



## A Collection of Primary Tools

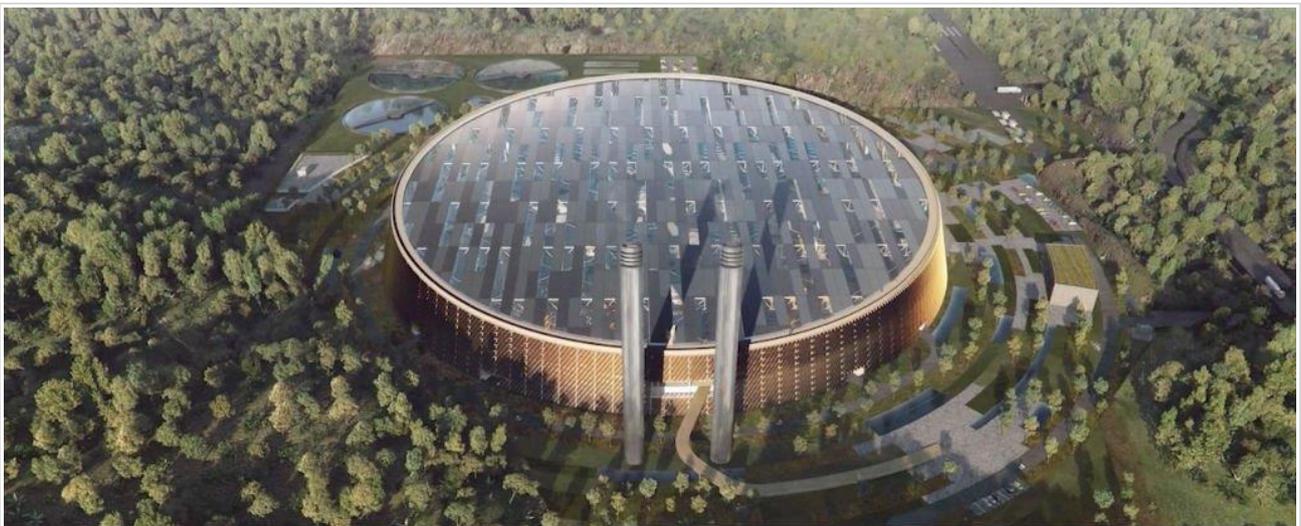


Solid Waste Management

### Tool SWM 4 - Management of Solid Waste Incinerators

**What this tool does:** Incinerators have become popular in China for processing of household waste. However, apart from their high capital costs, there is a lot of debate about the acceptability of this technology. Many cities are seeking advice, and express need to share experiences. This paper compares some Pros and Cons of the technology.

**Definition:**<sup>1</sup> “A waste treatment technology, which includes the combustion of waste for recovering energy, is called as “incineration”. Incineration coupled with high temperature waste treatments are recognized as thermal treatments. During the process of incineration, the waste material that is treated is converted into gases, particles and heat. These products are later used for generation of electricity. The gases, flue gases are first treated for eradication of pollutants before going in to atmosphere. Among waste-to-energy technologies, incineration stands taller.



