Overview of Waste Management and the Facility Maintenance

Center for Material Cycles and Waste Management Research
National Institute for Environmental Studies, Japan (NIES)

General flow diagram of waste management

Municipal waste

Industrial waste

Disaster waste

Transport

Incineration

Crushing/sorting

Composting

Other

Residue

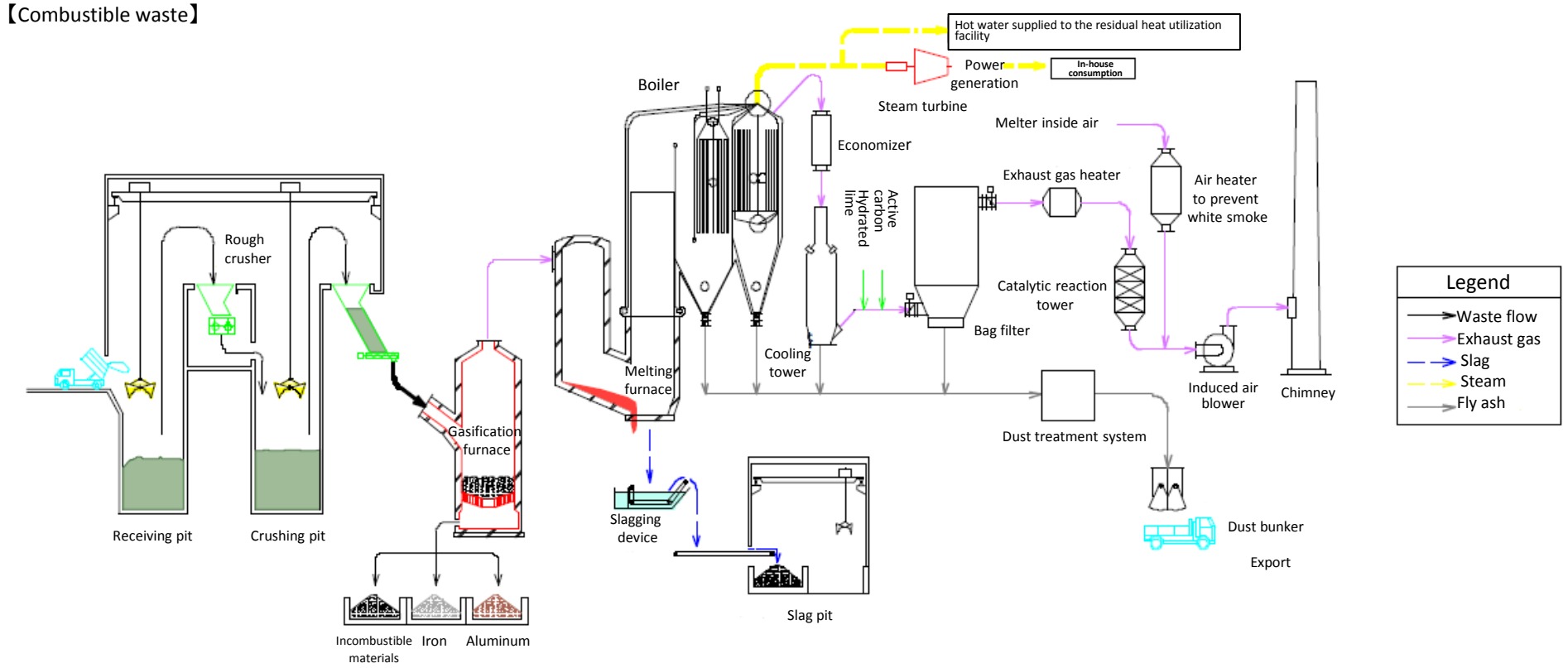
Valuables

Transport

Final disposal

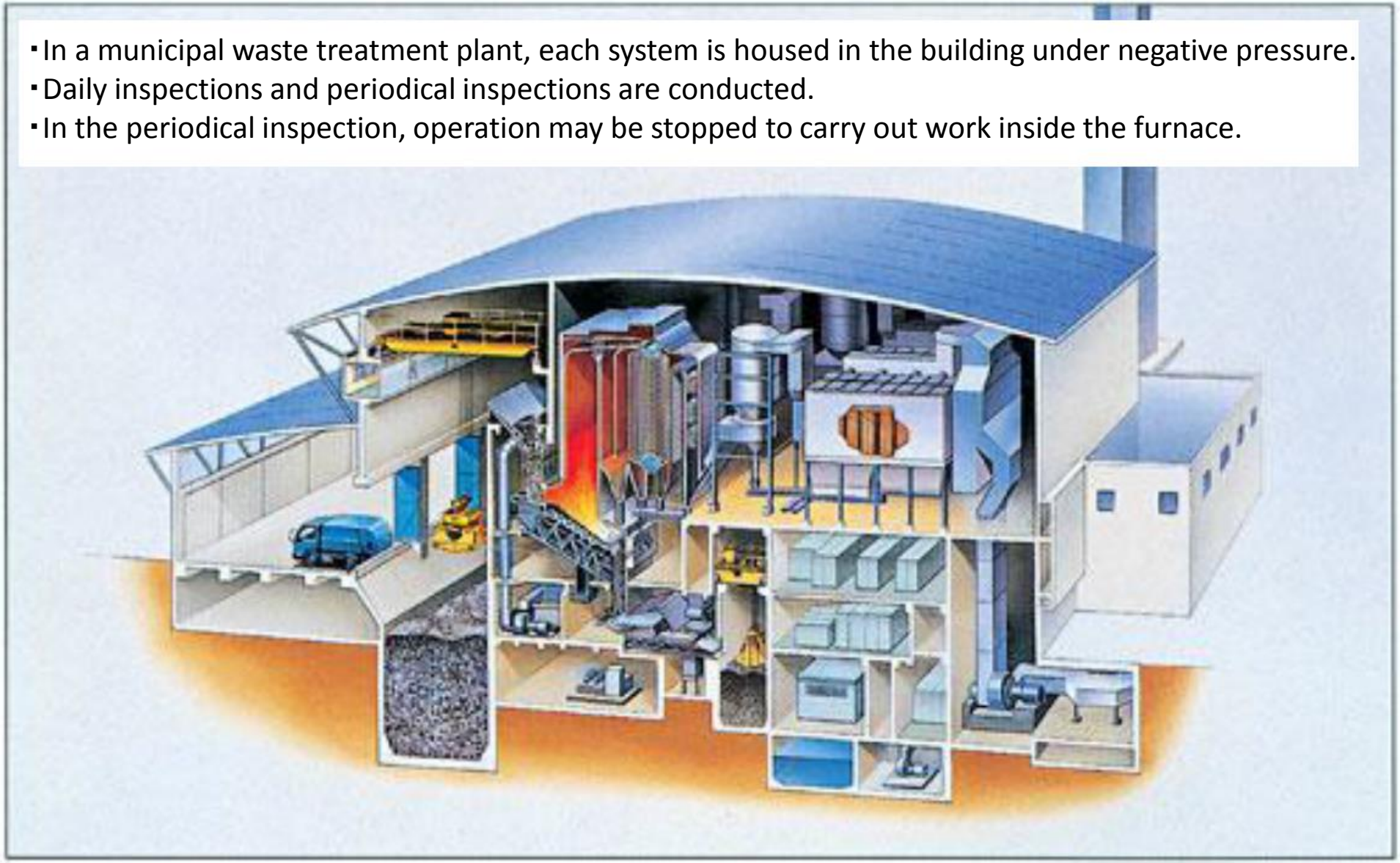
Recycled

An example flow diagram in the waste incineration facility



Cut-away view of the incineration facility

- In a municipal waste treatment plant, each system is housed in the building under negative pressure.
- Daily inspections and periodical inspections are conducted.
- In the periodical inspection, operation may be stopped to carry out work inside the furnace.



Source: Mitsubishi Heavy Industries Environmental & Chemical Engineering Co., Ltd. Homepage

Locations of potential high dose rate in the incineration facility

The dust is knocked off at regular intervals. There is no significant accumulation of dust at the bag filter system. The dose rate is relatively low.

