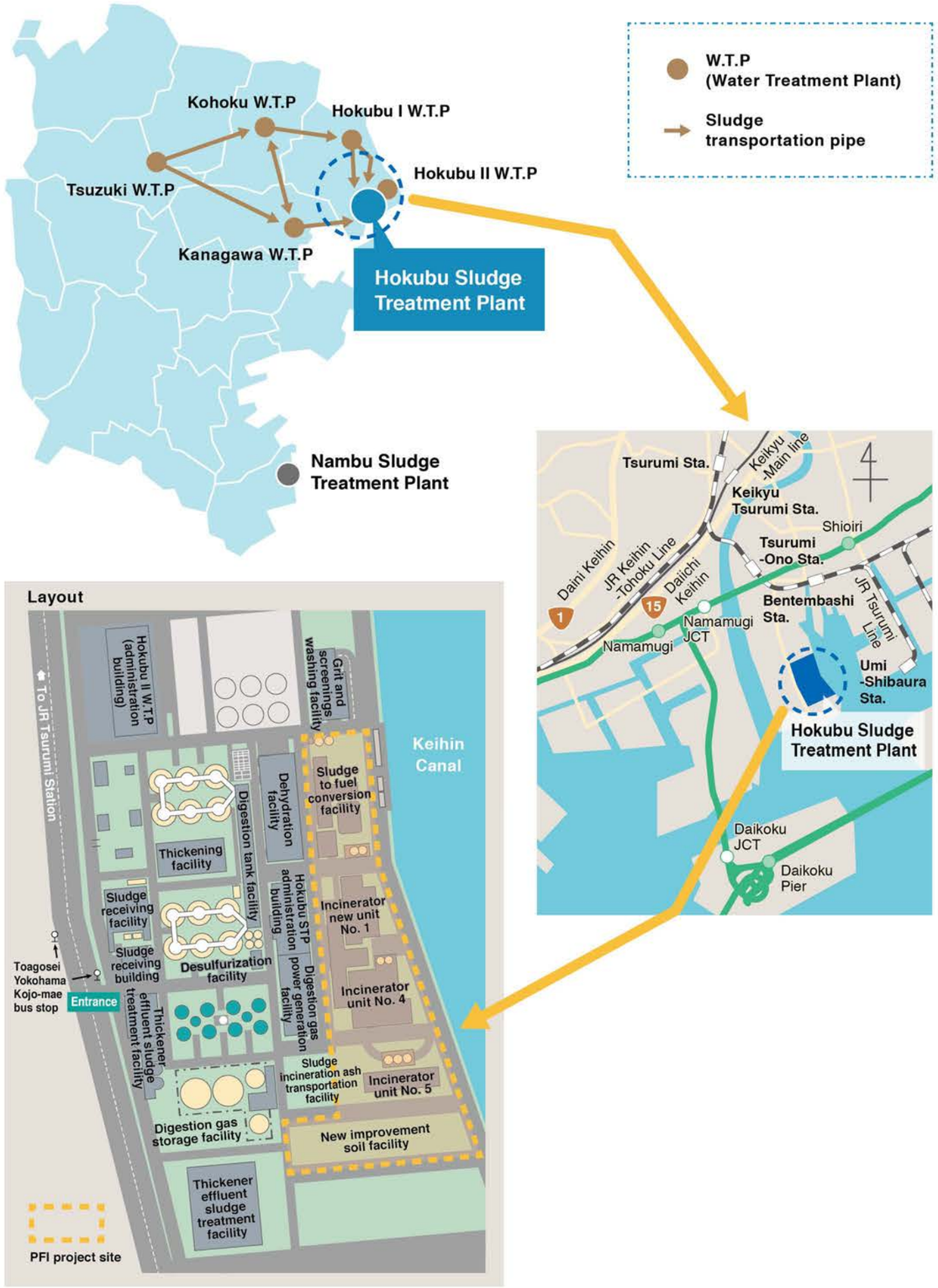

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Yokohama Bay Link Corporation

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Hokubu Sludge Treatment Plant, City of Yokohama

