

Radiation Dose Statistics for Nuclear Workers in FY 2021

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 referred 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) 2021 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.

The radiation dose statistics 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 published since FY 2017.

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, 2022
- (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, 2022.
- (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 2021 is 33. 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 2017 and 2021).

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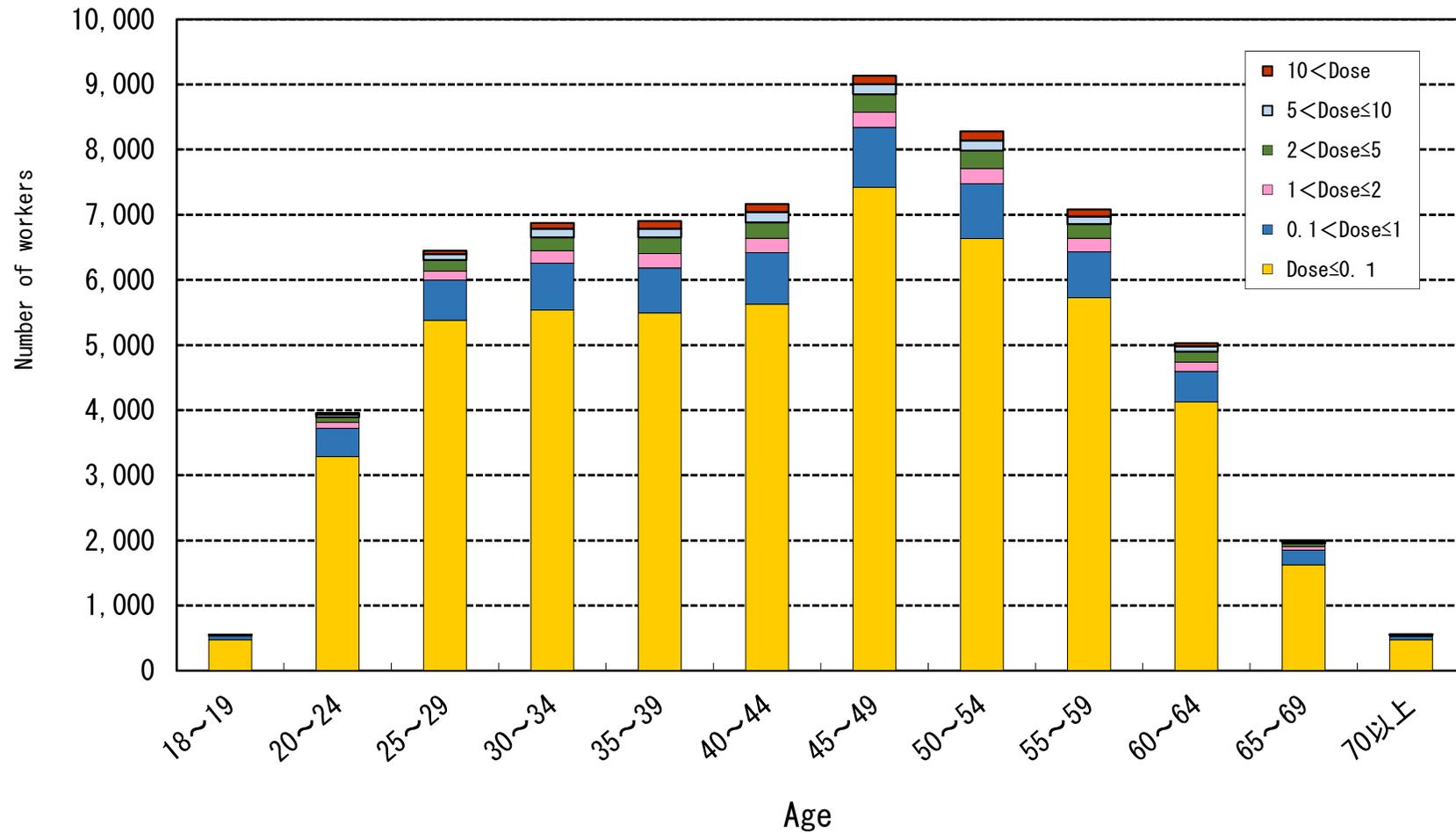
1. Dose Distribution of Workers by Age {FY 2021}

