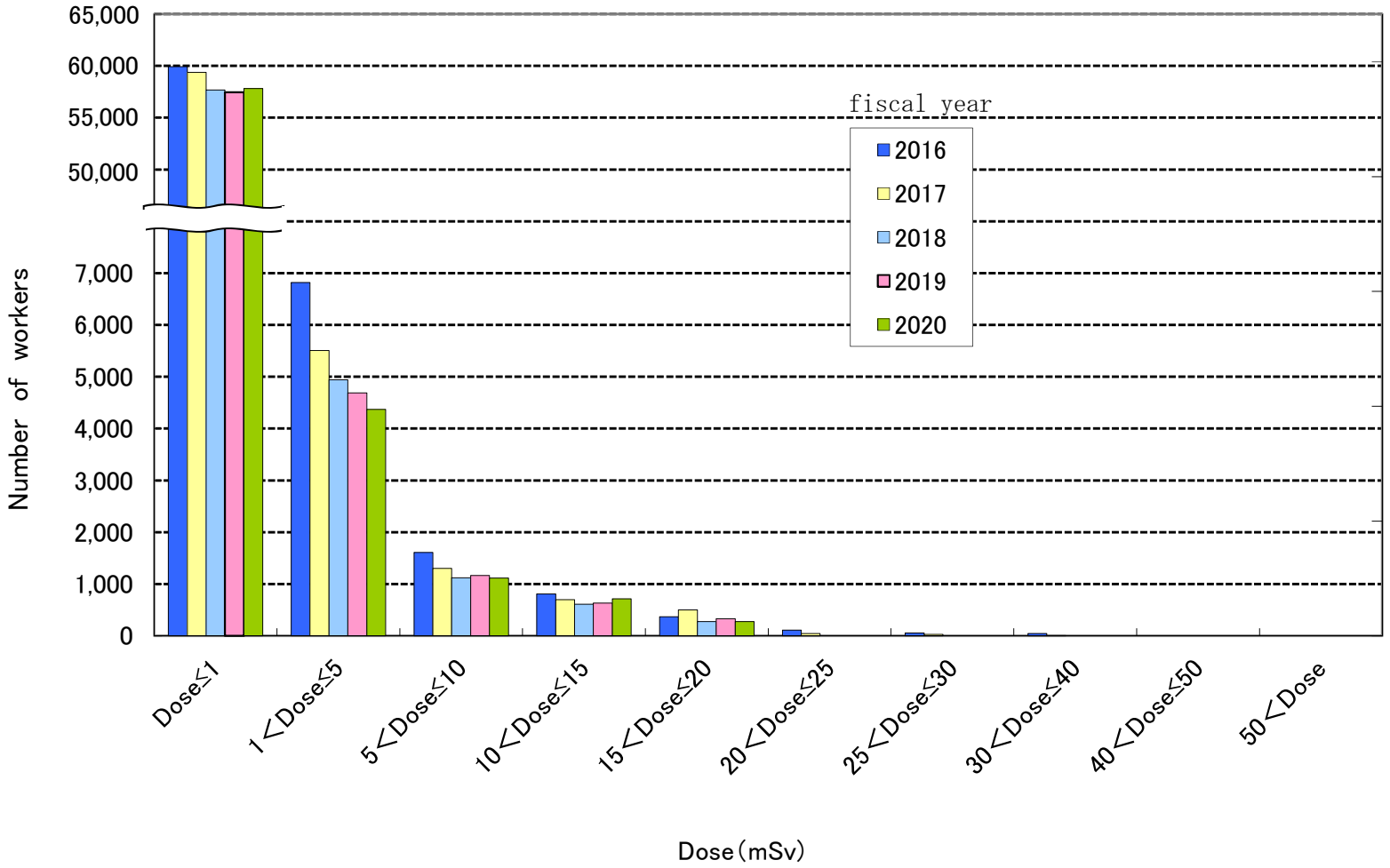
＊ This figure is based on the data in the Table 5 "Dose Distribution of Workers by Age{FY 2020}(Excluding the data for Fukushima-Daiichi Nuclear Power Plant)".

5. Annual Trends of Number of Workers by Age{FY 2016－2020}



＊ This figure is based on the data in the Table 1 "Dose Distributin of Workers by Age {FY 2020}" and those of the latest four years {FY 2016－2019}.