Project for Sewage Sludge Treatment and Effective Use

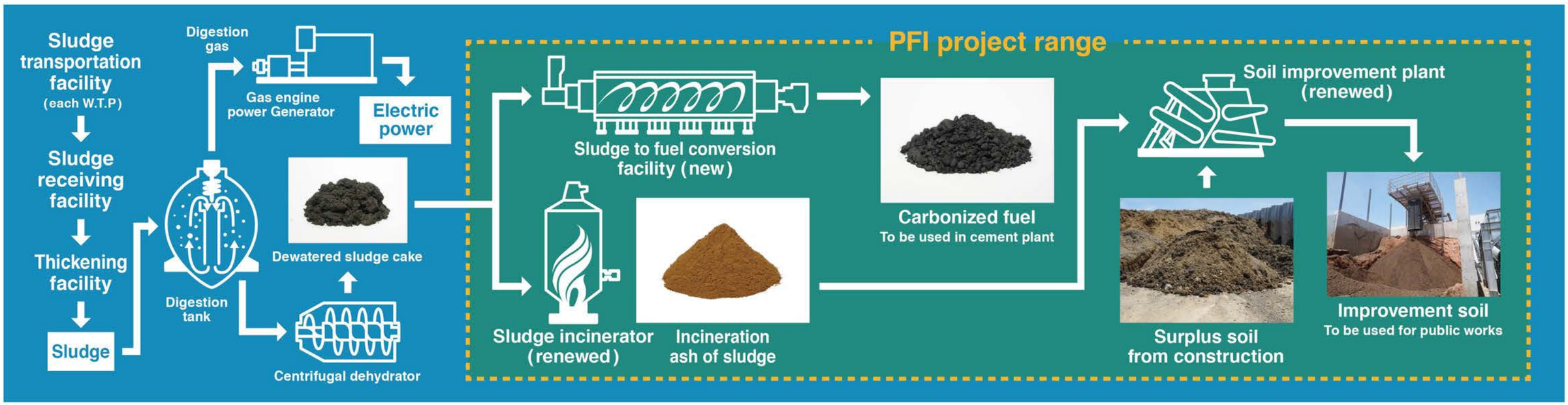
Private Finance Initiative
PFI
Private Finance Initiative

Environmental Planning Bureau, City of Yokohama

Yokohama Bay Link Corporation

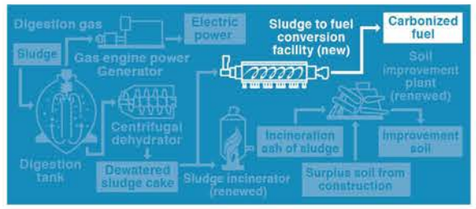
Overall process flow of Hokubu Sludge Treatment Plant

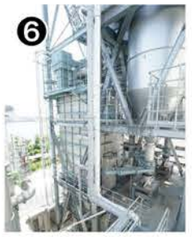
The system uses sewage sludge and incineration ash 100% effectively.