| 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 | 478 | 56 | 6 | 6 | 3 | 2 | 0 | 0 | 551 (0.9) | 101.8 | 0.2 | 13.2 |
| 20~24 | 3,290 | 434 | 88 | 79 | 42 | 19 | 6 | 0 | 3,958 (6.2) | 1,209.9 | 0.3 | 16.8 |
| 25~29 | 5,382 | 616 | 136 | 172 | 88 | 42 | 11 | 0 | 6,447 (10.1) | 2,355.8 | 0.4 | 16.9 |
| 30~34 | 5,535 | 724 | 190 | 201 | 135 | 78 | 9 | 0 | 6,872 (10.7) | 3,307.9 | 0.5 | 16.9 |
| 35~39 | 5,495 | 687 | 223 | 249 | 131 | 90 | 27 | 0 | 6,902 (10.8) | 3,955.1 | 0.6 | 16.9 |
| 40~44 | 5,627 | 791 | 220 | 243 | 162 | 93 | 27 | 0 | 7,163 (11.2) | 4,232.9 | 0.6 | 16.8 |
| 45~49 | 7,420 | 920 | 234 | 276 | 155 | 92 | 39 | 0 | 9,136 (14.3) | 4,545.9 | 0.5 | 17.0 |
| 50~54 | 6,633 | 843 | 236 | 274 | 154 | 94 | 44 | 0 | 8,278 (12.9) | 4,572.1 | 0.6 | 17.5 |
| 55~59 | 5,728 | 703 | 207 | 220 | 113 | 77 | 32 | 0 | 7,080 (11.1) | 3,617.5 | 0.5 | 17.0 |
| 60~64 | 4,124 | 473 | 143 | 159 | 81 | 38 | 11 | 0 | 5,029 (7.9) | 2,131.3 | 0.4 | 16.8 |
| 65~69 | 1,626 | 224 | 57 | 51 | 22 | 19 | 3 | 0 | 2,002 (3.1) | 792.1 | 0.4 | 16.7 |
| 70以上 | 476 | 53 | 12 | 10 | 2 | 3 | 0 | 0 | 556 (0.9) | 128.3 | 0.2 | 13.9 |
| Total No. of workers (%) | 51,814 (81.0) | 6,524 (10.2) | 1,752 (2.7) | 1,940 (3.0) | 1,088 (1.7) | 647 (1.0) | 209 (0.3) | 0 (0.0) | 63,974 (100.0) | — | — | — |
| Collective Dose (person · mSv) | 318.0 | 2,781.8 | 2,540.7 | 6,224.9 | 7,862.6 | 7,886.9 | 3,335.8 | 0.0 | — | 30,950.6 | 0.5 | 17.5 |

[Notes]

- How to read the numbers in table above: The number "136" in the box for the age row of "25~29" and the dose column of "1<Dose≤2" means that there were 136 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 2021.
- The workers' ages are calculated as of March 31, 2022.

2. Dose Distribution of Workers by Age {FY 2021}



* This figure is based on the data in the Table 1 "Dose Distributin of Workers by Age {FY 2021}".

