# Infrastructures

## 1. Introduction

Facility management is focused on securing the safety, stability, and reliability of equipment and systems at each experimental facility. It must provide an efficient and effective delivery of support services not only to domestic academia, research institutes, and industry, but also to foreign entities because SPring-8/SACLA offers world-leading, highly brilliant X-rays. We efficiently control and provide 24/7 support to all facilities.

We manage the construction and maintenance of the facilities and their systems, such as electrical equipment, cooling units, experimental drainage, telephones, and hygienic air conditioning, on a five-year plan. This plan includes daily systematic monitoring and periodic inspections. In addition, we have implemented a plan to improve the overall research environment through initiatives to address aging equipment and improve energy savings.

## 2. Management of utilities (lighting, heating, and water)

### 2-1. Electricity

Electricity is provided by Chubu Electric Power Miraiz Solution's duplicate lines. The receiving voltage is 77 kV. The total contracted power is 31,500 kW. (The industrial power for facilities is 30,000 kW, and the nonindustrial power for administrative/sitting rooms is 1,500 kW.) The electric power consumption in FY2023 was 171 GWh. Figure 1 and Table 1 show the trends of electric power use over the past five years.

For the periods of peak electric power demand, measures are implemented to ensure that the total consumed power remains below the contract limit. These measures include the increased monitoring of overall use, the adjustment of air-conditioning settings, and the implementation of energy conservation measures.

Additionally, facility management was responsible for supporting researchers' needs and their related organizations and divisions regarding electric power quality/stability enhancements toward upgrading/diversifying research.

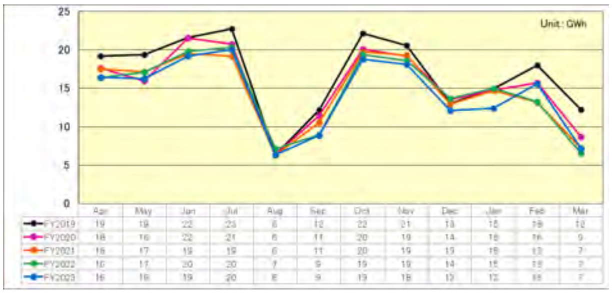


Fig. 1. Electricity consumption trends (at the Harima Campus).

Table 1. Electricity consumption.

| | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 |
|---|---|---|---|---|---|
| Industrial power | 195.4 | 178.6 | 170.0 | 169.1 | 164.3 |
| Nonindustrial power | 6.9 | 7.0 | 7.3 | 7.1 | 6.9 |
| SPring-8 as a whole | 202.3 | 185.6 | 177.3 | 176.2 | 171.2 |
| Comparative (±) | −3.6 | −16.7 | −8.3 | −1.1 | −5.0 |

[Unit: GWh]

### 2-2. Water and sewage

Tap water from the Chikusa River is provided by the water sewage office, Harima Highlands Wide-area Administration Association. The usage flow rate of tap water in FY2023 was 230 $km^3$, while the amount of sewage discharge was 92 $km^3$. Figure 2 and Table 2 show the water consumption trends over the past five years, while Figure 3 and Table 3 show the sewer discharge trends over the past five years.

Fig. 2. Amount of water used (at the Harima Campus).

Table 2. Amount of water used.

| | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 |
|---|---|---|---|---|---|
| Shared facility | 194.6 | 178.3 | 156.2 | 152.4 | 156.7 |
| RIKEN facility | 75.5 | 76.4 | 78.3 | 77.9 | 73.6 |
| SPring-8 as a whole | 270.0 | 254.7 | 234.5 | 230.3 | 230.3 |
| Comparative (±) | −10.6 | −15.3 | −20.2 | −4.2 | 0.0 |

[Unit: km$^3$]

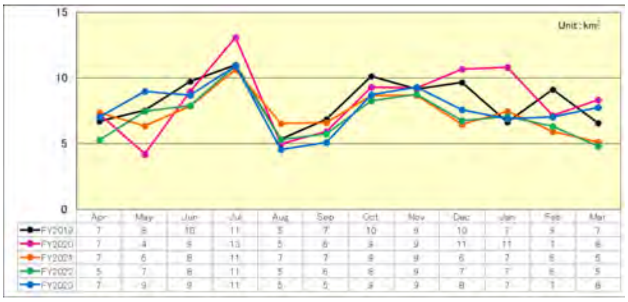

Fig. 3. Amount of sewer discharge (at the Harima Campus).