A large volume of dust (fly ash) is accumulated in the dust storage tank. The dose rate is high in the proximity.

Accumulation of radiocesium in the melting facility

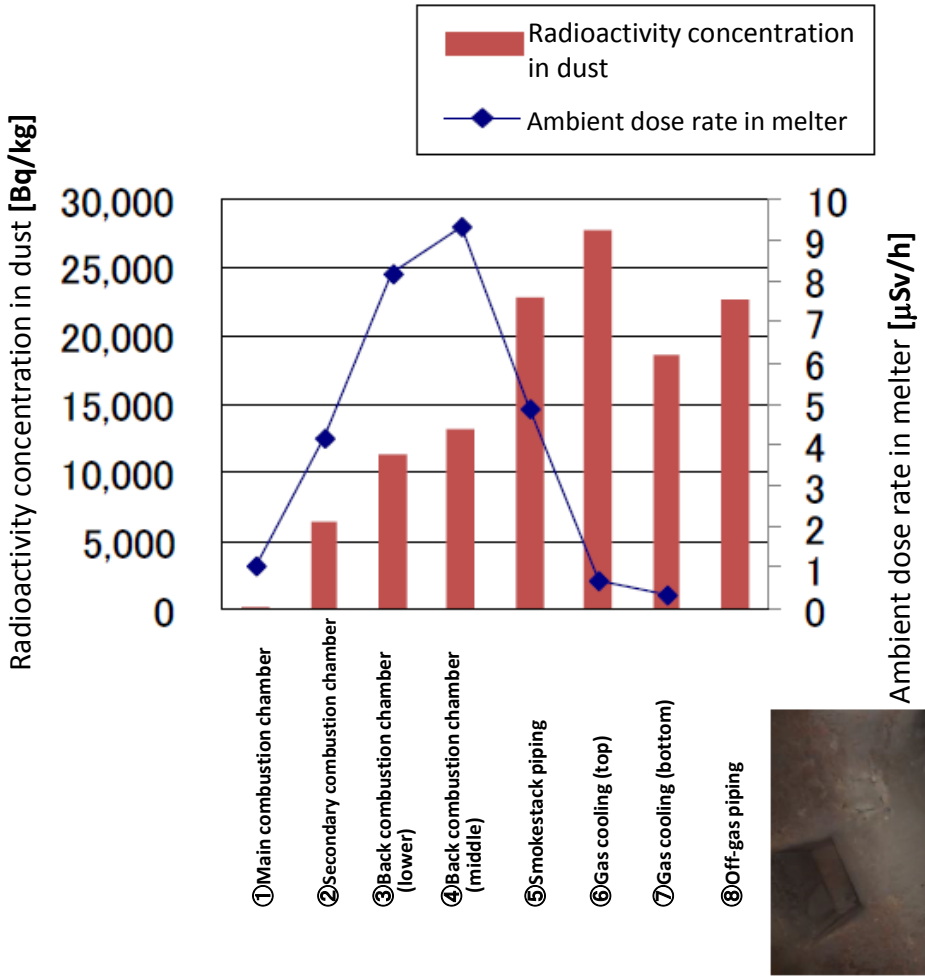


Figure: Radioactivity concentration in dust and ambient dose rate in melter

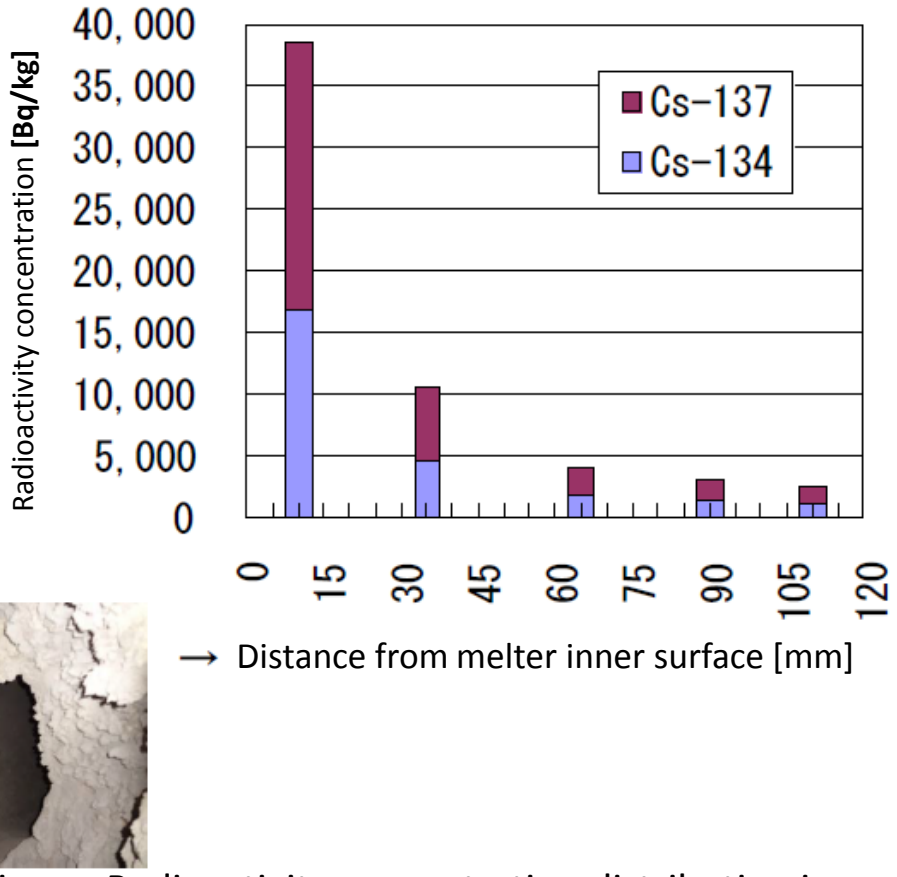
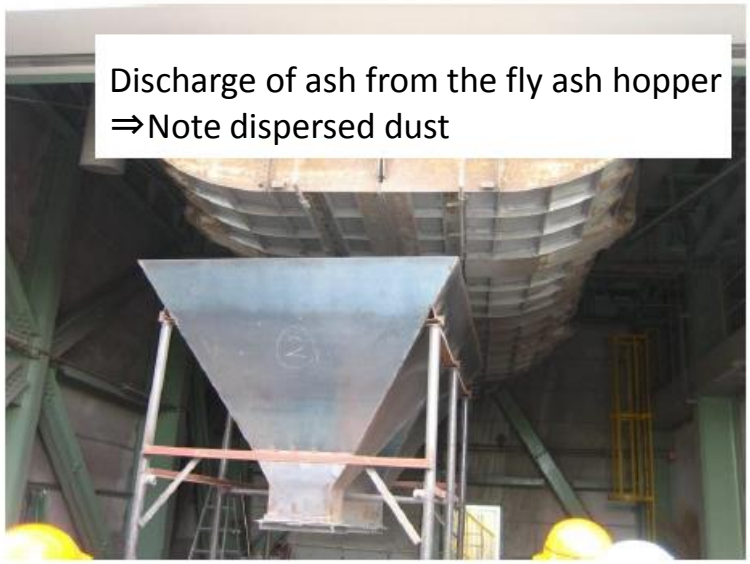


Figure: Radioactivity concentration distribution in the refractory of the back combustion chamber (middle)

Source : ”Survey on the ambient dose rate inside the rotating surface melter and the penetration of radiocesium into the refractory” by Abe et al., The 1st Workshop of The Society for Remediation of Radioactive Contamination in the Environment (2012)

Handling of incineration fly ash containing radiocesium



Treatment of disaster waste in Miyagi Prefecture

（Miyagi Eastern Block Secondary Processing Plant）

The issue in the future is the disaster waste treatment in the project managed directly by the national government in Fukushima Prefecture.

