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THE EFFECT OF COLLECTION ON THE OPERATIONAL PROBLEMS AT THE ISTANBUL'S MEDICAL WASTE INCINERATION PLANT

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ABSTRACT

Incineration of infectious wastes generated by hospitals and clinics is preferred option to get them sterilized and make them safe for the environment. Istanbul has been a rapid growing metropolitan city during last decades. Its present population is about 10 million. Number of hospitals which is being collected their medical wastes by Greater Municipality of Istanbul has been reached by about 200. Collected medical wastes are burned in the plant having capacity of one ton waste per hr.

In this presentation, main problems observed during collection of wastes and operation of the plant are introduced and evaluated.

TECHNICAL ASPECTS OF THE INCINERATION PLANT

The plant contains basic units of rotary drum combustion, turbine-generator group and stack gas cleaning. Capacity of combuster is one ton waste per hour. The plant has been designed for wastes in mean heat content of 3500 kcal/kg. Although that, the range of heat content of wastes to be combusted in the plant is 2000-4540 kcal/kg. For that reason, to burn wastes in combustion chamber in low heat content, additional consumption of fuel is subjected. Projected generations of steam and electricity from the combustion process are 5,22 t/h and 428 kW/h respectively. Medical wastes are fed into the chamber of combustion through Cr-Ni stainless steel vibrating ducts. The rotary drum has 7.5m length, 2.73m diameter and 0-12 rph rotating velocity. Combustion is made in two steps: first step in 900°C and second step in 1200°C. Combustion is reinforced by two auxiliary burners. Water to be used in the plant is prepared in a reverse osmosis unit in a capacity of 1 m^3/hr.

Stack gas cleaning unit is composed of a water-sprinkling tower, a reactor, a filtration unit and a stack. Water sprinkling tower has 8m height, 2.2 diameter. 10,980 m^3/hr burned gas enters the tower. Influent and effluent gas temperatures are 170 and 140°C subsequently. In the reactor, lime particles are used in order to remove sulfurdioxide and halogenated compounds. Its sizes are 1.6 m (L) * 1.6 m (W) * 7.5 m (H). Liming dosage is between 10-200 kg/hr. Lime particles reacted with pollutants are taken from the gas stream in bag house filter with 210 bags. The stack has 50 m height and 0.60 m diameter. 14,000 m^3/hr gas from the stack is discharged.

All of the units in the plant are connected to computers in a control room. Two operators employed to keep on control the units. The plant also is equipped with 4 cameras and 4 monitors at different points.

PROBLEMS DURING WASTE COLLECTION

A numerous problems are observed during collection of medical wastes. Some of them is as stated below:

- Lack of interest of responsible persons in institutions
- Lacks of organization and communication in institutions
- Unqualified private cleaning firms in institutions
- Improper disposal ways for medical waste items
- Collecting with thin bags (thinner than 150μm thickness)
- Mixing serum bottles with infected wastes
- Insensitivity in separate disposal of infected and other wastes
- Absent of temporary depot for medical wastes in some institutions
- Insufficient technical specifications of temporary depots
- Intensive bureaucracy originated from valid legislation
- Seasonal fluctuations in medical waste production
- Economic insufficiency of institutions
- Lack of inspection of related authorities
- Decreasing of waste amounts due to doubt of charge for wastes

Problems mentioned above cause to:

- Lower amount of medical wastes collected
- Wastes in poor quality to burn in the plant
- Variable amounts of wastes collected by time
- Variable quality of wastes collected by time, different contents of water and heat etc.
- Arriving of domestic wastes together with medical wastes to the plant
- Failure in the collection of infected wastes, overlooked wastes, contamination risk

PROBLEMS DURING OPERATION OF THE PLANT

Some of the most important problems arising during operation of the plant and their fixing ways have been presented as follows:

a) Blood and other liquids leak from the bags, bags are weak, contamination danger for workers and public health:
To solve this problem, as sharp things tear bags, medical waste producers were warned to drop their sharp items like needle etc into a small box resisting being punctured. Bag loading area also was made more hygienic by establishment of a ventilation system. In the ventilation system, exhaust gas was fed into the combustion chamber as an air supply.

b) Feeding system prior to combustion chamber failures occasionally:
Feeding system was looked over.

c) Refractory bricks of rotary combustion chamber fall down:
Bricks are 2 times repaired, and changed partly.

d) Grate system following the combustion chamber is clogged by liquefied:
Stone accumulation sticking to walls of the system has chemical characteristic given in Table 1 [1]. In a different study, the rate of materials insoluble in acids was between 33-39% [2].

In the system, 270 kg wet and 230 kg dry ash (about 10 kg metal pieces also contains) for one ton wet fed waste mass is obtained currently. This amount defines us that the general waste stream coming to the plant has so much inert portion in it. It can be estimated that it becomes heavily from glass content of the stream, because iron content in the ash is not so high.

Table 1. Chemical composition of inert accumulations on the wall of the system [1]

Element	% weight	Oxides of the element	% weight
Na	12.6	Na_2O	11.9
Mg	1.2	MgO	1.3
Al	3.4	Al_2O_3	4
Si	5.5	SiO_2	7.1
P	1.7	P_2O_5	2.2
K	2.8	K_2O	1.9
Ca	30	CaO	23.7
Ti	5.4	TiO_2	5
Fe	0.9	FeO	0.7
Zn	1.4	ZnO	1.1
S	23.6	SO_3	34.7
Cl	11.6	Cl	6.5

Grate system has been converted to water-cooled instead of air-cooled. By this way, the mass of ash and slag being like a bone in the system have been made brittle. Clogging does not occur any more.

e) Upper side refractory bricks of after burner fall down:
Repaired.

f) At second entry of steam generator and super heater zone, clogging occurs due to condensation of ash. In order to fix this problem;

1. Soda was fed into combustion chamber from near side of waste feeding hole
2. Cleaning system by balls in 3-4 mm diameter was settled. Balls were applied by pressured air. System starts time by time automatically.
3. Due to difficulty of repair and maintenance, type and position of super heater were changed. It was taken from top to side of boiler.

g) Due to lower gas temperature (115°C) in the bag-house, clothes of bags are clogged in the existence of humidity by $CaCl_2$, $CaSO_4$ and so on:
Preheating by 140°C to prevent condensation in the filter unit was realized.

CONCLUSION

After setting up medical-waste incineration plant of Istanbul, some typical problems in the operation of the plant have been arisen. Surely, these problems are originated from medical waste composition. Because waste producers still do not show interest to separation of infectious wastes from other waste items, undesirable troubles on refractory bricks, boiler walls and grates of the present plant appear. Especially high content of glass in the waste stream is leading cause of these troubles. To decrease glass content, education and dialogue programs are on the agenda of the Greater Municipality of Istanbul. Nevertheless, it seems that will take sometime. In the beginning, glass content was between 20-25%. Today, the rate of glass in the waste stream has come between 10-15%.

REFERENCES

[1] Analysis report by "Turkiye Sise ve Cam Fab. A.S., Research and Technology Branch, Analytical Support Services Laboratory", 1998.
[2] Analysis report by "Yildiz Technical University, Env.Eng.Dept.", 1997