Musashino City
武蔵野市
Musashino Clean Center, that is fitting in with the town and connected to the town

Musashino Clean Center has been disposing of combustible, non-combustible, bulky, and harmful wastes as a waste disposal facility mounted with incinerators and non-combustible and bulky waste disposing equipment, while gaining the understanding of neighbors and enlisting cooperation from them, since 1984. The operation of the current facility was started in 2017. The facility has been operated as an environmentally-friendly and safe facility equipped with the state-of-the-art plant equipment. In addition, the design of the exterior renders a thicket on Musashino Plateau, which is in harmony with landscapes. Musashino Clean Center is an open facility with a route for visitors which facilitates their understanding of the flow of waste disposal merely by going round the second floor. As mentioned above, we are aiming to not only take the role as a clean center but also become “Musashino Clean Center, that is fitting in with the town and connected to the town.”
Musashino Clean Center

Four types of wastes, including combustible, non-combustible, bulky, and harmful wastes, are carried in to the Clean Center. While taking into consideration the surrounding environment and global warming, we conduct the "intermediate disposal process" to transport wastes to the final disposal site in Hinodemachi and recycling plants. Other kinds of wastes are directly delivered to recycling plants.

**Destinations of wastes produced in Musashino City**

- **Recyclable materials**
  - House-to-house collection
  - Base collection (Voluntary collection at stores)
- **Consumer electronics recycling**
- **Things still usable**
- **Recycling by manufacturers**
- **Reuse**

**3R promotion**

The first R (Reduce) refers to reduction in wastes as much as possible.

The second R (Reuse) is to repeatedly use things that are still usable.

The third R (Recycle) aims to use wastes again as resources.
Development of a safe, reliable, environmentally-friendly facility

- **A safe system that meet the strictest limit of emissions in Japan**
  We voluntarily specified the strictest limit of emissions in Japan and operate the facility mounted with the cutting-edge incinerator and a dry sodium bicarbonate exhaust gas disposal system while keeping emissions below the limit.

<table>
<thead>
<tr>
<th>Item</th>
<th>The emission limit specified by laws (such as Air Pollution Control Act)</th>
<th>The emission limit specified voluntarily by Musashino Clean Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust and soot (g/㎥ N)</td>
<td>0.08</td>
<td>0.01</td>
</tr>
<tr>
<td>Hydrogen chloride (HCl) (ppm)</td>
<td>430</td>
<td>10</td>
</tr>
<tr>
<td>Sulfur oxide (SOx) (ppm)</td>
<td>105</td>
<td>10</td>
</tr>
<tr>
<td>Nitrogen oxide (NOx) (ppm)</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>Dioxins and dioxin-like compounds (ng – TEQ/㎥ N)</td>
<td>1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

You can check measured exhaust gas values on the digital signage (installed in the community space), at the central control room (in the route for visitors), and on the website (http://mues-ebara.com/).

- **Realized a power generation efficiency of 20% through efficient heat utilization**
  We have introduced a highly efficient waste power generation system harnessing the heat generated through waste combustion and achieved a power generation efficiency of about 20% through heat utilization with less energy loss thanks to a low excess air incinerator with high combustion efficiency, a high-temperature and high-pressure boiler, a low-temperature economizer, and a dry sodium bicarbonate exhaust gas disposal system.

Development of a facility conscious of landscapes and architectural design

- **Development of landscapes which render a thicket on Musashino Plateau**
  As a waste disposal facility located in the center of an urban area adjacent to the city hall, we cared for streetscapes and landscapes. We have successfully reduced an oppressive feeling by the architectural design composed of a compact, stylish building. In addition, by creating a soft impression with a terra-cotta louver (a grid-type exterior terra-cotta part), which renders a thicket on Musashino Plateau, and an outer wall covered with greenery, we aimed to develop a facility that would fit in with the surrounding streetscape.
Development of a disaster-resistant facility

Disaster-resistant design capable of withstanding severe earthquakes

The entire building is designed based on the seismic analytical model with the aseismic level being 1.25 times higher than the statutory level. In addition, as the platform has been installed underground, we have adopted the truss structure which can provide column-free space. The chimney has been reused with its quake resistance reinforced to ensure the aseismic level of 1.25 times higher than the statutory level.

Function as a base for energy supply in case of emergency

In normal times, steam is produced by heat generated through waste combustion in an incinerator and used to create electricity with the waste power generation equipment. Steam and electricity are supplied to the city hall and the sports complex, and electricity is supplied to Midori-cho Community Center, in addition to use in the facility. In case of emergency, we receive gas through a quake-resistant medium-pressure gas pipe to start the gas co-generation equipment. Then we generate electricity and steam not only to supply energy to the city hall, which will serve as a disaster countermeasures office, but also to reactivate the incinerator for continuing waste disposal. The gas co-generation equipment is used also for auxiliary power generation when the incinerators are stopped due to power shortages in summer and for maintenance. As described above, the Clean Center is capable of functioning as an energy supply base for surrounding public institutions both in normal times and in case of emergency.