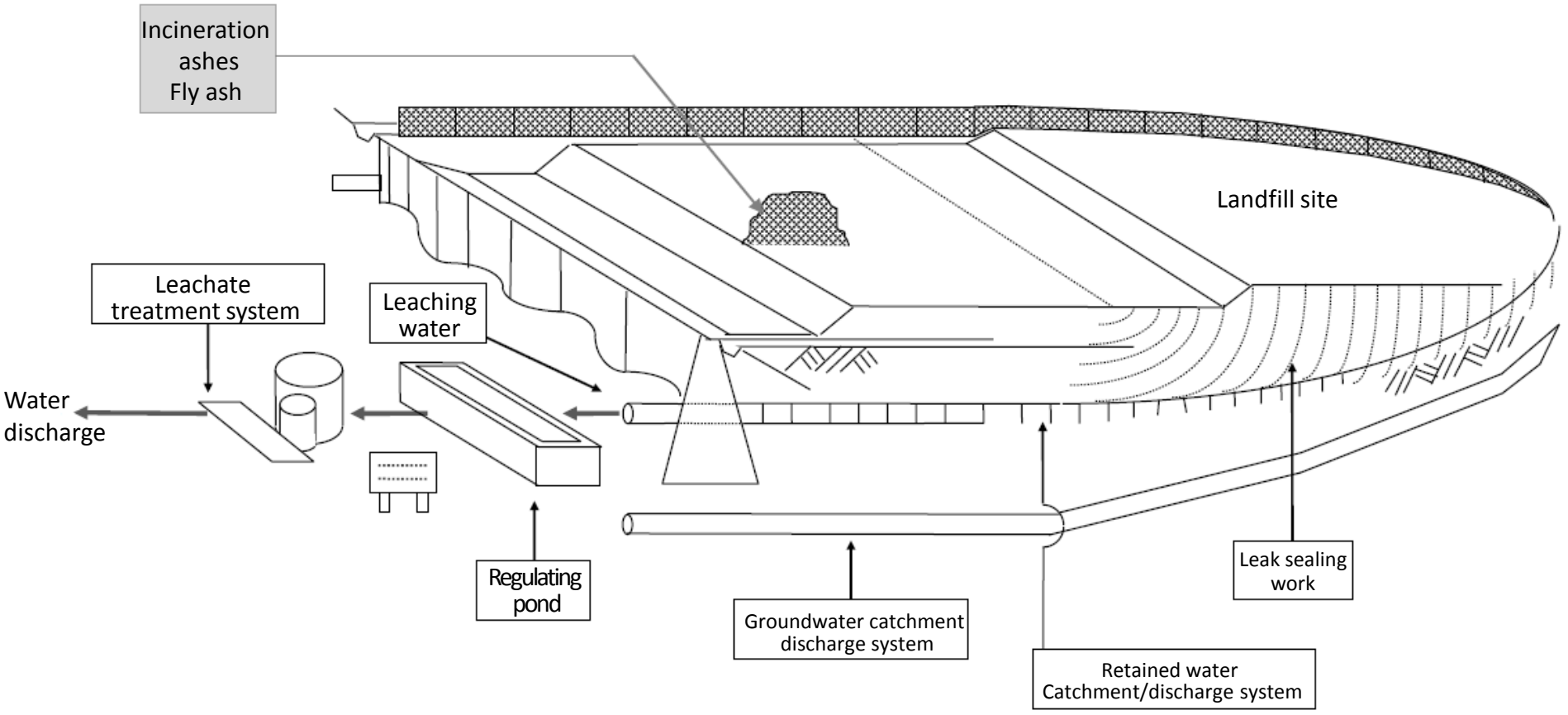
Track scale transportation management

Roofed stock yard for waste mixtures

Crushing/sorting facility for mixed waste

Temporary incineration facility (stoker type)

