Ultimate Disposal of Wastes by Pyrolysis and Incineration

C. A. HESCHLES, PE and R. F. BONNER, JR., PE
Malcolm Pirnie, Inc.
White Plains, N.Y.

DISCUSSION by Herbert I. Hollander, PE, Staff Consultant, Gilbert Associates, Inc., Reading, Pennsylvania

The progressive program outlined in this well written paper is especially meaningful to me having participated in the early efforts of the Pollution Control Committee of the Cincinnati Chamber of Commerce, to find practical, realistic and environmentally acceptable solutions for the disposal of liquid/semi-liquid wastes of industry.

The Cincinnati Metropolitan Sewer District officials and the participating Cincinnati Area industries must be commended and respected for embarking on this landmark cooperative undertaking.

The basic facilities design concept described by the authors seems to parallel that attempted by a disposal service firm in Logan Township, N.J. and no doubt many of the problems experienced there will be avoided in Cincinnati.

It is recognized that within the allotted length and time for presentation the authors were obliged to limit their depth of coverage if they were to address themselves to all of the significant aspects of the project.

The questions to be raised and comments offered are all meant to be constructive.

An overview of the facility concept reveals that provisions have been made to anticipate, monitor, store and modestly condition those wastes from industry considered to be acceptable for thermal processing in the systems to be installed. The industrial wastes have been comprehensively identified and useful classifications developed.

A minimum waste flow rate will be necessary to operate the MSD facilities at break-even costs. Is this minimum flow of specific wastes assured? Will all industries in Cincinnati (Hamilton County) with non-sewerageable liquid/semi-liquid wastes, be "obliged" to utilize the MSD facilities? Will the MSD facility be capable of servicing additional quantities of wastes. . . . serve new industrials who will have wastes amenable to the process? What are the other waste disposal options available to the industrials?

Those wastes received at MSD, stored and then analyzed to be unacceptable must be disposed of somehow. What provisions will MSD have for the management and disposal of the rejected wastes which are on hand . . . and those on-going quantities being generated by industry?

Since finite storage of wastes will be provided at the MSD facility what back-up or contingency program has been established for possible prolonged outages of the processing system? Continuity of service is essential to avoid constipation. Will industry be required to also provide redundant processing facilities (or extensive storage) on their site?

Even for well designed processing systems for predictable materials and flow rates there will come a time for major overhaul or rehabilitation. Optimistically this will occur at the scheduled outage but all too frequently the necessity occurs at the most inopportune time.

Providing multiple processing trains or totally independent sub-systems avoids the need for total outage of the service facility. Independent systems are more costly than a system with integrated inter-dependent elements. However, they do provide higher availability of service since they more readily permit implementing an effective preventive maintenance and remedial program avoiding the repetitive crisis situations which are so disconcerting and so costly.

Integrated multi-purpose systems require sophisticated controls. Complex controls and associated instruments require almost continual maintenance to provide functional reliability and safety. An "on-going" training program for the cadre of operating personnel is essential so that

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they might react quickly and effectively when upsets occur and rectify the circumstances themselves placing the system back into reliable service in the shortest possible time.

Although the design "outlined" by the authors purports to provide at least partial capacity when one of the integrated furnace systems is out of service, maintenance and repair within the system would probably nevertheless require complete shut-down and cooling.

A very ambitious control program has been described for the gas suction system through a set of controlling dampers at the inlet of the "single" inducted draft fan. The varying gas weights, gas temperatures and the inevitable air infiltration will prompt continual hunting. Perhaps maintaining a balanced modulating system under all operating conditions will be attained. However, such single multi-function gas suction control systems have eventually led to wide open operation without any modulating control.

The commercial cyclone furnace for burning bituminous coals at high heat release rates to provide ash slagging temperatures, are water cooled. The refractory cyclone furnace operation described with low excess air will encounter high operating temperatures. The binders used in refractory materials become vunerable to chemical attack at elevated temperatures. Perhaps some provision is being made for heat extraction or cooling of the cyclone furnace so as to prolong the life of its refractories.

The fluidized bed reactor system with its broad capability to process a wide spectrum of liquid, semi-liquid and solid wastes is available for processes requiring balanced draft in the free board. The furnace temperature is usually dictated by the process requirements with materials of construction selected to suit. The massive heat sink of the fluid bed in conjunction with the complete surface exposure of the waste particles in the churning bed and the intimate mixing of air with combustible permits effective thermal reduction at lower temperatures even of highly aqueous wastes.

Plume suppression by heating or cooling is not only expensive, but is only partially effective especially as ambient temperatures descend to 50 F and below. The complications to the system, the additional fans, power, and controls required can only make the system more vulnerable to unscheduled outages all with questionable benefit.

A wet scrubber for flue gas clean-up will require make-up water for that lost in the blowdown and the evaporative loss in the stack. Since make-up water will be required continuously, introducing it as wash water on the demister elements may reduce or eliminate salt encrustment entirely.

The sad record of experience attempting to use grit laden slurry waters in spray nozzles has prompted the availability of Venturi scrubber systems using non-orificed open pipe water supply. No doubt a system of this design will be used on this project.

The adjustable throat Venturi does provide the designer and the operator an opportunity to accommodate the conditions as they are experienced in the field. However, if the furnace systems can be programmed to reasonably maintain designated temperatures, the wet gas flow through the Venturi will normally not vary widely. Therefore, once the optimum Venturi pressure drop is established, modulating it will have little significance. The hardware and control complication with its functional vulnerability could possibly be avoided.

An on-site thermo-chemical characterization program for the wastes as delivered is vital for safe handling, mixing and thermal processing. Unfortunately the analysis procedures can become time consuming especially if the data is challenged. The vehicle time delay may be disconcerting to the driver-hauler and those waiting to be served. No doubt some management program has been or will be developed to minimize these circumstances.

In regard to the intended thermo-chemical characteristics to be obtained, it should be recognized that the ASTM/BuM procedures for the Proximate Analysis was developed for coals. The volatile matter, fixed carbon relationship and their determination is strictly empirical and arbitrary. Since this data is only useful when compared with the library of similar data accumulated for coals there is a question whether the reaction rate characteristics they are intended to portray are valid for cellulosic, or petroleum base materials at the contemplated furnace operating temperatures. Determining the relative thermal reactivity of the various wastes to be encountered can be a most valuable operating guide since the rate of energy release can effect the surges in gas flow, gas temperature and even the refractory envelope. In recent years thermal gravimetric analysis techniques have been used to plot various parameters of energy release (burning profile) with time and temperature.

These techniques can also reveal whether the reaction will be endothermic, exothermic or at what condition the reaction changes. The analysis procedure for a profile plot can usually be accomplished rather quickly.

This discussion has only focused on those areas considered to be of prime significance although there are other areas reported in this paper which warrant comment.

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We will all be looking forward to the successful operation of this facility and the precedent it establishes for mutually beneficial government – industry cooperation.

We appreciate his contributions to the art of Waste Management and especially the interest in solutions to handle industrial wastes.

AUTHORS' REPLY

Mr. Hollander has presented some very thoughtful comments in his discussion on our paper.

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