6. Annual Trends of Number of Workers by Dose Range {FY 2016－2020}



＊ This figure is based on the data in the Table 1 "Dose Distributin of Workers by Age {FY 2020}"and those of the latest four years {FY 2016－2019}.

7. Dose Distribution of Workers by Gender{FY 2020}

Gender / Dose(mSv)	Male (%)	Female (%)	Total No. of workers (%)	Collective dose (person·mSv) (%)
Dose ≤ 0.1	48,872 (77.8)	871 (96.2)	49,743 (78.1)	340.5 (1.0)
0.1< dose ≤ 1	7,438 (11.8)	31 (3.4)	7,469 (11.7)	3,222.6 (9.2)
1< dose ≤ 2	2,167 (3.5)	2 (0.2)	2,169 (3.4)	3,154.9 (9.0)
2< dose ≤ 5	2,200 (3.5)	0 (0.0)	2,200 (3.5)	7,007.9 (19.9)
5< dose ≤ 10	1,115 (1.8)	1 (0.1)	1,116 (1.8)	8,101.1 (23.0)
10< Dose ≤15	714 (1.1)	0 (0.0)	714 (1.1)	8,759.9 (24.9)
15< Dose ≤20	275 (0.4)	0 (0.0)	275 (0.4)	4,628.7 (13.1)
20< Dose	0 (0.0)	0 (0.0)	0 (0.0)	0.0 (0.0)
Total No. of workers (%)	62,781 (100.0)	905 (100.0)	63,686 (100.0)	—
Total No. of workers Ratio of man and famel(%)	98.6	1.4	100.0	—
Collective dose (person・mSv)	35,192.0	23.4	—	35,215.6 (100.0)
Mean dose (mSv)	0.6	0.0	0.6	—
Max dose (mSv)	19.3	6.5	19.3	—

[Notes]

・ How to read the numbers in table above : The number "2,167 " in the box of the dose row "1 < Dose ≤ 2" and the "Male" column means that there were 2,167 man workers whose radiation doses were in the range of greater than 1 and less than or equal to 2 millisieverts in FY 2020.

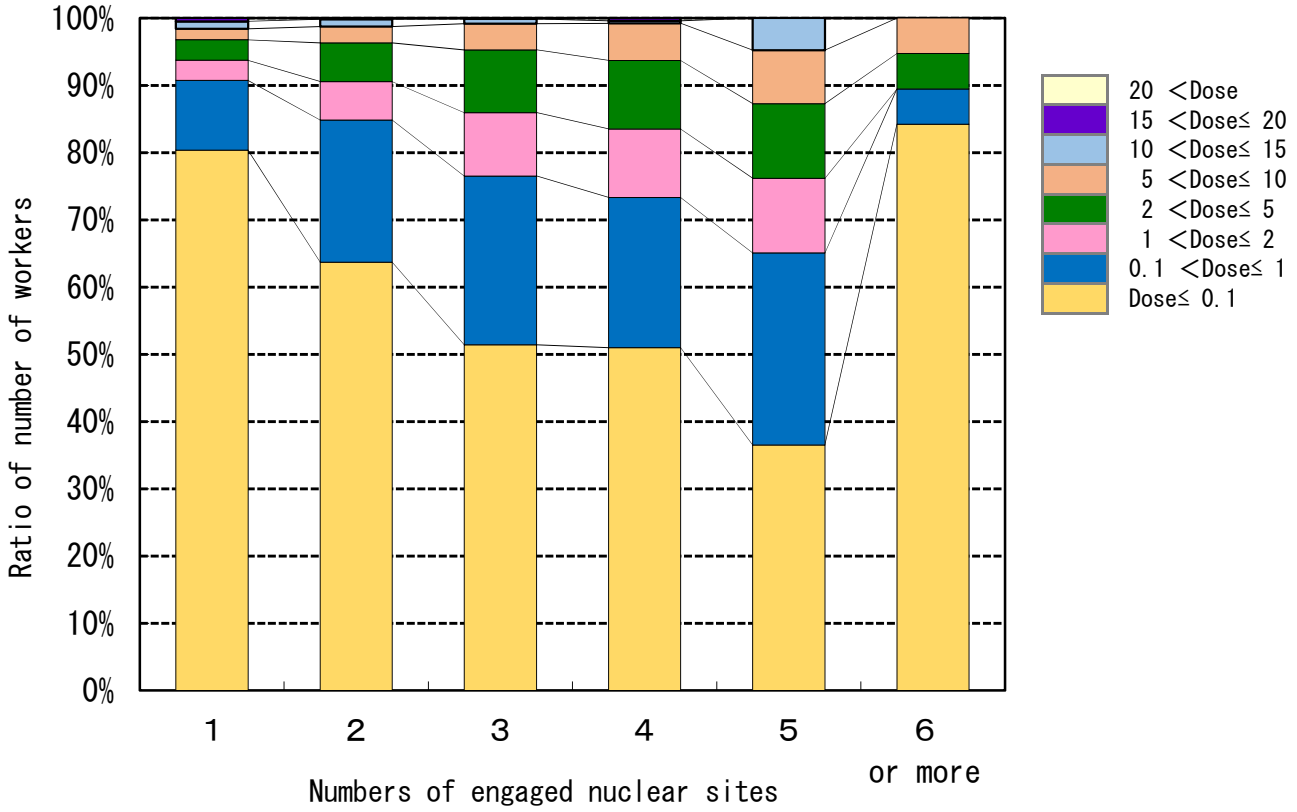
8. Dose Distribution of Workers by Number of Work Sites{FY 2020}