Landfill disposal site



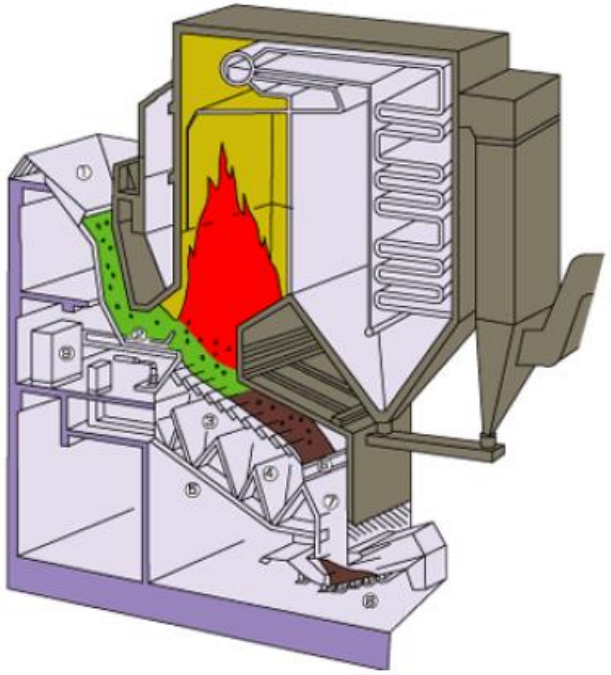
Landfill works: Transportation and placement using trucks ⇒Leveling with heavy equipment ⇒Covering with soil

（Reference）

For measures to prevent radiation exposure at waste incineration facilities, refer to “Preventive measures for dioxin exposure at works in waste incineration facilities”, issued by the Ministry of Health, Labour and Welfare on 25 April 2001.

（Reference）What is the behavior of radiocesium in the waste when being incinerated?

The radiocesium in the waste will be divided into two parts: one part is volatilized or forms small liquid drops when the flame temperature is 850℃ or higher and it is discharged along with the exhaust gas; and that the second part remains in the ash.



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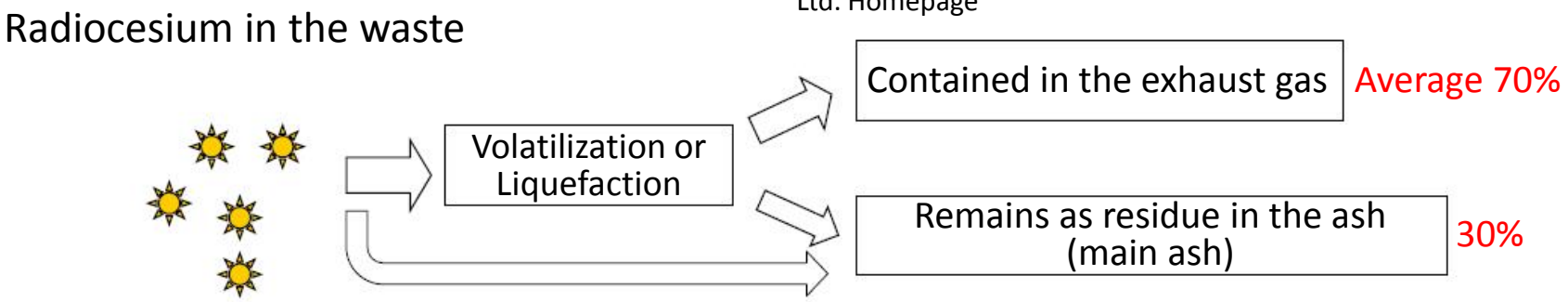
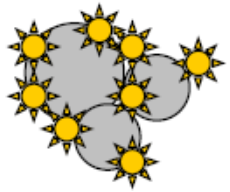


（Reference）What is the behavior of the volatilized radiocesium in exhaust gas?

When the exhaust gas is cooled, radiocesium in the form of a gas or a liquid will form chemical compounds, most likely (radio)cesium chloride, in solid form, and the resulting solid particles are transported along with other materials as dust particles.

Cesium chloride, etc. in the form of gas

Condensed



Dust particles (fly ash)
（Several tens of μm in average）

The temperature near the bag filter drops to 200℃ or below

Characteristics of cesium chloride (CsCl) in exhaust gas
Boiling temperature (temperature to transform from liquid to gas phase): 1300℃
Melting point (temperature to transform from solid to liquid phase): 646℃

(Reference) Comparison of vapor pressure at temperatures of 150 and 170℃ near the bag filter (Calculated by NIES)