Development of an open facility

Tours and experiences about the flow of waste disposal available

The route for visitors is available during service hours. The layout was designed so that the route would make a circuit of the second floor and visitors could view plant equipment as it is through broad glass windows. In addition, details of the inside of the plant equipment are presented through image contents, allowing visitors to learn the system of waste disposal while having fun.

Dissemination of environmental information through waste disposal

Aiming for providing more citizens with opportunities to visit our facility, we hold events, workshops, etc. for disseminating information on wastes and the environment and suggesting environmentally-friendly lifestyles. In addition, the roof top is equipped with solar panels, a vegetable garden using garbage compost, and a meadow using wastes such as plastic bottle caps and buried seeds, where it is possible to learn wastes and the environment.
Anyone can tour freely the Clean Center without a reservation during service hours. The monitors installed in the route for visitors, rental tablets, Pepper, and Moo concierges (staff exclusively for citizens visiting the facility) support your visit. Restrooms for everyone, a lactation room, Braille pamphlets, and tools for communicating by means of writing are available.

Enjoy the route for visitors more!

Contents that describe waste disposal in a more understandable way are available. Visitors can watch images on the monitors installed in the route for visitors. In addition, individual visitors can rent tablets at the reception of the route for visitors (in principle, visitors will be asked for their IDs to rent tablets. For more detail, please contact us).

2nd floor

Floor guide

Must-see points in the route for visitors

Enjoy the route for visitors more!

Contents that describe waste disposal in a more understandable way are available. Visitors can watch images on the monitors installed in the route for visitors. In addition, individual visitors can rent tablets at the reception of the route for visitors (in principle, visitors will be asked for their IDs to rent tablets. For more detail, please contact us).

Video that explains the destinations of wastes produced in Musashino City (Hall 3)

Explanation by Pepper about the Clean Center (Hall 2)

Quizzes to learn the destinations of wastes (Hall 1)

Introduction of the history of the Clean Center (Hall 1)

CG visual contents that introduce the energy system (Hall 2)
Hall 1
- Touch screen on which visitors can take quizzes, and information board

Hall 2
- Section where visitors can learn energy

Hallway
- Bright hallway through which natural light comes just like sunlight filtering through trees in a thicket
- Hallway with the ceiling covered with cedar wood produced in the Tama region

Hall 1
- Central control room
- Platform and waste pit
- Gas co-generation
- Incinerator room
- Steam turbine generator

Hall 2
- Steam condenser
- Ash sorting facility
- Ash pit
- Non-combustible and bulky waste sorting room
- Non-combustible and bulky pit

Hall 3
- Visitors can watch videos about "destinations of wastes" and "Musashino Clean Center (architecture/equipment design)" on a large monitor.
- Benches that are made of ginkgo trees in the premises

Pendant light that uses recycled glass material
Musashino Clean Center incinerates 100 tons of wastes collected by garbage trucks, equivalent to 80 truckloads of wastes, every day. As the Clean Center is located in an urban area, we take various measures against burdens imposed on the surrounding environment due to odors, noise, vibration, and exhaust gas.

**Flow of waste disposal**

Combustible wastes are conveyed by garbage trucks to the waste pit from the platform and incinerated in an incinerator until they become ash completely. The weight and volume of wastes incinerated to become ash will decline to about 1/10 and 1/30, respectively.

**Central control room**

The central control room is a room where the entire facility is operated and managed. The operation of equipment inside the Clean Center and exhaust gas are monitored and controlled on alternating 24-hour shifts. When you touch the button on the glass in front of the central control room, you can check the waste combustion amount, the temperature of the incinerator, the exhaust gas limit, and power generation output.

In addition, the crane operation room for moving the crane bucket in the waste pit is located inside the central control room.

**Platform**

Combustible wastes are transported by garbage trucks to the platform. The platform of the Clean Center is located on the first basement. The entrance is equipped with a high-speed roller shutter and air curtain to prevent leakage of odors.

**Waste pit**

The wastes transported to the platform are conveyed to the waste pit. The size of the waste pit equals a five-story building, and the maximum amount of waste that can be stored takes about 6 days to be incinerated. The wastes conveyed are stirred thoroughly with a waste crane bucket so that they will be incinerated homogeneously, and then put into an incinerator.

**Incinerator**

The wastes conveyed to an incinerator are then incinerated until they become ash completely while being sent slowly on a stepped fire grate, called a stoker, spending 2 to 3 hours. The temperature during waste combustion is over 850℃. The reason for such a high temperature is to prevent generation of dioxins and dioxin-like compounds. The Clean Center can dispose of 120 tons of waste a day by using the 2 incinerators housed in the basement.
**Flow of exhaust gas**

Combustion of waste produces high-temperature exhaust gas. Exhaust gas purified by removing hazardous substances through the filter-type dust collection equipment, etc. is discharged from the chimney.

**Boiler**

High-temperature exhaust gas boils water in the tubes lining up inside a boiler while moving through it and produces high-temperature and high-pressure steam. The temperature of exhaust gas will drop below 200°C by heat exchange before entering filter-type dust collection equipment.