3. Dose Distribution of Workers by Age{FY 2021}
(Excluding the Data for Fukushima-Daiichi Nuclear Power Plant)

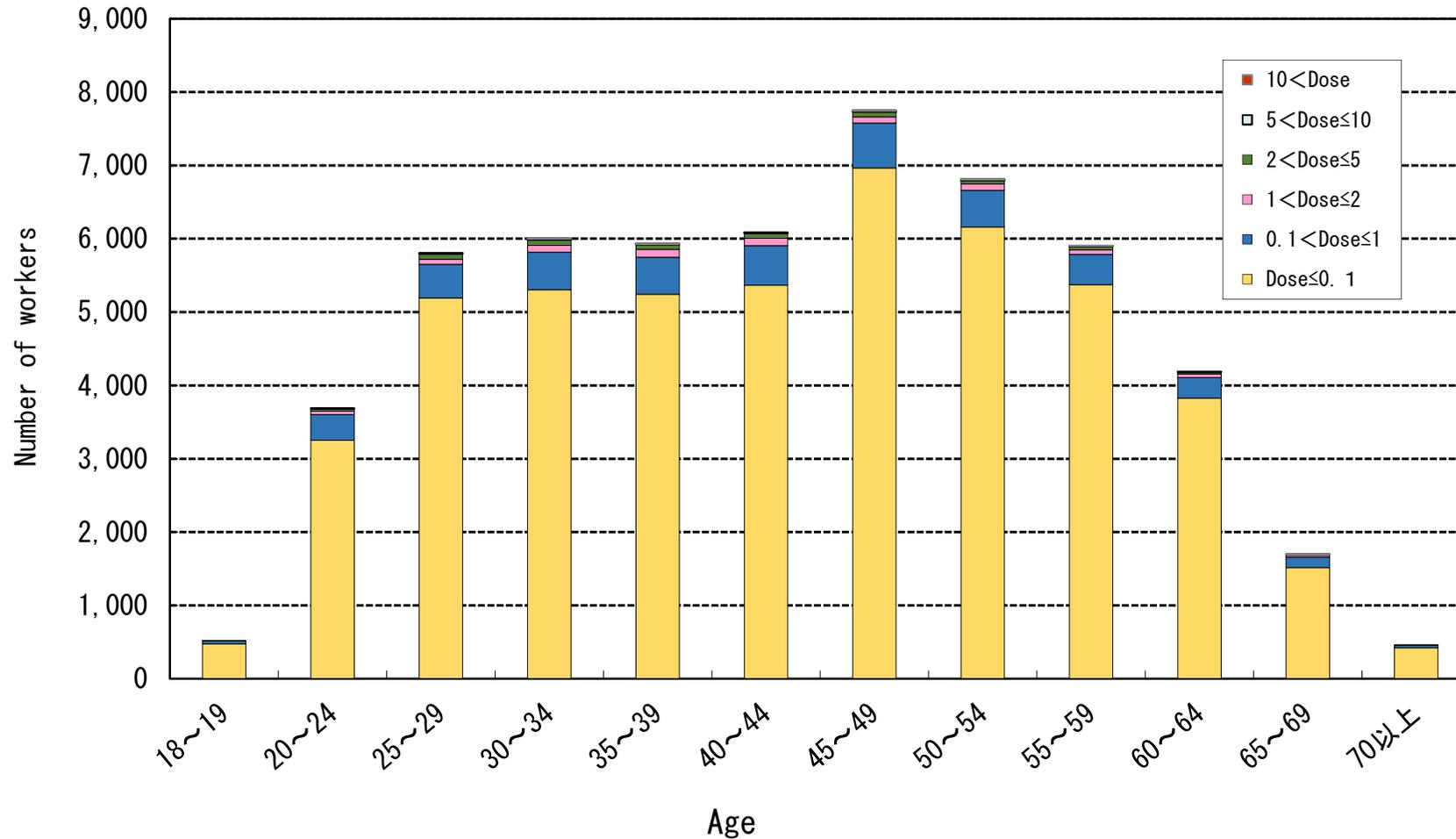
| Dose (mSv) Age | Number of workers | | | | | | | | | Dose | | |
|-----------------------------------|-------------------|----------------|--------------|--------------|---------------|----------------|----------------|-------------|-----------------------------|--------------------------------------|---------------|--------------|
| | 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 | 475 | 43 | 1 | 4 | 0 | 0 | 0 | 0 | 523 (1.0) | 36.0 | 0.1 | 3.2 |
| 20~24 | 3,252 | 352 | 46 | 31 | 7 | 0 | 0 | 0 | 3,688 (6.7) | 369.2 | 0.1 | 9.2 |
| 25~29 | 5,192 | 458 | 70 | 75 | 11 | 0 | 0 | 0 | 5,806 (10.6) | 625.0 | 0.1 | 8.9 |
| 30~34 | 5,306 | 511 | 94 | 74 | 16 | 2 | 0 | 0 | 6,003 (10.9) | 730.7 | 0.1 | 15.0 |
| 35~39 | 5,243 | 505 | 108 | 64 | 12 | 1 | 0 | 0 | 5,933 (10.8) | 678.3 | 0.1 | 13.0 |
| 40~44 | 5,367 | 540 | 99 | 70 | 9 | 0 | 0 | 0 | 6,085 (11.1) | 652.3 | 0.1 | 9.6 |
| 45~49 | 6,966 | 609 | 87 | 68 | 15 | 2 | 0 | 0 | 7,747 (14.1) | 740.0 | 0.1 | 12.2 |
| 50~54 | 6,158 | 501 | 91 | 46 | 14 | 2 | 0 | 0 | 6,812 (12.4) | 640.8 | 0.1 | 10.8 |
| 55~59 | 5,375 | 410 | 64 | 45 | 7 | 1 | 0 | 0 | 5,902 (10.8) | 472.6 | 0.1 | 11.0 |
| 60~64 | 3,826 | 283 | 50 | 23 | 7 | 0 | 0 | 0 | 4,189 (7.6) | 327.5 | 0.1 | 8.8 |
| 65~69 | 1,514 | 145 | 27 | 8 | 2 | 2 | 0 | 0 | 1,698 (3.1) | 173.7 | 0.1 | 11.4 |
| 70以上 | 421 | 37 | 3 | 2 | 0 | 0 | 0 | 0 | 463 (0.8) | 26.2 | 0.1 | 4.4 |
| Total No. of workers (%) | 49,095 (89.5) | 4,394 (8.0) | 740 (1.3) | 510 (0.9) | 100 (0.2) | 10 (0.0) | 0 (0.0) | 0 (0.0) | 54,849 (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 | — | 5,472.3 | 0.1 | 15.0 |

[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 "70" in the box for the age row of "25~29" and the dose column of "1<Dose≤2" means that there were 70 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 2021.
- The workers' ages are calculated as of March 31, 2022.

