INCINERATION OF HAZARDOUS SLUDGE AND SOLID WASTES

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Incineration is the process of preference for the disposal of organic hazardous wastes. It is the process of preference of the regulatory community, of the public, and increasingly so of waste generators. However, the waste profile for the hazardous waste incinerator is becoming more complex, more difficult and costly to handle. The waste characteristics are tending towards waste materials with physical forms showing higher viscosities with a larger percentage of the waste being solids and semi-solids. The reasons for this are:

1. Land disposal of hazardous organic sludges and solids is being phased out because of the regulatory climate. Also because of the acknowledgement by the generator that landfills will not contain the organic wastes or leachate from the wastes over an indefinite period and, therefore, could result in costly groundwater problems.

2. More recovery and recycling operations, by both the generator and commercial recovery industry are producing viscous residues.

3. High heat content liquid wastes are being burned in boilers, cement kilns and potentially at sea in incinerator ships, thus reducing the waste Btu’s available to assist in burning sludges in land-based incinerators.

4. Remediation of contaminated sites often means the incineration of various viscous materials from abundant pits and ponds and the incineration of organic chemical contaminated soil.

The incineration of hazardous solid and sludge wastes are, for the most part, presently being carried out in the United States in conventional rotary kilns. This paper will compare the conventional kiln with two other types of kilns, one of which is still in the development stage, and one that has been used successfully in Europe.

The conventional kiln is presently being operated by Rollins at three locations and by other companies such as DuPont, Dow, 3M, and Eastman Kodak. These kilns are part of an incinerator train that usually consists of a kiln, an afterburner, a liquid burner, and combustion gas scrubbing.

The kiln, which is a steel cylinder lined with refractory brick, rotates at less than one revolution per minute and operates at temperatures from 1400°F to 2000°F. The temperature of the kiln is maintained by the wastes being fed to the kiln or by ancillary fuel if there is not sufficient heat content in the waste to maintain the desired temperature. Solid wastes are fed into the kiln in several ways -- by a pump that can handle viscous materials or by being packaged in fiber drums, and the fiber drum being fed to the kiln. The temperatures and dwell time in the conventional kiln should be sufficient to vaporize the wastes and to initiate the combustion process.
From the kiln the waste vapors are fed into an afterburner that is maintained at above 2000°F with dwell times of two seconds or more. Here the combustion process is completed to the required RCRA destruction efficiency of 99.99% or to the required PCB destruction efficiency of 99.9999%. The 2000°F or greater temperature in the afterburner is maintained by burning high Btu wastes or other ancillary fuels in the afterburner. The offgases from the afterburner, which are mainly CO₂, water vapor, and HCl are fed to a scrubbing system that scrubs out and neutralizes the acid gases and greatly reduces any particulate such as heavy metals that are in the gas stream. The gases from the scrubbing system, which are mainly CO₂ and water vapor, are released to the atmosphere through a stack.

There are various types of scrubber systems in operation. The high energy venturi and the wet well electrostatic precipitator are two of the most popular.

The advantages of the conventional kiln are:

. It has been around awhile and there is a good background of experience in both engineering and operations of the kiln.
. It is relatively easy to operate and can handle a wide range of waste streams.

The disadvantages are:

. Costly to operate, especially if wastes are of low heat value.
. Will not easily handle 55 gallon steel drums. This necessitates repacking the steel drum contents in fiber containers, which is a costly operation and one that can possibly expose personnel to hazardous materials.

The second type of kiln that we are comparing today, is the slagging kiln. This kiln is in operation in Europe. The slagging kiln is similar to the conventional kiln, except that its operating temperatures are from 2500°F to 2800°F. The afterburner and scrubbing systems are similar to the conventional systems. The advantages of the slagging kiln are:

. It allows the feeding of the steel drums directly to the kiln. At the kiln operating temperatures the wastes materials vaporize and the steel drum melts forming a slag.
. The slag forms a protective coating on the kiln refractory brick liner, increasing the life of the refractory.
. Provides for a greater degree of combustion in the kiln, which permits a smaller afterburner and ensures greater destruction efficiencies.

Some of the disadvantages are:

. Higher temperatures necessitate more exotic materials of construction for the kiln, which increase capital costs.
Higher temperatures require more heat which can mean increased usage of auxiliary fuels -- this can increase operating costs.

The third kiln discussed today is a mechanically fluidized bed kiln that is still in the development stage. The design principles of the kiln provide excellent heat and mass transfer.

It is hoped that this design will provide the following benefits:

1. Ability to incinerate wastes having low heat values with a minimum of auxiliary fuel.
2. Neutralization of acidic combustion gases by the addition of lime to the combustion chamber.

This kiln is presently in the pilot plant stage, and these benefits, as well as design and economic concerns, are being investigated.