Temperature (℃)	Vapor pressure of 2,3,7,8-T4CDD (Pa) (tetrachlorodibenzo dioxin)	Vapor pressure of OCDD (Pa) (octachlorodibenzo dioxin)	Vapor pressure of CsCl (cesium chloride) (Pa) (Note that this is an estimated value)
150	0.522	7.15E-03	2.75E-12
170	2.560	4.79E-02	3.37E-11

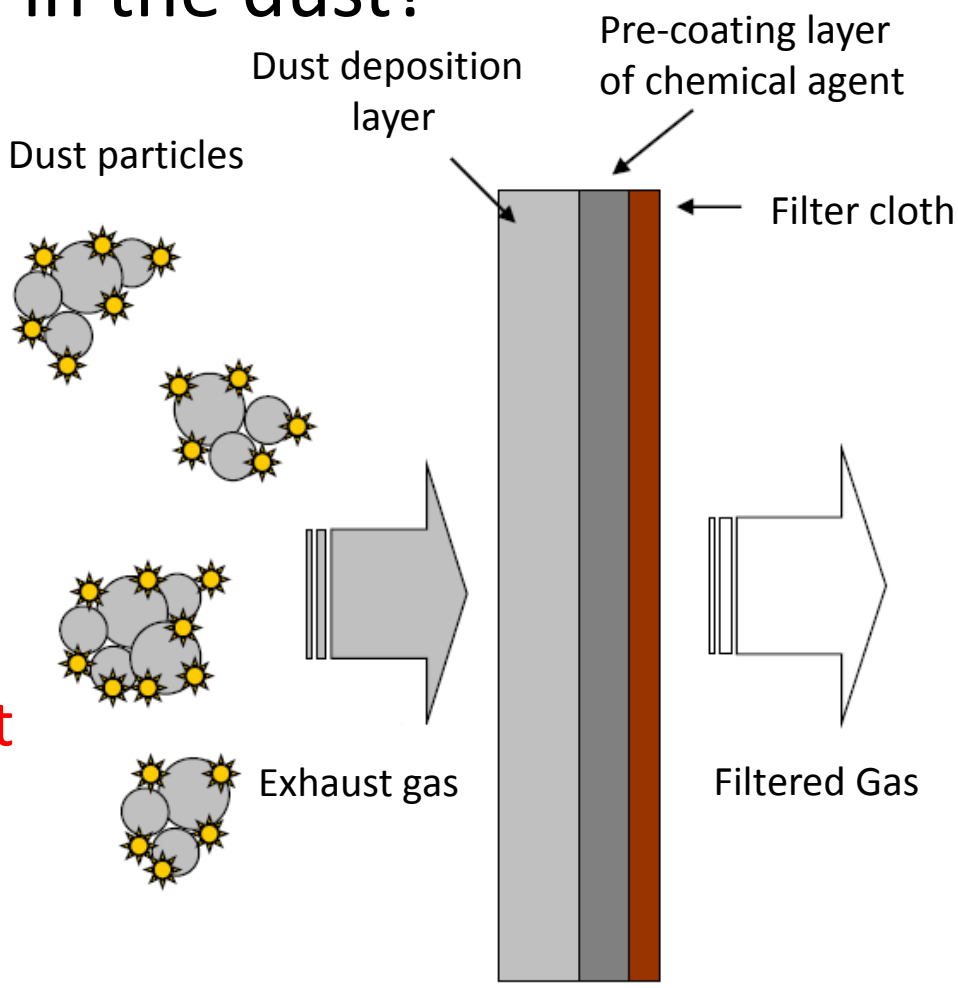
Vapor pressure of CsCl (cesium chloride) is substantially lower compared with dioxins. All are trace contaminant but the estimated vapor pressure of CsCl is 9 to 11 orders of magnitude lower than the values of the dioxins.

Radiocesium is solidified more easily than dioxins are, meaning it is removed more easily with the bag filter.

（Reference）What is the behavior of radiocesium contained in the dust?

○Dust particles containing radiocesium may be removed or collected efficiently with a bag filter.

○A pre-coating layer of chemical agent is formed on the filter. Dust particles deposit as a layer on the coated filter and particles having a size of submicron order (less than 1μm) are removed.



Mechanism of removing particles with the bag filter