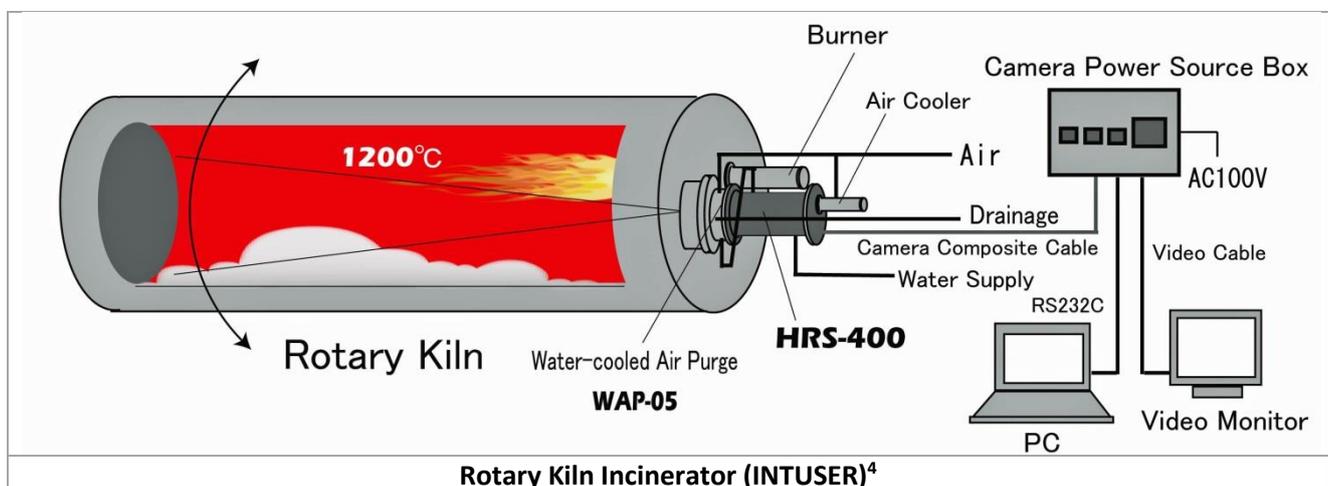
*The Chinese city of Shenzhen plans to tackle its serious waste problem by burning 5,000 tonnes of it a day in what will become the largest waste-to-energy plant in the world<sup>2</sup>*

Other technologies are gasification, PDG, anaerobic digestion and Pyrolysis. Sometimes Incineration is conducted without the reason for recovering energy. In [the] past, incineration was conducted without separating materials thus causing harm to environment. This un-separated waste was not free from bulky and recyclable materials, even. This resulted in risk for plant workers health and environment. Most of such plants and incinerations never generate electricity. Incineration reduces the mass of the waste from 95 to 96 percent. This reduction depends upon the recovery degree and composition of materials. This means that incineration however, does not replace the need for landfilling but it reduced the amount to be thrown in it. Incineration comes with a number of benefits in specific areas like medical wastes and other life risking waste. In this process, toxins are destroyed when waste is treated with high temperature. Incineration or thermal treatment of waste is much popular in countries ... where there is scarcity of land. The energy generated by incineration is highly demanded in countries like Denmark and Sweden. In year, 2005 it was estimated that 4.8 percent of the electricity as is consumed by Danish nation was produced by incineration and the amount of heat was some 13.7 percent out of total. Other than Denmark and Sweden many European countries are recovering heat and electricity from waste.

### How does it work? <sup>3</sup>

Incinerators and their types: Incinerator can be understood more precisely as a furnace where waste is burnt. Modern incinerators are equipped with pollution improvement systems, which play their part in cleaning up the Flue gas and such toxicants. Following are the types of plants for burning waste:

**Moving Grate:** The incineration plant used for treating MSW is moving grate. This grate is capable for hauling waste from combustion chamber to give way for complete and effective combustion. A single such plant is capable for taking in thirty-five metric ton of waste every hour for treatment. Moving grates are more precisely known as incinerators of municipal solid waste. This waste is poured in the grate with a help of crane from and opening or throat. From here, the waste has to move towards the ash pit. Waste is further treated and water locks wash out ash from it. Air is then flown through the waste and this blown air works for cooling down the grate. Some of grates are cooled with help of water. Air is blown through the boiler for another time but this time comparatively faster than before. This air helps in complete burning of the flue gases with the introduction of turmoil leading to better mixing and excess of oxygen. In some grates, the combustion air at fast speed is blown in separate chamber. European Waste incineration Directive is of the view that an incineration plant must be designed so that operating worker must know that flue gases are reaching the temperature of eight fifty degrees centigrade with in two seconds. This would ensure complete and required breakdown of toxins of organic nature. In order to achieve this every time back-up auxiliary burners must be installed.



