Facility Management

1. Introduction

Facility management is focused on securing safety, stability, and reliability of facility equipment and systems at each experimental facility. It must provide 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 construction and maintenance of the facilities and their systems such as electrical equipment, cooling units, experimental drainage, telephones, and hygiene 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 KEPCO's (Kansai Electric Power Company) duplicate lines. The receiving voltage is 77 kV. The total contracted power is 36,100 kW. (The industrial power for facilities is 34,500 kW, and the non-industrial power for administrative/sitting rooms is 1,600 kW.). The electric power consumption in FY2019 was 202 GWh. Figure 1 and Table 1 show the electric use trends for the past five years.

At peak electric demand times, measures are implemented to ensure the total consumed power remains below the contract limit. These measures include increased monitoring of overall use, controlling air-conditioning set points, and implementing 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.

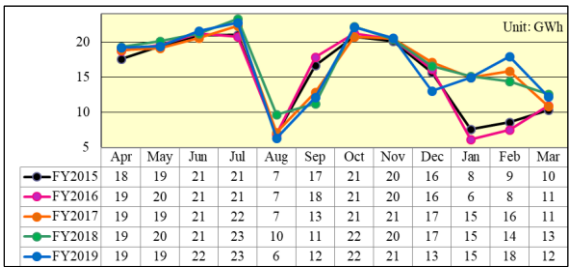

Fig. 1. Electricity consumption trends (at the Harima campus).

Table 1. Electricity consumption.

	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Industrial power	179.4	180.4	193.4	198.9	195.4
Non-industrial power	6.0	6.8	7.3	7.0	6.9
SPring-8 as a whole	185.4	187.2	200.7	205.9	202.3
Year-on-year (±)	-9.2	1.7	13.5	5.2	-3.6

[Unit: GWh]

2-2. Water and sewage

Tap water is provided by the water sewage office Harima highlands wide-area administration association from the Chikusa River. The usage flow rate of tap water in FY2019 was 270 km^3 while the amount of sewage discharge was 98 km^3. Figure 2 and Table 2 show the water consumption trends for the past five years, while Fig. 3 and Table 3 show the sewer excretion trends for the past five years.

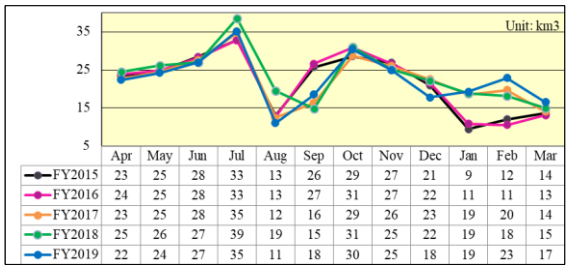

Fig. 2. Amount of water used (at the Harima Campus).

Table 2. Amount of water used.

	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Shared facility	191.4	196.4	197.0	204.1	194.6
RIKEN facility	68.1	66.0	70.9	76.5	75.5
SPring-8 as a whole	259.5	262.4	267.9	280.6	270.0
Year-on-year (±)	-22.9	2.9	5.5	12.7	-10.6

[Unit: Km^3]

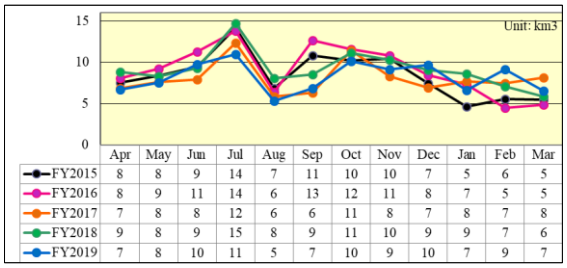

Fig. 3. Amount of sewer excretion (at the Harima Campus).

Table 3. Amount of sewer excretion.

	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
SPring-8 as a whole	101.0	108.9	97.0	109.8	98.4
Year-on-year (±)	-8.0	7.9	-11.9	12.8	-11.4

[Unit: Km^3]

2-3. Gas

Town gas (13A) is provided by the West Harima Station of Osaka Gas. The FY2019 usage flow rate was 220 km^3. Figure 4 and Table 4 show the gas use trends for the past five years.

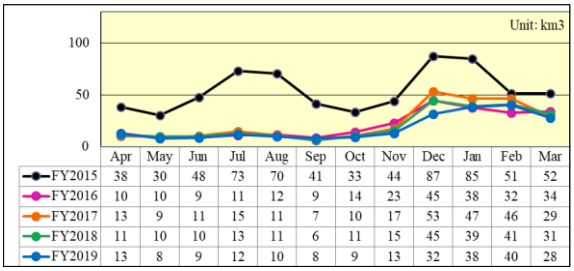

Fig. 4. Amount of town gas used (at the Harima Campus).