No. of Work sites / Dose(mSv)	Number of workers						
	1	2	3	4	5	6 or more	Total No. of workers (%)
Dose ≤ 0.1	45,066	3,952	556	130	23	16	49,743 (78.1)
0.1 < Dose ≤ 1	5,810	1,312	271	57	18	1	7,469 (11.7)
1 < Dose ≤ 2	1,679	355	102	26	7	0	2,169 (3.4)
2 < Dose ≤ 5	1,708	357	101	26	7	1	2,200 (3.5)
5 < Dose ≤ 10	904	150	42	14	5	1	1,116 (1.8)
10 < Dose ≤ 15	632	70	8	1	3	0	714 (1.1)
15 < Dose ≤ 20	265	8	1	1	0	0	275 (0.4)
20 < Dose	0	0	0	0	0	0	0 (0.0)
Total No. of workers (%)	56,064 (88.1)	6,204 (9.7)	1,081 (1.7)	255 (0.4)	63 (0.1)	19 (0.0)	63,686 (100.0)
Mean dose (mSv)	0.5	0.7	0.9	1.1	1.7	0.6	0.6

[Notes]

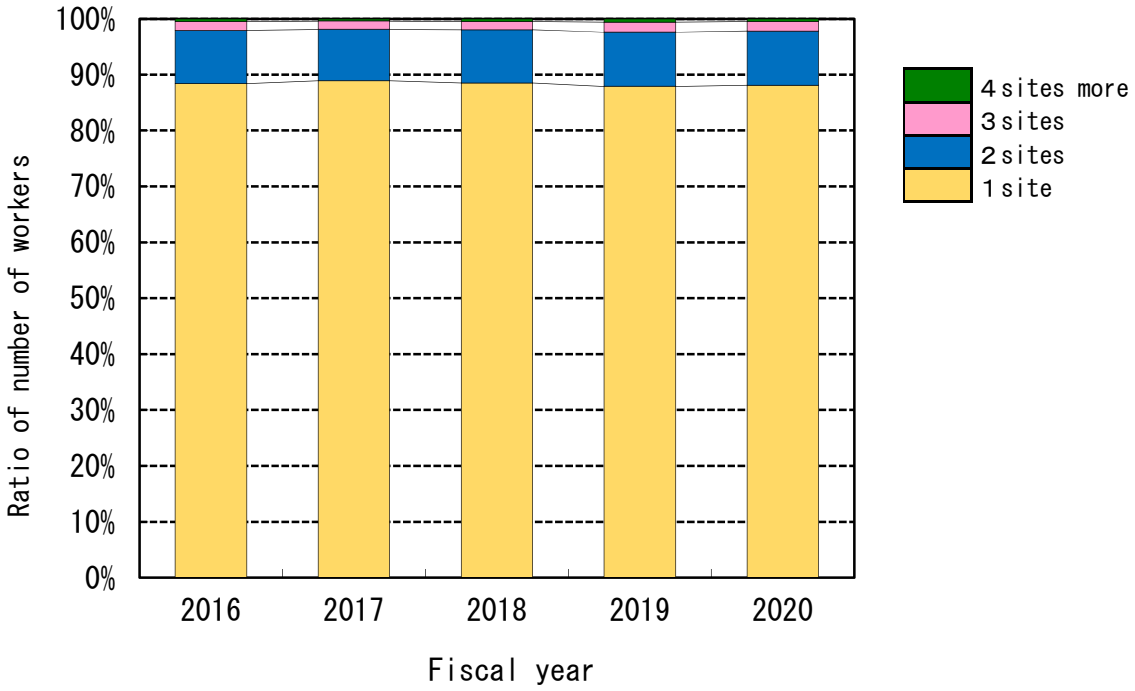
- How to read the numbers in table above : The number "23" in the box for the dose row of "Dose≤ 0.1" and the No. of work sites of "5" column means that there were 23 workers who were engaged in five work sites and whoes radiation doses were less than 5 millisievert in FY 2020.