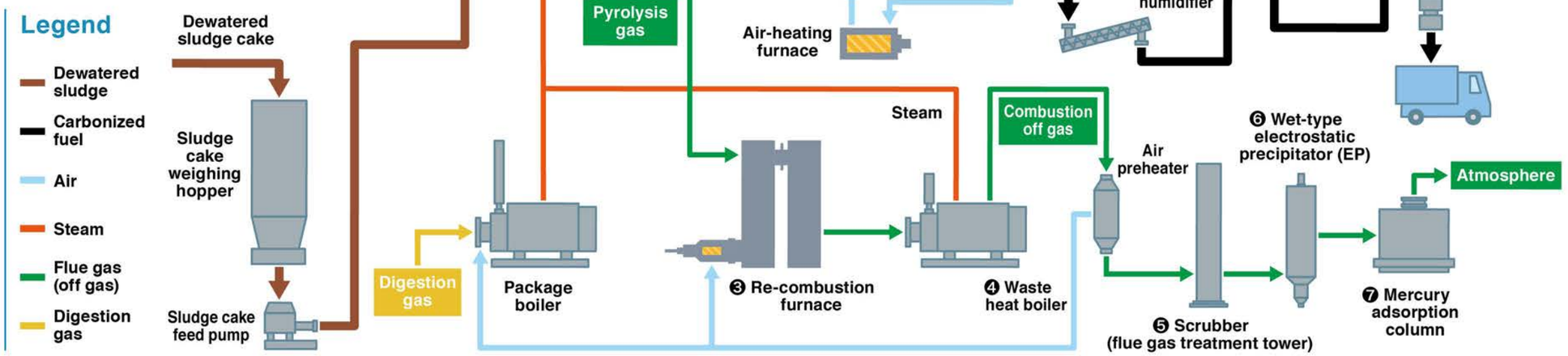


Process flow of sludge to fuel conversion facility

Dewatered sludge cake is converted into fuel at this facility. The produced fuel is used as an alternative fuel to coal.







❶ Sludge cake dryer

It is a sludge dryer of a steam indirect heating system, and reduces water content of dewatered sludge cake up to approximately 25%.

❷ Carbonization furnace

The furnace heats dried sludge at a low-oxygen atmosphere for around one hour for carbonization. It produces carbonized fuel with high calorific value by low-temperature carbonization.

❸ Re-combustion furnace

The furnace burns the pyrolysis gas from the carbonization furnace, flue gas from the scrubber, and odor in the facility stably at approximately 950°C.

❹ Waste heat boiler

The boiler collects the heat from the flue gas of re-combustion furnace to increase the heat efficiency of the facility. The collected heat energy is used for production of the steam to be supplied to the sludge cake dryer.

❺ Scrubber (flue gas treatment tower)

The scrubber removes soot and dust, and sulfur oxides and hydrogen chlorides in the flue gas by gas-liquid contact between the flue gas from the re-combustion furnace and the sewage treatment water.

❻ Wet-type electrostatic precipitator (EP)

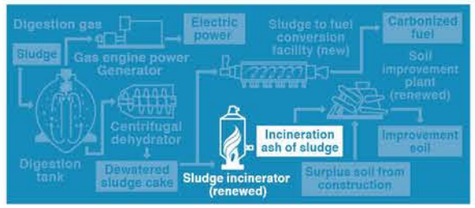
The precipitator removes soot and dust in the flue gas by electrifying the floating particles in the flue gas by corona discharge in an electric discharge electrode and collecting them in a dust collecting electrode.

❼ Mercury adsorption column

The column adsorbs and removes mercury in the flue gas by the mercury adsorbent.

Process flow of incineration facility

The facility reduces the quantity of sludge cake by incineration.



Legend

- Dewatered sludge
- Sludge incineration ash
- Air
- Flue gas (off gas)
- Drying flue gas
- Water
- Fuel (digestion gas, city gas)

Sewage Treatment water
Sludge cake
Fixed-quantity feeder
Sludge cake transfer pump
Auxiliary fuel
❶ Dryer
❷ Incinerator
Auxiliary burner
❸ Primary air preheater
Primary air blower
❸ Secondary air preheater
Secondary air blower
❹ Waste heat boiler
❺ Cyclone
❺ Filter
Induction fan
Atmosphere
Flue
❻ Ash hopper
Water discharge

❶ Dryer

It is a sludge cake dryer of a steam indirect heating system, and reduces water content of dewatered sludge cake up to approximately 30%. By drying, it reduces the auxiliary fuel consumption in the incinerator.

❷ Incinerator

The furnace incinerates sludge cake completely by the fluidized bed adjusted to a prescribed temperature. The burner which can be used by switching between the city gas and the digestion gas enables economical and environmentally friendly operations.

❸ Primary/secondary air preheater

The air preheater performs heat exchange between the incinerator flue gas and the combustion air, and heats the combustion air up to approximately 700°C.

❹ Waste heat boiler

The boiler collects the heat from the flue gas to increase the heat efficiency of the facility. The collected heat energy is used for production of the steam to be supplied to the sludge cake dryer.

