USE OF ELECTRICALLY HEATED RADIANT GLASS FURNACE FOR DESTRUCTION OF HAZARDOUS WASTE

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The incineration method of destruction of hazardous organic waste requires in combination:

a. Elevated temperature, above 1800°F (980°C)
b. Presence of excess oxygen, say 3% minimum
c. Presence of water vapor, say 12% minimum

An electrically heated radiant glass furnace provides these conditions readily.

The elevated temperature is required to break down the polychlorinated biphenyls (PCB's), which are stable to almost 1700°F (930°C). That property is the reason they have been used as insulating oils in transformers.

The breaking down requires oxygen to form the stable harmless gases CO_2 and H_2O. A 3% excess O_2 is needed to drive the reaction in the favorable direction.

The chlorine which is released must not be released as chlorine itself or as poisonous phosgene gas (CO Cl_2). Both of these forms can be prevented by the presence of the 3% excess oxygen plus 12% water vapor. In this case, hydrogen chloride is formed. HCl is readily converted to NaCl, common salt, in a scrubber tower having sodium carbonate in solution. Fig. 1.

An electric glass furnace for this purpose consists of a ceramic refractory tunnel, typically 4 ft square by 20 ft long. The pool of molten glass is kept molten by means of a power electric current passing through the glass between immersed electrodes.

The temperature of the glass is kept above 2300°F (1260°C), which is well above the ignition temperature for combustible materials. These materials burn with admitted air in the first half of the chamber, while the second half of the same chamber "polishes" the process to ensure complete combustion.

Ashes and any non-combustible materials drop onto the surface of the glass and are melted into the glass.

Liquid and slurry wastes are introduced at a controlled rate

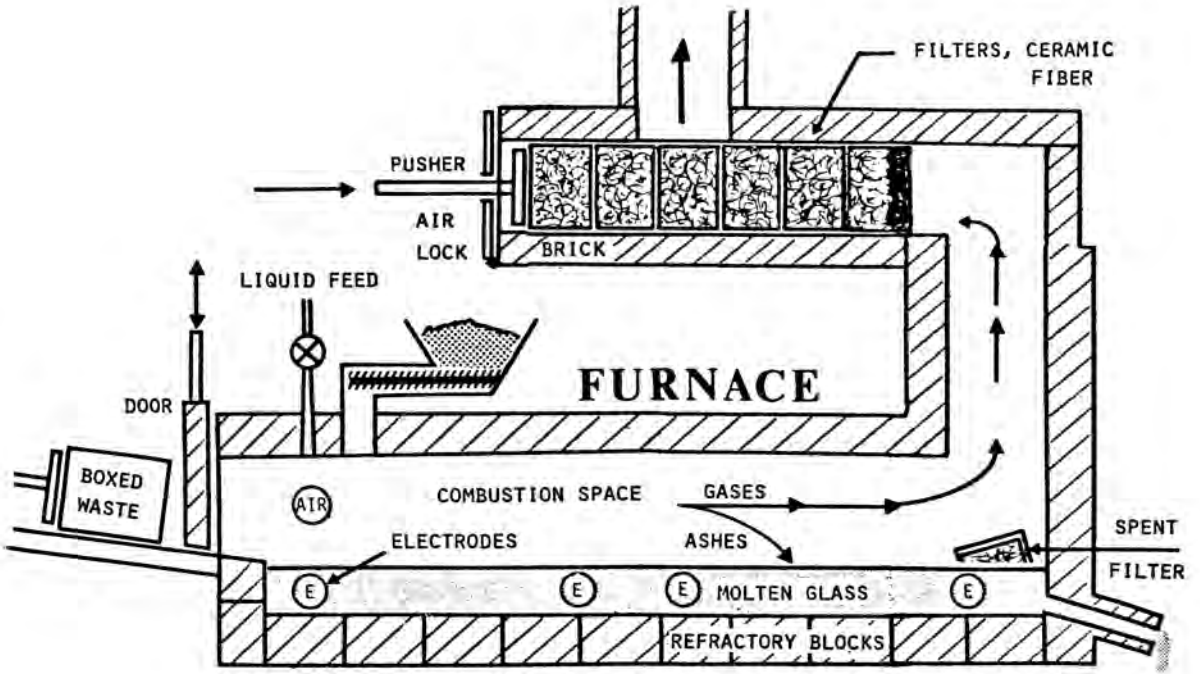

FIG I PENBERTHY FURNACE FOR HAZARDOUS (AND RADIOACTIVE) WASTES

through a pipe. If the liquid base is water, the water boils to steam progressively, leaving solids behind.

Hazardous wastes containing lead, arsenic, copper, barium are broken down to CO_2, H_2O and the oxide of the metals. The metal oxides are caught and chemically bound in a ceramic filter. When the filter is loaded, it is pushed into the furnace where it melts down to join the glass in the pool.

Wastes containing fluorine break down to CO_2, H_2O and HF. The HF is partly caught in the ceramic filter and the balance is caught in the scrubber. Where there is much fluorine in the off-gas, the scrubber solution is augmented with calcium hydroxide to take advantage of the low solubility of calcium fluoride.

The salts are dried and canned for storage, burial, or dispersal at sea.

Dirt coming with the waste falls onto the glass surface and melts therein. Excess glass is tapped off into drums as needed.

This type of furnace does not handle metal objects. Another kind of furnace is used for glassifying ashes and melting metal objects.

With this equipment, the shipping of hazardous waste to a landfill is avoided. The process is economic enough and clean enough to be located anywhere in a general industrial zone. The long-term potential for leakage of hazardous waste from a landfill is completely avoided because the waste has been made harmless.