9. Ratio of Number of Workers by Number of Work Sites{FY 2020}



＊ This figure is based on the data in the Table 8 "Dose Distribution of Workers by Number of Work Sites {FY 2020}".

10. Annual Trends of Ratio of Workers by Number of Work Sites {FY 2016-2020}



＊ This figure is based on the data in the Table 8 "Dose Distribution of Workers by Number of Work Sites {FY 2020}" and those of the latest four years {FY 2016－2019}.

11. Dose Distribution of Workers by Number of Work Sites {FY 2020}

(Excluding the Data for Fukushima-Daiichi Nuclear Power Plant)

No. of Work sites / Dose(mSv)	Number of workers						
	1	2	3	4	5	6 or more	Total No. of workers (%)
Dose ≤ 0.1	42,788	3,756	527	128	20	15	47,234 (86.7)
0.1 < Dose ≤ 1	3,767	1,086	237	54	16	1	5,161 (9.5)
1 < Dose ≤ 2	618	262	92	25	6	0	1,003 (1.8)
2 < Dose ≤ 5	454	246	87	24	7	1	819 (1.5)
5 < Dose ≤ 10	84	68	27	9	5	1	194 (0.4)
10 < Dose ≤ 15	28	10	3	1	3	0	45 (0.1)
15 < Dose ≤ 20	1	3	0	1	0	0	5 (0.0)
20 < Dose	0	0	0	0	0	0	0 (0.0)
Total No. of workers (%)	47,740 (87.7)	5,431 (10.0)	973 (1.8)	242 (0.4)	57 (0.1)	18 (0.0)	54,461 (100.0)
Mean dose (mSv)	0.1	0.4	0.8	0.9	1.9	0.6	0.2

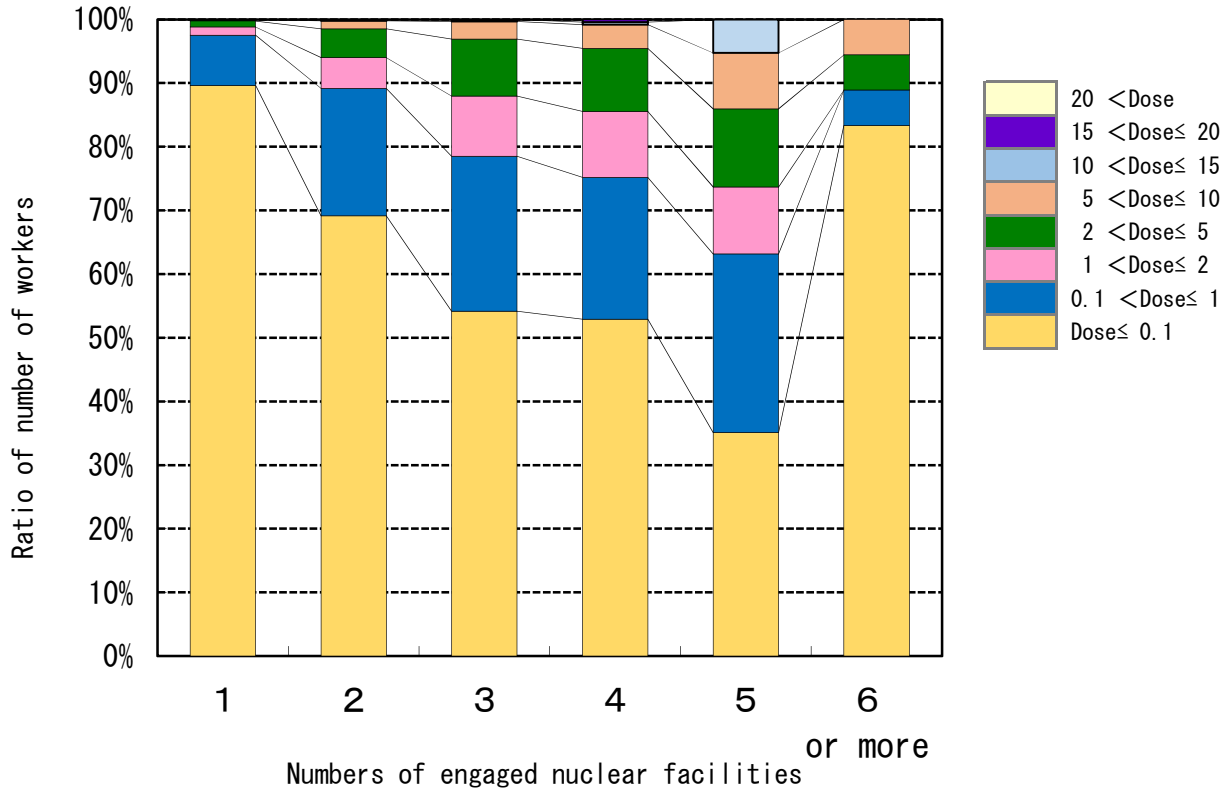
[表の見方]