**Filter-type dust collection equipment**

Sodium bicarbonate and activated carbon are sprayed on the exhaust gas cooled down in the boiler, and hazardous substances are removed while the cooled exhaust gas is moving through the filters (6.6 m × 180 filters × 2 units) installed in the filter-type dust collection equipment.

**Ash sorter**

The ash produced in the incinerator is pulverized by using an ash crusher, a magnetic sorter, etc. in the ash sorter, and metal, etc. is removed to satisfy the criteria for converting the ash into eco-cement. Finally, the ash is immersed in water with an ash extruder to prevent ash scattering and then extruded to the ash pit.

We voluntarily specified the strictest limit of emissions in Japan and satisfy the voluntarily specified limit by using exhaust gas disposal equipment. Purified exhaust gas is discharged from the chimney.

**Flow of ash**

Ash produced through waste combustion is sent to the ash pit after metal is removed by using an ash sorter, and then loaded onto an ash delivery truck by an ash crane to be transported to the facility for producing eco-cement in Hinodemachi.

**Ash sorter**

The ash is accumulated in the ash pit and loaded with a crane onto an ash delivery vehicle and then transported to the facility for producing eco-cement at the final disposal site in Futatsuzuka, Hinodemachi. Eco-cement, which is made from ash produced through waste combustion, is used as the raw material for roadside ditches and blocks for sidewalks.

**Fly ash and jet pack truck**

Fly ash captured in an incinerator and filter-type dust collection equipment is accumulated in a fly ash storage tank, sucked up into a jet pack truck, and transported to the facility for producing eco-cement in Hinodemachi. In addition, auxiliary solidification is provided to fly ash by using a kneader and the solidified fly ash is conveyed to the ash pit.
Flow of waste disposal | Non-combustible, bulky, and harmful wastes

Non-combustible and bulky wastes collected all over the city are pulverized with a crusher, and then recyclable materials, such as iron and aluminum, are collected with a sorter. They are transported to recycling plants as valuable resources. Harmful wastes, too, are carried into the Clean Center. As fluorescent tubes and batteries contain mercury, they are put in drum cans in the platform and then transported to recycling plants capable of disposing of mercury. Spray cans are collected as iron after being pierced.

Non-combustible and bulky waste pit

Non-combustible and bulky wastes collected all over the city are accumulated in the non-combustible and bulky waste pit.

Primary crusher

Wastes are grabbed with a waste crane bucket and sent to a receiving hopper, and then conveyed to the low-speed primary crusher by using a supply conveyer to be crushed slowly.
Fluorescent tubes, which are categorized into harmful wastes, are crushed by using a fluorescent tube crusher and then put in drum cans.

Crushing equipment for large combustible waste
Some of bulky wastes, such as wooden furniture, are put in the crushing equipment for large combustible waste located by the combustible waste pit, pulverized there, and conveyed to the combustible pit for incineration.

Flow of odors and dust

Odors and dust generated in each equipment room in the non-combustible and bulky waste disposing facility are discharged from a special chimney (fume stack) through bag filters and deodorizing apparatus. In addition, when all of the incinerators are stopped for maintenance, odors in the combustible waste pit are discharged from the fume stack via deodorizing apparatus.

Flow of non-combustible and bulky wastes

Secondary crusher
Wastes crushed by using a primary crusher are sent to a high-speed secondary crusher through a transport conveyor for roughly crushed wastes to be pulverized.

Magnetic sorter
Wastes are transported to a sorting conveyor, and iron is removed with a magnetic sorter which uses magnets. Wastes other than iron are conveyed to a particle size sorter.

Particle size sorter
Fine wood offcuts and waste plastic are sorted with a particle size sorter from the remaining wastes after iron collection and sent to the combustible pit for incineration. Other wastes are conveyed to an aluminum sorter.

Aluminum sorter
Aluminum is removed by using an aluminum sorter from the wastes. Removed wooden offcuts and waste plastic are sent to the combustible waste pit for incineration. Nonferrous metal is collected separately.

Hopper (iron and aluminum)
Collected iron and aluminum are stored in respective tanks. When a truck gets under a hopper, the hopper opens and iron (or aluminum) is loaded onto the truck bed and transported to a recycling plant.
Plant designed and constructed by
Ebara Environmental Plant Co., Ltd.

Construction design
KAJIMA DESIGN

Constructed by
Ebara Environmental Plant Co., Ltd. and Kajima Corporation

Construction supervised by
Musashino City and Nikken Sekkei Ltd.

Design plan overseen by
Musashino City, Nikken Sekkei Ltd., and Toshihiro Mizutani Architects

Plant technology supported by
Japan Waste Management Association

Operated by
Musashino E Service Co., Ltd. (special-purpose company)
From April 2017 (for 20 years)

http://mues-ebara.com/ (Website of Musashino E Service Co., Ltd.)
http://www.city.musashino.lg.jp (Website of Musashino City)