Table 4. Amount of town gas used.

	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Shared facility	261.4	222.5	252.5	227.2	204.3
RIKEN facility	392.5	25.2	15.3	15.3	15.3
SPring-8 as a whole	653.9	247.7	267.8	242.5	219.6
Year-on-year (±)	-219.2	-406.2	20.1	-25.3	-22.9

[Unit: Km^3]

2-4. Energy conservation

The following measures were implemented in FY2019 to reduce CO_2 emission and save energy:

1) One hundred units of through-the-wall packaged air conditioners at the Main Building were replaced due to deterioration over time.
2) One absorption chiller at the Cafeteria was replaced with a new one.
3) All the lighting in the following facilities was replaced with LEDs: Experimental Facility for the SPring-8 Users (shared space lighting), Structural Biology Facility (stairwell lighting), Main Building (downlighting), Storage Ring (measurement preparation room lighting),

Cafeteria (downlighting), Structural Biology Experimental Facility (shared space lighting), Medium-length Beamline Facility (room lighting), Accelerator and Beamline R&D Facility (parking area lighting).

4) Two air compressors at the Storage Ring were replaced with new ones.
5) Operations of an injection system and machine cooling system at the Storage Ring were temporarily suspended during inspection adjustment periods in the summer, winter, and fiscal year-end. These efforts eliminated 1,977 tons of CO_2 per year.
6) Machine cooling equipment, which was a recirculating piped water system 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.
7) Partially running the air handling units (AHUs) in the Experimental Hall at the Storage Ring during the summer/winter maintenance periods and the fiscal year-end eliminated 638 tons of CO_2 per year.
8) Partially operating 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 the fiscal year-end eliminated 46 tons of CO_2 per year.
9) Partially operating air conditioners in the Experimental Hall at the RI Laboratory during the summer/winter maintenance periods and the fiscal year-end eliminated 21 tons of CO_2 per year.
10) Partially operating 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 25 tons of CO_2 per year.
11) Partially operating the humidifying function of the outdoor air handling units (OHUs) in the tunnels for injector/accelerator and in the Experimental Hall at the Storage Ring eliminated 63 tons of CO_2 per year.
12) Air-conditioning units for nighttime use were 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 in water treatment. Wastes containing poisonous and deleterious substances such as experimental waste liquid and lead-acid batteries used for 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 for specially controlled industrial waste. Then we asked a contracted waste management company to dispose of them.

Although animals used for lab experiments can be disposed of as general waste, we buried them in an animal cemetery to express our sympathy for the loss of the lab animals by 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 posting announcements to employees not properly handling waste. Tables 5–7 show the waste amounts for the past five years.

Table 5. Waste amount in general industrial waste.

	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Sludge	16,015	23,505	12,518	6,029	2,337
Waste oil/slush	4,193	7,080	3,041	3,390	7,892
Waste alkali	879	570	73	231	123
Waste acid	466	191	202	86	81
Waste plastic	30,131	27,346	21,354	12,211	11,141
Waste wood	7,149	5,370	7,569	3,937	2,886
Waste/scrap metal	206,606*1	132,772	121,964	110,199	93,505
Waste/cullet glass	739	1,126	1,093	1,079	710
Wastes other than above (concrete, stone, etc.)	1,569	982	1,027	212	75
Biochemically stable waste mixture*2	-	-	-	2,427	9,560
Biochemically unstable waste mixture*2	-	-	-	33,558	8,376
Waste plastic*2 (containing asbestos)	-	-	-	220	0
Mercury used product industrial waste*2	-	-	-	934	1,074
Dry batteries*2	-	-	-	130	301

[Unit: kg]

*1: Since a concrete shielding wall (covered by an iron plate) was disposed of, there is an increase in waste metal.

*2: In accordance with the waste reclassification, new items were added in FY2018.

Table 6. Amount of specially controlled industrial waste.

	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Waste acid	276	2,488	807	183	2,694
Waste alkaline	31	18	708	423	428
Waste oil	1,051	403	182	279	237
Sludge	221	198	372	173	134
Infectious waste	9	3	16	12	7
PCB	—	—	—	—	—

[Unit: kg]

Table 7. Amount of general waste.

	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Laboratory animal	636	499	410	566	444

[Unit: kg]

Harima Administrative Division, RIKEN

Harima Safety Center, RIKEN