❺ Cyclone and Filter

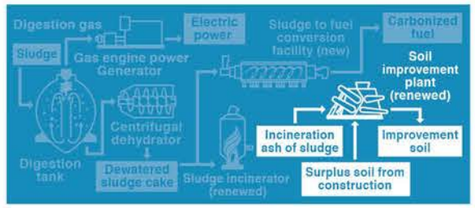
These remove the incineration ash in the flue gas by 99% or more.

❻ Ash hopper

The hopper temporarily stores the incineration ash collected from the waste heat boiler and the flue gas treatment facility. The stored incineration ash is transferred to the improvement soil facility.

Process flow of improvement soil facility

The facility for production of high quality backfill (improvement soil) by adding/mixing incineration ash generated in the incineration facility to/with excavated soil from sewer construction , etc.



Legend

- Soil generated in construction
- Improvement soil
- Sludge incineration ash
- Quicklime
- Unsuitable matter

Soil generated in construction
Generated soil charging hopper
❶ Generated soil separator
Unsuitable matter
• Asphalt
• Concrete
• Natural stone, etc.
❷ Picking conveyor (with magnetic separator)
Generated soil transport conveyor
Unsuitable matter
• Metals
• Vinyl, etc.
Quicklime hopper
Incineration ash hopper
❸ Primary mixer
❸ Secondary mixer
❹ Primary classifier
(particle size : > 40 mm)
Improvement soil (particle size : < 40 mm)
Improvement soil charging hopper
❺ Secondary classifier
Improvement soil (particle size : < 20 mm)

❶ Generated soil separator

From the soil generated in construction from which large particles (more than 300 mm) have been removed by the generated soil charging hopper, medium particles (300 to 150 mm) are sorted and removed by the generated soil separator.

❷ Picking conveyor

Unsuitable matters (iron scrap, waste plastic, wood piece, etc.) which cannot be removed by the generated soil separator are sorted and removed manually or by a magnetic separator.

❸ Primary/secondary mixer

Lime and incineration ash are added and mixed to/with the soil generated in construction. Then, only the incineration ash is added, and the soil is mixed again. The soil generated in construction and the conditioner are mixed enough by two mixing processes.

❹ Primary classifier

Small particles (150 to 40 mm) are sorted and removed from the soil generated in construction after adding the incineration ash, to produce the improvement soil of a particle size of less than 40mm.

❺ Secondary classifier

The improvement soil is sorted into particles less than 20mm and particles less than 40mm. The improvement soil after sorting is stored in each stockyard.

Project outline

❶ Project purpose

- Reconstruct aging equipment
- Effective use of all sewage sludge
- Reduction of greenhouse gas emissions