- This table was compiled by excluding the data for Fukushima-Daiichi Nuclear Power Plant. The dose data of workers at Fukushima-Daiichi Nuclear Power Plant are shown in HP of Tokyo Electric Power Company Holdings,Inc.

- How to read the numbers in table above : The number "20" in the box for the dose row of "Dose ≤ 0.1" and the No. of work sites of "5" column means that there were 20 workers who were engaged in five nuclear sites and whoes radiation doses were less than 5 millisievert in FY 2020.

12. Dose Distribution of Workers by Number of Work Sites {FY 2020}

(Excluding the Data for Fukushima-Daiichi Nuclear Power Plant)



* This figure is based on the data in the Table 11 "Dose Distribution of Workers by Number of Work Sites {FY 2020}".

13. Transient Dose Distribution of Workers by Number of Work Sites in Latest five Years {FY 2016-2020}

No. of work sites in five years / Dose(mSv)	Number of workers									
	1	2	3	4	5	6	7	8 or more	Total No. of workers	(%)
Dose ≤ 1	71,094	12,160	3,193	1,101	428	161	65	70	88,272	(80.5)
1 < Dose ≤ 5	7,008	2,508	1,012	500	236	117	32	19	11,432	(10.4)
5 < Dose ≤ 10	2,537	821	338	173	91	46	21	10	4,037	(3.7)
10 < Dose ≤ 15	1,284	381	147	83	44	26	7	7	1,979	(1.8)
15 < Dose ≤ 20	893	232	87	47	24	12	9	4	1,308	(1.2)
20 < Dose ≤ 25	508	149	54	21	9	6	3	3	753	(0.7)
25 < Dose ≤ 30	373	105	38	17	5	5	2	0	545	(0.5)
30 < Dose ≤ 40	449	118	38	13	6	4	1	1	630	(0.6)
40 < Dose ≤ 50	227	82	22	8	2	0	2	0	343	(0.3)
50 < Dose ≤ 60	154	35	7	2	0	0	0	0	198	(0.2)
60 < Dose ≤ 70	83	20	4	0	0	0	0	0	107	(0.1)
70 < Dose ≤ 80	78	13	3	0	0	0	0	0	94	(0.1)
80 < Dose ≤ 90	12	0	0	0	0	0	0	0	12	(0.0)
90 < Dose ≤ 100	0	0	0	0	0	0	0	0	0	(0.0)
100< Dose	0	0	0	0	0	0	0	0	0	(0.0)
Total no. of workers (%)	84,700 (77.2)	16,624 (15.2)	4,943 (4.5)	1,965 (1.8)	845 (0.8)	377 (0.3)	142 (0.1)	114 (0.1)	109,710 (100.0)	
Mean dose (mSv)	1.6	2.4	2.9	3.2	3.4	4.3	5.4	3.3	1.9	

[Notes]

- The statutory dose limits for radiation workers are 100 mSv per five years and 50 mSv per year. Five-year period started from April, 2016, so that FY 2016-2019 data are given above.

- How to read the numbers in table above : The number "173" in the box for the dose row of "5< Dose ≤10" and in column of the No. of work sites in five years of "4"column means that there were 173 workers who engaged in radiation works at four work sites in four years and whose radiation doses were greater than 5 and less than or equql to 10 millisieverts from FY 2016 to 2020.