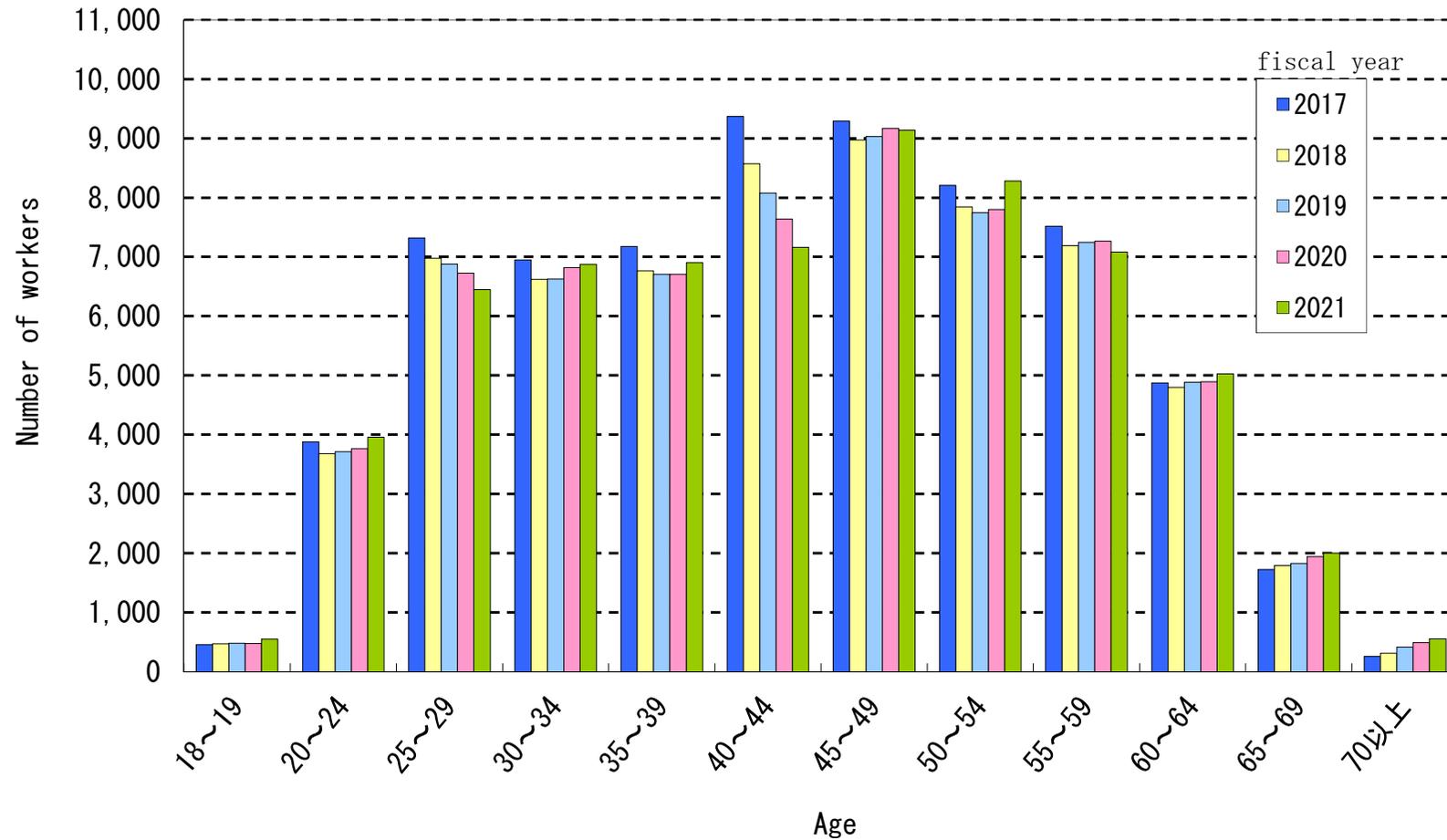
4. Dose Distribution of Workers by Age {FY 2021}