Table 3. Amount of sewer discharge.

| | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 |
|---|---|---|---|---|---|
| SPring-8 as a whole | 98.4 | 99.8 | 87.5 | 84.4 | 92.4 |
| Comparative (±) | −11.4 | 1.4 | −12.3 | −3.1 | 8.0 |

[Unit: km$^3$]

### 2-3. Gas

Town gas (13A) is provided by the West Harima Station of Osaka Gas. The FY2023 usage flow rate was 216 km$^3$. Figure 4 and Table 4 show the trends of gas use over the past five years.

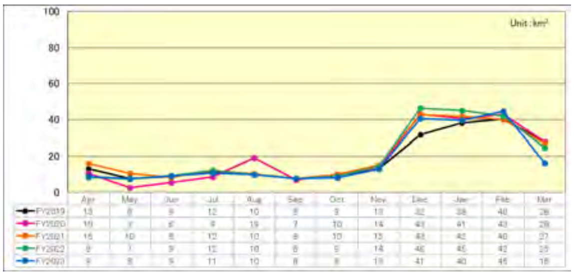

Fig. 4. Amount of town gas used (at the Harima Campus).

Table 4. Amount of town gas used.

| | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 |
|---|---|---|---|---|---|
| Shared facility | 204.3 | 216.0 | 225.4 | 221.1 | 201.5 |
| RIKEN facility | 15.3 | 15.5 | 16.3 | 15.5 | 14.6 |
| SPring-8 as a whole | 219.6 | 231.5 | 241.7 | 236.6 | 216.1 |
| Comparative (±) | −22.9 | 11.9 | 10.2 | −5.1 | −20.5 |

[Unit: km$^3$]

### 2-4. Energy conservation

The following measures were implemented in FY2023 to reduce $CO_2$ emissions and save energy.

(1) Packaged air conditioners were updated at the Main Building and Utility Management Building. These efforts eliminated 44 tons of $CO_2$ per year.

(2) Heat source equipment was updated at the Experimental Facility for SPring-8 Users. This effort eliminated 53 tons of $CO_2$ per year.

(3) All the lighting in the following facilities was updated with LEDs: Main Building, Experimental Facility for SPring-8 Users, Accelerator and Beamline R&D Facility, Machine Laboratory, Medium-length Beamline Facility, RI Laboratory, Storage Ring Annex West, and exterior lights around certain areas of the premises. These efforts eliminated 178 tons

of $CO_2$ per year.

(4) The substation equipment was updated at the following facilities: Experimental Facility for SPring-8 Users, Energy Center No. 2, Guest House, and Utility Management Building. These efforts eliminated 13 tons of $CO_2$ per year.

(5) Photovoltaic power generation systems were newly installed at the Main Building and Vacuum Drainage Station. These efforts eliminated 34 tons of $CO_2$ per year.

(6) The photovoltaic power generation systems at the SACLA Accelerator Building, North Building, and Vacuum Drainage Station generated their own power all year round. These efforts eliminated 18 tons of $CO_2$ per year.

(7) Operations of an injection system and a machine cooling system at the Storage Ring were temporarily suspended during inspection adjustment periods in the summer/winter, and at the fiscal year-end. These efforts eliminated 1,704 tons of $CO_2$ per year.

(8) The machine cooling equipment, which was a recirculating piped water system used to remove waste heat at the Storage Ring, was upgraded to a more energy-efficient one. The new equipment uses cold outside air in the winter and a refrigerating machine in the summer. These efforts eliminated 162 tons of $CO_2$ per year.

(9) The partial operation of the air handling units (AHUs) in the Experimental Hall at the Storage Ring during the summer/winter maintenance periods and at the fiscal year-end eliminated 623 tons of $CO_2$ per year.