1. **Fixed Grate:** This was the fixed and much older version for grate. This kind generally is lined with the brick while lower or ash pit is made up of metal. This grate generally has an opening at the top and for loading purpose; a side of the grate is left open. A number of fixed grate were first formed in houses, which today are replaced by waste compactors.
2. **Rotary-kiln:** Industries and municipalities generally use this sort of incinerator. This incinerator consists of two chambers i.e. primary and secondary chamber.
3. **Fluidized Bed:** In this sort of incineration, air is blown at high speed over a sand bed. The air gets going through the bed when a point come where sand granules separates and let air pass through them and here comes the part of mixing and churning. Therefore, a fluidized bed comes in to being and fuel and waste are then can be introduced. The sand along with the pre-treated fuel or waste is kept suspended and is pumped through the air currents. The bed is thus mixed violently and is uptight while small inert particles are kept suspended in air in form of fluid like form. This let the volume of the waste, sand and fuel to be circulated throughout the furnace, completely.
4. **Specialized incineration:** When it comes to the furniture factory for incineration of the waste, they need to take special precautions, as they have to handle inflammable material. For this purpose, they have incinerators, which are installed with burn back prevention systems and are very much necessary for the dust suspensions when they are more able to catch up the fire.
5. **Use of Heat:** The heat that is produced by an incinerator can be used for generating steam, which is used for driving a turbine in order to produce electricity. The typical amount as is produced by Municipal waste per ton is 2/3 MWh for electricity and two MWh for heating.
6. **Pollution:** Incineration is conducted with a number of outputs, which include ash and flue gas emission. Before the flue gas cleaning systems were introduced, the flue gas has to move to atmosphere thus leading to pollution.

#### 7. **Emission of Gases:**

**a. Furans and Dioxins:** The biggest most concern, which has caught thoughts of environmentalists about MSW's incineration, is production of a huge amount of furans and dioxins. These are considered staidly injurious to health. Modern generators are equipped with special equipment to clean emission of gases from these injurious components. There was a time when no governmental regulation were there to bound incineration and save environment and atmosphere from this hazardous emission of gases but today there are strict and rigid rules and regulations to follow and conduct incineration.

**b. Carbon dioxide:** Incineration while being conducted produces a vast amount of Carbon dioxide. Carbon dioxide plays a due role in global warming, as this is the greenhouse gas. It has been observed that almost everything which has carbon in its composition is when processed by incineration evolves out as carbon dioxide.

**c. Extra Emissions:** Some other emissions of gases by waste processing are sulphur dioxide, hydrochloric acid, fine particles and heavy metals.

**d. Cleaning out Flue Gas:** A number of processes are involved for the cleaning up of flue gas. The mixture of flue gas is collected by means of Particle filtration and this filtration is conducted using electrostatic precipitators and baghouse filters. Baghouse are very effective for fine particles. The next step of the processing and cleaning of flue gas is processing of scrubbers, which are critical for the removal of hydrochloric acid, nitric acid, mercury, hydrofluoric acid, lead and residuary heavy metals. With the reaction of lime, sulphur is converted in to gypsum. The wastewater, which comes out of scrubbers, is then passed through wastewater

treatment plant. Desulphurization is a process that is used to remove sulphur dioxide with the limestone slurry injection directly in to flue gas. Nitric component or gases are reduced with catalytic reduction with help of ammonia application. Heavy metals are removed with the help of active carbon injection. Particles are the collected at filters.

**e. Solidify Outputs:** Flue ash and Bottom ash is produced with the processing of waste materials and settle at the bottom of the incineration plant. The ash, which is produced, is four to five percent of total weight of the waste processed while the flue ash makes up some ten to twenty percent of total weight of waste material. The heavy metals, which are contained in the flue or bottom ash, are lead, cadmium, zinc and copper. A small amount of furans and dioxins are also produced. It is to mention here that bottom ash seldom have heavy metals in it. Flue ash is hazardous while bottom ash is not that dangerous or injurious to health.

**8. Other issues related to Pollution:** Older models of incinerators have inconvenience that this produce odour pollution. However, in modern plants are saved from producing dust and odour pollution. They are designed to store waste in enclosed containers along with a negative pressure to keep from odour and dirt dispersal. Another issue that is affecting community is increased load of traffic due to weighted call value (WCV) for hauling waste materials. This is the issue, which has forced incinerators to move in to industrial areas. “