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



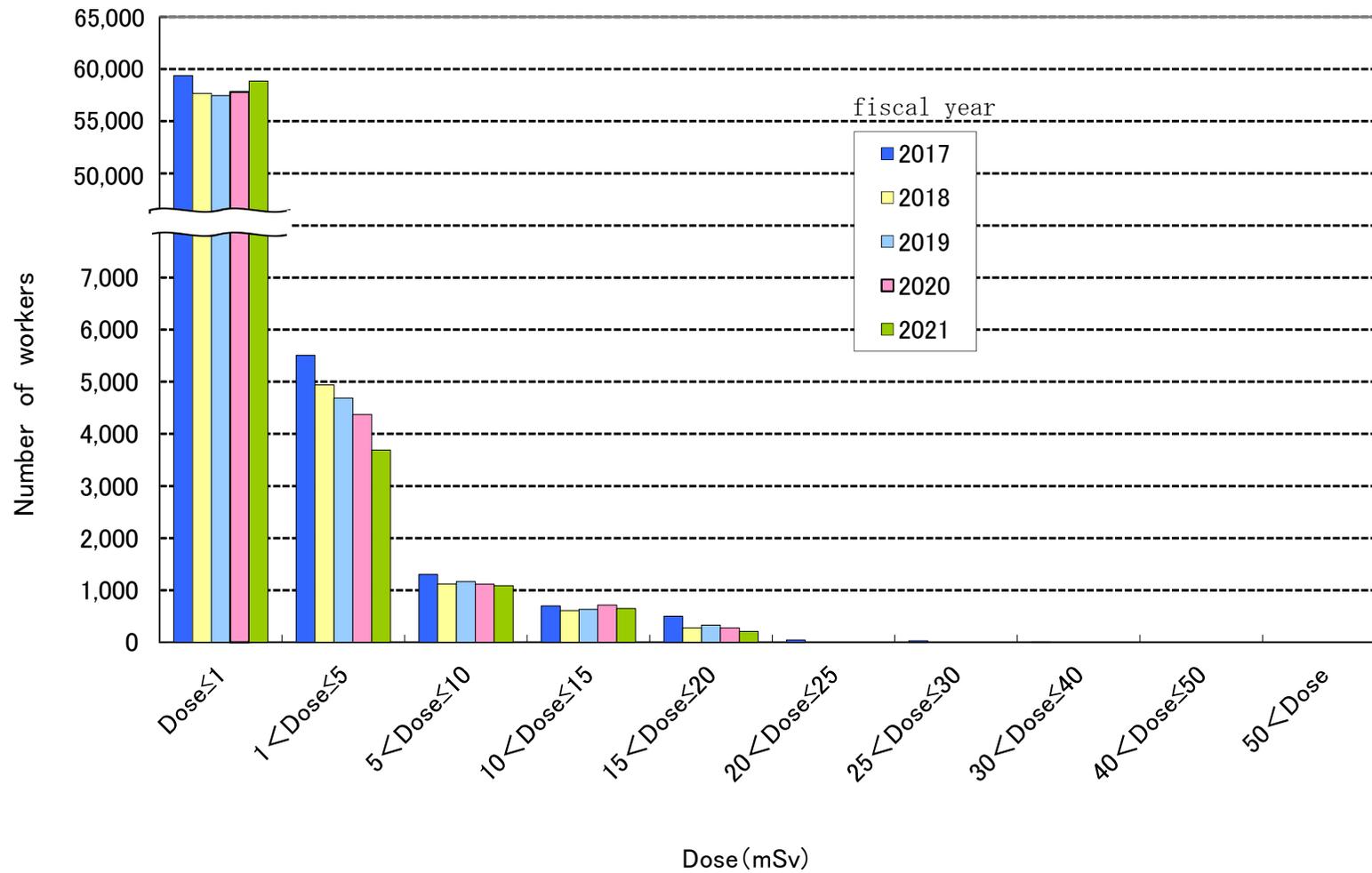
* This figure is based on the data in the Table 5 "Dose Distribution of Workers by Age {FY 2021} (Excluding the data for Fukushima-Daiichi Nuclear Power Plant)".

5. Annual Trends of Number of Workers by Age {FY 2017—2021}



* This figure is based on the data in the Table 1 "Dose Distributin of Workers by Age {FY 2021}" and those of the latest four years {FY 2017—2020}.

6. Annual Trends of Number of Workers by Dose Range {FY 2017—2021}



* This figure is based on the data in the Table 1 "Dose Distributin of Workers by Age {FY 2021}" and those of the latest four years {FY 2017—2020}.

7. Dose Distribution of Workers by Gender {FY 2021}

| Gender Dose (mSv) | Male (%) | Female (%) | Total No. of workers (%) | Collective dose (person·mSv) (%) |
|----------------------------------------------------|-------------------|------------------|--------------------------------|----------------------------------------|
| Dose ≤ 0.1 | 50,804 (80.7) | 1,010 (96.7) | 51,814 (81.0) | 318.0 (1.0) |
| 0.1 < dose ≤ 1 | 6,496 (10.3) | 28 (2.7) | 6,524 (10.2) | 2,781.8 (9.0) |
| 1 < dose ≤ 2 | 1,747 (2.8) | 5 (0.5) | 1,752 (2.7) | 2,540.7 (8.2) |
| 2 < dose ≤ 5 | 1,939 (3.1) | 1 (0.1) | 1,940 (3.0) | 6,224.9 (20.1) |
| 5 < dose ≤ 10 | 1,088 (1.7) | 0 (0.0) | 1,088 (1.7) | 7,862.6 (25.4) |
| 10 < Dose ≤ 15 | 647 (1.0) | 0 (0.0) | 647 (1.0) | 7,886.9 (25.5) |
| 15 < Dose ≤ 20 | 209 (0.3) | 0 (0.0) | 209 (0.3) | 3,335.8 (10.8) |
| 20 < Dose | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0.0 (0.0) |
| Total No. of workers (%) | 62,930 (100.0) | 1,044 (100.0) | 63,974 (100.0) | — |
| Total No. of workers Ratio of man and famel (%) | 98.4 | 1.6 | 100.0 | — |
| Collective dose (person · mSv) | 30,927.9 | 22.7 | — | 30,950.6 (100.0) |
| Mean dose (mSv) | 0.5 | 0.0 | 0.5 | — |
| Max dose (mSv) | 17.5 | 4.5 | 17.5 | — |