(10) The partial operation of outdoor AHUs and air-exhaust ventilators of the tunnels for the injector and accelerator at the Storage Ring during the summer/winter maintenance periods and at the fiscal year-end eliminated 42 tons of $CO_2$ per year.

(11) The partial operation of air conditioners in the Experimental Hall at the RI Laboratory during the summer/winter maintenance periods and at the fiscal year-end eliminated 20 tons of $CO_2$ per year.

(12) The partial operation of the fan coil units (FCUs) in the tunnels for the injector and accelerator at the Storage Ring during the summer/winter maintenance periods and the fiscal year-end eliminated 20 tons of $CO_2$ per year.

(13) The partial operation of the humidifying function of the outdoor air handling units (OHUs) in the tunnels for the injector/accelerator and in the Experimental Hall at the Storage Ring eliminated 66 tons of $CO_2$ per year.

(14) The use of air-conditioning units during the night was suspended between 19:00 and 07:00 at the research building of the Medium-length Beamline Facility.

## 3. Environmental conservation

### 3-1. Industrial waste

Wastes discharged from operating activities were mainly experimental equipment, office automation equipment, scrap metal, waste plastics such as packing material/filters, and sludge generated during water treatment. Wastes containing poisonous and deleterious substances, such as experimental waste liquid and lead-acid batteries, used in operations and maintenance were collected and stored as specially controlled industrial waste. Additionally, because tools such as sterilized syringe needles and scalpels are difficult to distinguish from medical waste, they were collected and stored as specially controlled industrial waste. Then, we hired a contracted waste management company to dispose of them.

Although animals used in laboratory experiments can be disposed of as general waste, we buried them in an animal cemetery to express our sympathy for the loss of the laboratory animals, following the guidance of the local municipality.

Because cooperation from employees and users is necessary to properly conduct garbage separation, explanatory sessions on waste disposal were held and warning notices were issued via emails and posted announcements to employees not properly handling waste. Tables 5–7 show the amounts of waste generated over the past five years.

Table 5. Waste types and amounts in industrial waste.

| | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 |
|---|---|---|---|---|---|
| Sludge | 2,337 | 4,405 | 2,165 | 3,273 | 1,339 |
| Waste oil/slush | 7,892 | 3,560 | 5,024 | 1,999 | 2,801 |
| Waste alkali | 123 | 44 | 90 | 485 | 26 |
| Waste acid | 81 | 92 | 14 | 57 | 447 |
| Waste plastic | 11,141 | 8,898 | 9,454 | 8,733 | 9,000 |
| Waste wood | 2,886 | 1,949 | 1,653 | 1,674 | 6,075 |
| Waste/scrap metal | 93,505 | 60,779 | 113,255 | 65,443 | 136,146 |
| Waste/cullet glass | 710 | 628 | 511 | 403 | 906 |
| Wastes other than above (concrete, stone, etc.) | 75 | 44 | 925 | 810 | 11 |
| Biochemically stable waste mixture | 9,560 | 2,797 | 3,156 | 1,980 | 19,536 |
| Biochemically unstable waste mixture | 8,376 | 3,062 | 4,458 | 2,823 | 9,235 |
| Waste plastic (containing asbestos) | 0 | 0 | 0 | 0 | 0 |
| Mercury-containing product industrial waste | 1,074 | 710 | 711 | 1,035 | 570 |
| Dry batteries | 301 | 210 | 50 | 30 | 60 |

[Unit: kg]

Table 6. Amount of specially controlled industrial waste.

| | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 |
|---|---|---|---|---|---|
| Waste acid | 2,694 | 489 | 250 | 375 | 561 |
| Waste alkali | 428 | 430 | 475 | 49 | 54 |
| Waste oil | 237 | 305 | 187 | 50 | 22 |
| Sludge | 134 | 93 | 174 | 14 | 19 |
| Infectious waste | 7 | 10 | 10 | 10 | 10 |
| PCB | — | — | — | — | — |

[Unit: kg]

Table 7. Amount of general waste.

| | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 |
|---|---|---|---|---|---|
| Laboratory animals | 444 | 36 | 158 | 214 | 202 |

[Unit: kg]

Harima Administrative Division, RIKEN
Harima Safety Center, RIKEN