### **The debate over Incineration<sup>5</sup>**

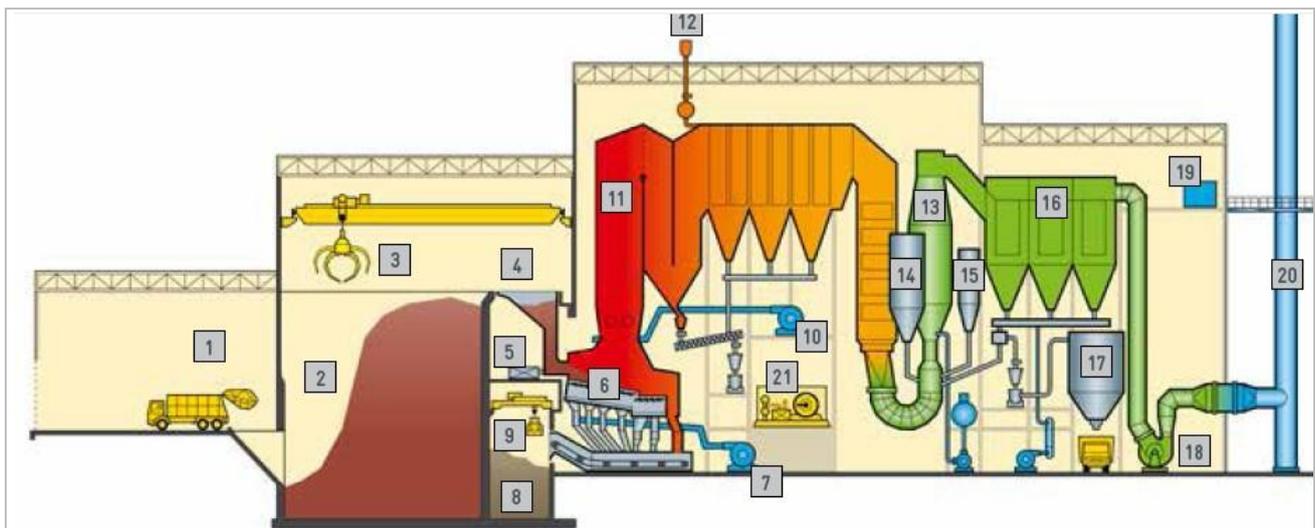
Usage of incineration for waste management is divisive. The debate for incinerators generally involves business interests, regulations of government, activists if environment and citizens.

#### **Arguments supporting incinerations:**

8. The first concern for incineration stands against its injurious effects over health due to production of furans and dioxin emission. However, the emission is controlled to greater extent by developing of modern plants and governmental regulations.
9. Incineration plants are capable for producing energy and can substitute power generation plants of other sort.
10. The bottom ash after the process is completed is considered non-injurious that still is capable for being land filled and recycled.
11. Fine particles are removable by processing through filters and scrubbers.
12. Treating and processing medical and sewage waste produces non-injurious ash as product.

#### **Arguments against incinerations:**

13. Extremely injurious matter needs adequate disposing off. This requires additional miles and need special locations for land filling this material.
14. Although after a lot of regulations and restrictions and developments concerns are still alive about emission of furans and dioxins.
15. Incinerating plants are producers of heavy metals, which are injurious even in minor amounts.
16. IBA is consistent over a considerably high level of heavy metals and can prove fatal if they are not disposed of, or reused properly.
17. Initial investment costs are only recovered through long periods of contract for incinerating plants.
18. Local communities always have opposed the presence of incinerating plant in the locality. The upheld view is to recycle, reuse and waste reduction instead of incineration.”



WASTE DELIVERY	INCINERATION	FLUE GAS CLEANING	ENERGY RECOVERY
1 Tipping hall	5 Ram feeder	13 Flue gas reactor	21 Steam turbine / generator
2 Waste bunker	6 Incineration grate	14 Hydrated lime	
3 Waste crane	7 Primary air fan	15 Activated carbon	
4 Waste feeding chute	8 Bottom ash bunker	16 Bag filter	
	9 Bottom ash crane	17 Residue silo (fly ash)	
	10 Secondary air fan	18 ID fan	
	11 Steam boiler	19 Emissions Monitoring System (CEMS)	
	12 Boiler safety valve	20 Stack	

Components of a municipal solid waste incineration plant with flue gas cleaning. Image source: Doosan Lentjes GmbH<sup>6</sup>

## Credentials

Principal authors: Michael Boldt, Sweco  
 With Annabelle Cleeve (Mott MacDonald)  
 Editing: Kosta Mathey and Florian Steinberg.

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