[Notes]

- How to read the numbers in table above : The number "1,747 " in the box of the dose row "1 < Dose ≤ 2" and the "Male" column means that there were 1,747 man workers whose radiation doses were in the range of greater than 1 and less than or equal to 2 millisieverts in FY 2021.

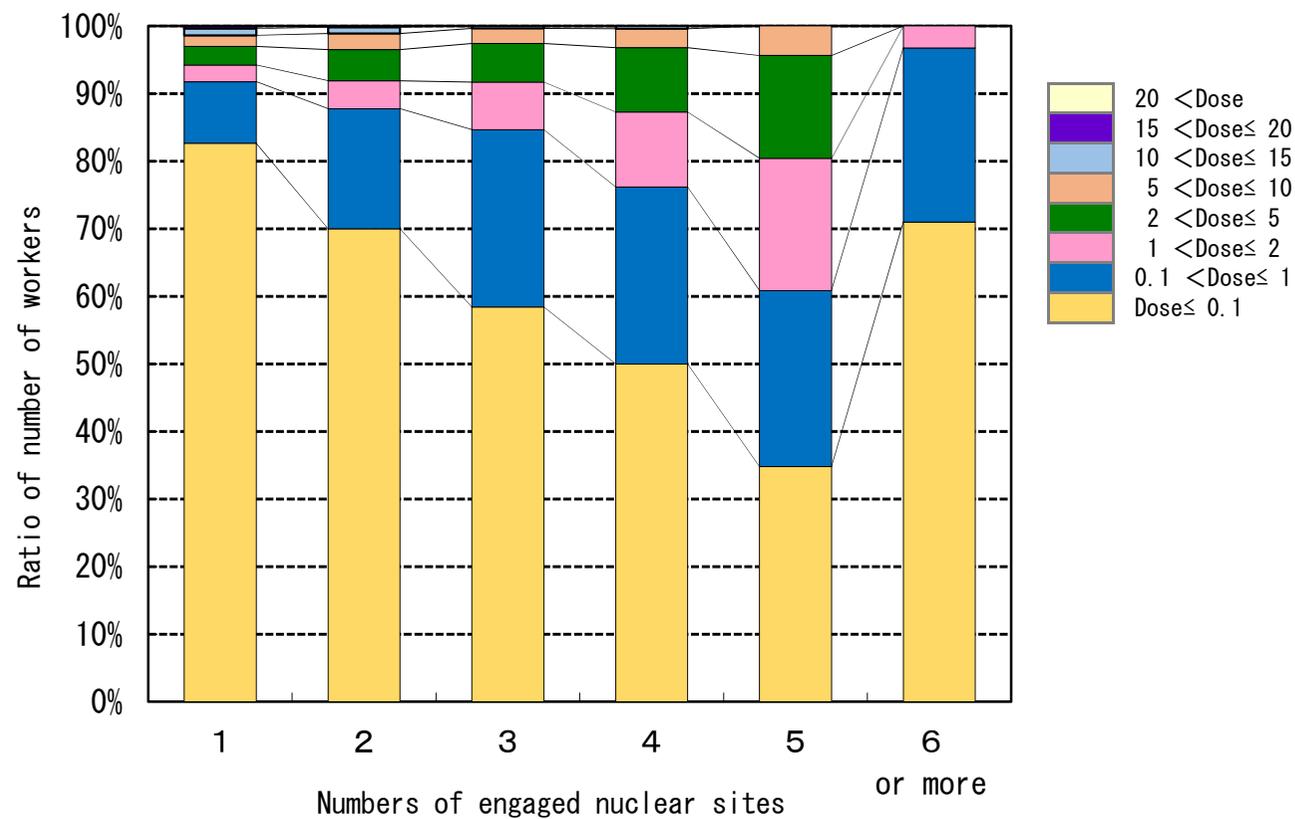
8. Dose Distribution of Workers by Number of Work Sites{FY 2021}