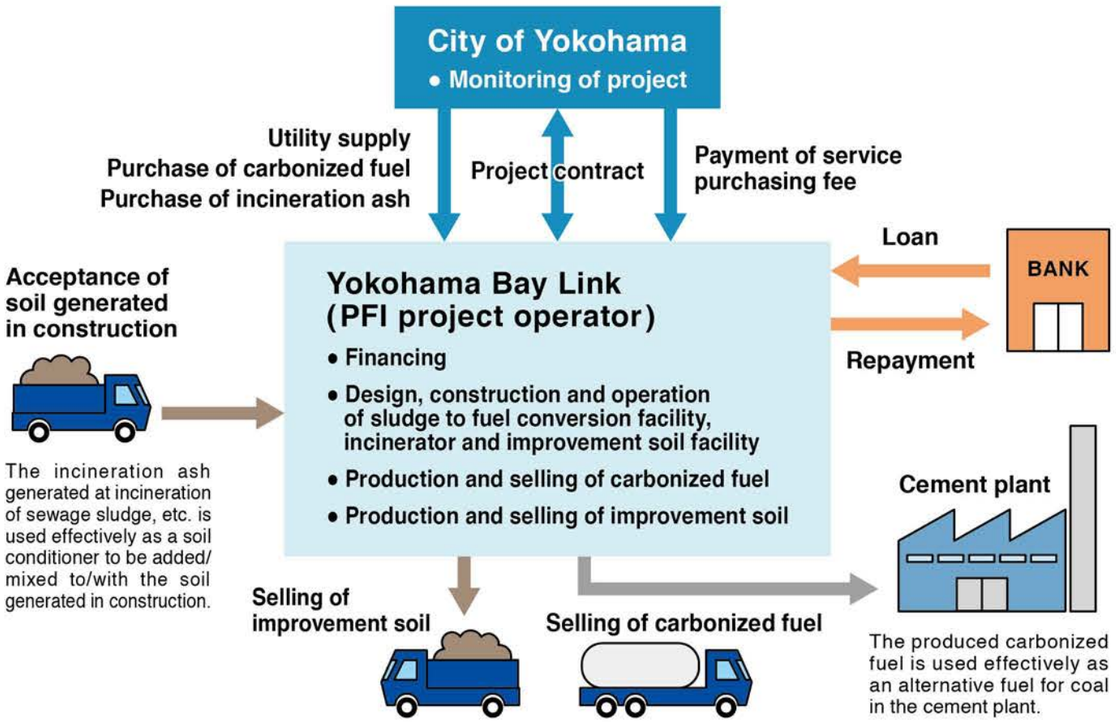
❷ Project method

The project method is the BTO (Build Transfer Operate). After designing and building the sludge to fuel conversion facility, incinerator and improvement soil plant, the project operator transfers its ownership to the city and operates the facilities until the end of the project period.

❸ Project period

From August 31, 2016
to March 31, 2039

Project implementation system



The incineration ash generated at incineration of sewage sludge, etc. is used effectively as a soil conditioner to be added/mixed to/with the soil generated in construction.

The produced carbonized fuel is used effectively as an alternative fuel for coal in the cement plant.

Project effects

Cost reduction

The cost is reduced by carrying out the project as a PFI project using private capitals and inventive ideas.

Greenhouse gas reduction

Greenhouse gas emissions are reduced by up to 32% (8,556 t-CO_2 / year) compared to the existing incinerator and improvement soil facility.

Stable project operation

Stable project operation is possible over 22 years from design and construction to operation by using experience and know-how of the project operator.

Outline of facilities

Sludge to fuel conversion facility

Carbonization system	Low temperature carbonization system * This enables production of fuel with higher heating value and lower pyrophoric property compared to the high temperature carbonization system and the medium temperature carbonization system.
Dust removing system	Wet-type electrostatic precipitator
Processing capacity	Up to 200 t-wet/day
Planned carbonized fuel production amount	4,555 t/year (for 214 days operation)
Carbonized fuel property (representative value)	• Shape ϕ 1 to 2 mm granular • Bulk specific gravity 0.6 to 0.65 approximately • High-order heating value 14.8 MJ/kg

Environmental load item	Exhaust gas concentration
Sulfur oxide	50 ppm or less
Nitrogen oxide	80 ppm or less
Soot and dust	0.02 g/m³ (N) or less
Hydrogen chloride	50 mg/m³ (N) or less
Dioxin	0.05 ng-TEQ/m³ (N) or less
Odor (outlet)	Odor index 38 or less
Odor (site boundary)	Odor index 15 or less
Mercury	50 μg/m³ (N) or less

※ Exhaust gas concentration complies with the environmental standards stipulated by Yokohama City.

Incineration facility

Combustion system	Fluidized bed system Circulation fluidized bed system
Dust removing system	Filter
Processing capacity	Up to 150 t-wet/day (fluidized bed system) Up to 200 t-wet/day (circulation fluidized bed system)

Environmental load item	Exhaust gas concentration
Sulfur oxide	50 ppm or less
Nitrogen oxide	100 ppm or less
Soot and dust	0.04 g/m³ (N) or less
Hydrogen chloride	50 mg/m³ (N) or less
Dioxin	0.1 ng-TEQ/m³ (N) or less
Odor (outlet)	Odor index 35 or less
Odor (site boundary)	Odor index 15 or less
Mercury	50 μg/m³ (N) or less

※ Exhaust gas concentration complies with the environmental standards stipulated by Yokohama City.

Improvement soil facility

Production capacity	70 m³/h
Incineration ash adding quantity	40 kg/m³ or more
Improvement soil property	• CBR value 15% or more • Particle size General use less than 40 mm PVC pipe foundation use less than 20 mm