| Dose (mSv) \ No. of Work sites | Number of workers | | | | | | |
|--------------------------------|-------------------|-------------|-----------|-----------|----------|-----------|--------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 or more | Total No. of workers (%) |
| Dose ≤ 0.1 | 47,054 | 4,048 | 548 | 126 | 16 | 22 | 51,814 (81.1) |
| 0.1 < Dose ≤ 1 | 5,165 | 1,027 | 246 | 66 | 12 | 8 | 6,524 (10.2) |
| 1 < Dose ≤ 2 | 1,409 | 239 | 66 | 28 | 9 | 1 | 1,752 (2.7) |
| 2 < Dose ≤ 5 | 1,587 | 268 | 54 | 24 | 7 | 0 | 1,940 (3.0) |
| 5 < Dose ≤ 10 | 920 | 138 | 21 | 7 | 2 | 0 | 1,088 (1.7) |
| 10 < Dose ≤ 15 | 588 | 55 | 3 | 1 | 0 | 0 | 647 (1.0) |
| 15 < Dose ≤ 20 | 200 | 9 | 0 | 0 | 0 | 0 | 209 (0.3) |
| 20 < Dose | 0 | 0 | 0 | 0 | 0 | 0 | 0 (0.0) |
| Total No. of workers (%) | 56,923 (89.0) | 5,784 (9.0) | 938 (1.5) | 252 (0.4) | 46 (0.1) | 31 (0.0) | 63,974 (100.0) |
| Mean dose (mSv) | 0.5 | 0.6 | 0.6 | 0.8 | 1.1 | 0.2 | 0.5 |

[Notes]

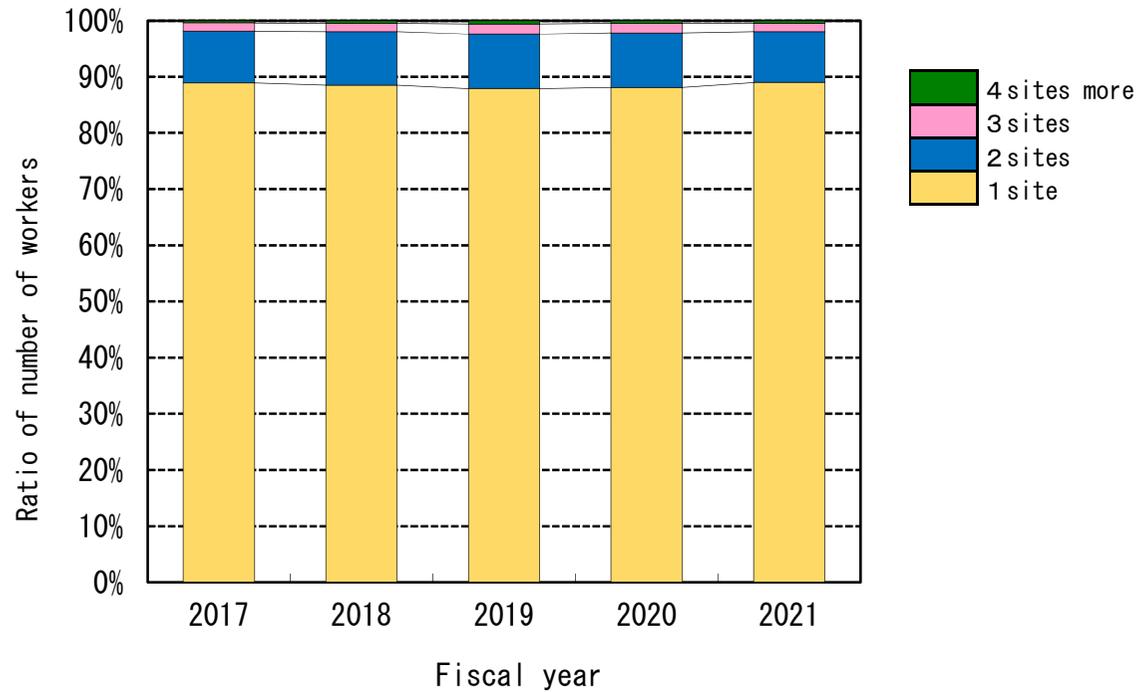
- How to read the numbers in table above : The number "16" in the box for the dose row of "Dose ≤ 0.1" and the No. of work sites of "5" column means that there were 16 workers who were engaged in five work sites and whose radiation doses were less than 5 millisievert in FY 2021.

9. Ratio of Number of Workers by Number of Work Sites {FY 2021}



* This figure is based on the data in the Table 8 "Dose Distribution of Workers by Number of Work Sites {FY 2021}".

10. Annual Trends of Ratio of Workers by Number of Work Sites {FY 2017–2021}



* This figure is based on the data in the Table 8 "Dose Distribution of Workers by Number of Work Sites {FY 2021}" and those of the latest four years {FY 2017–2020}.

11. Dose Distribution of Workers by Number of Work Sites {FY 2021}
(Excluding the Data for Fukushima-Daiichi Nuclear Power Plant)

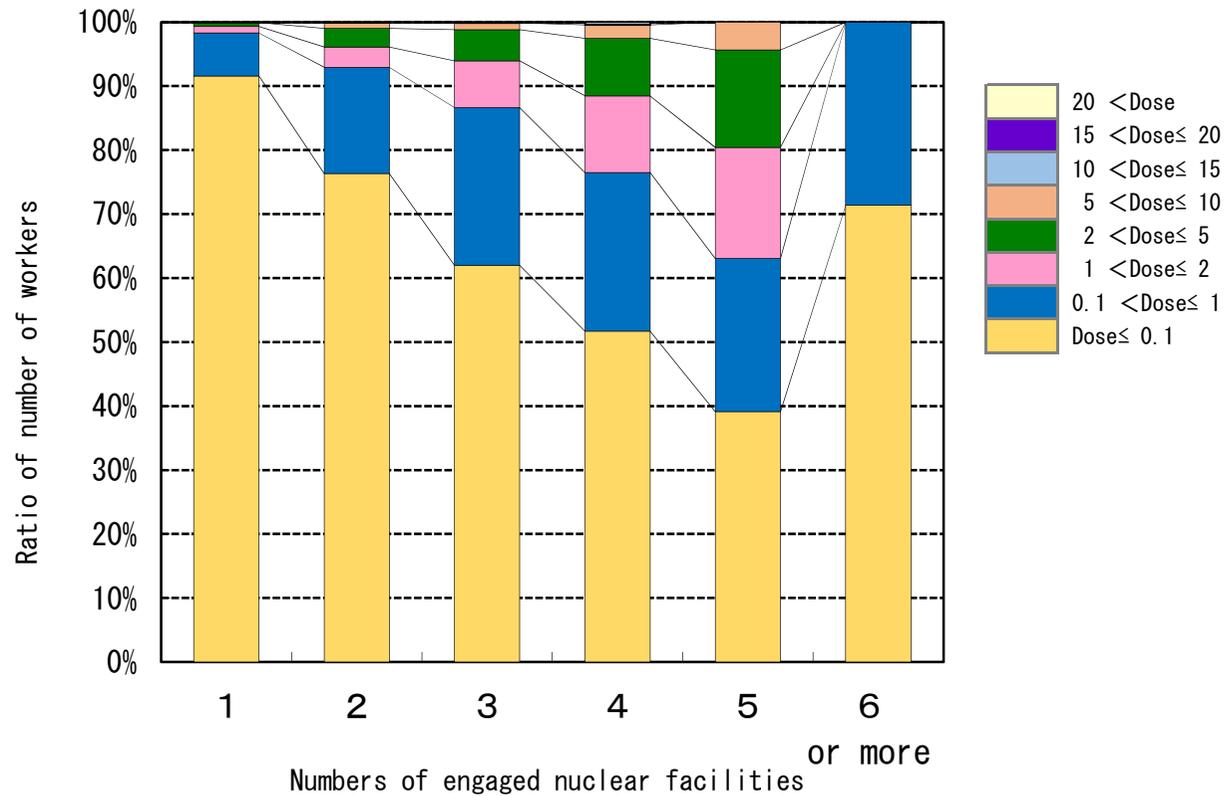
| Dose (mSv) \ No. of Work sites | Number of workers | | | | | | Total No. of workers (%) |
|--------------------------------|-------------------|-------------|-----------|-----------|----------|-----------|--------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 or more | |
| Dose ≤ 0.1 | 44,570 | 3,832 | 534 | 121 | 18 | 20 | 49,095 (86.7) |
| 0.1 < Dose ≤ 1 | 3,274 | 831 | 212 | 58 | 11 | 8 | 4,394 (9.5) |
| 1 < Dose ≤ 2 | 482 | 159 | 63 | 28 | 8 | 0 | 740 (1.8) |
| 2 < Dose ≤ 5 | 293 | 147 | 42 | 21 | 7 | 0 | 510 (1.5) |
| 5 < Dose ≤ 10 | 39 | 45 | 9 | 5 | 2 | 0 | 100 (0.4) |
| 10 < Dose ≤ 15 | 4 | 4 | 1 | 1 | 0 | 0 | 10 (0.1) |
| 15 < Dose ≤ 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 (0.0) |
| 20 < Dose | 0 | 0 | 0 | 0 | 0 | 0 | 0 (0.0) |
| Total No. of workers (%) | 48,662 (88.7) | 5,018 (9.1) | 861 (1.6) | 234 (0.4) | 46 (0.1) | 28 (0.1) | 54,849 (100.0) |
| Mean dose (mSv) | 0.1 | 0.3 | 0.5 | 0.8 | 1.1 | 0.1 | 0.1 |

[Notes]

- 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 "18" in the box for the dose row of "Dose ≤ 0.1" and the No. of work sites of "5" column means that there were 18 workers who were engaged in five nuclear sites and whose radiation doses were less than 5 millisievert in FY 2021.

12. Dose Distribution of Workers by Number of Work Sites {FY 2021}

(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 2021}".