DISCUSSION by Richard D. Smith, Chief Application Engineer, ZIMPRO

Beginning on Page 4, the operations of the Mill Creek Furnaces is discussed. Since a reader who is not familiar with the subject might assume that this discussion is representative of all incinerators, it would be well to emphasize somewhere in the text that conditions and observations will vary due to several factors such as coke quantity and quality. The information is representative of many similar installations.

Having been the application and field engineer for the manufacturer, I can assure ASME that the information is a full representation of what happened while I was there and has been presented in a very factual and objective manner.

DISCUSSION by J. W. Stephenson, Partner, Havens & Emerson

In this day and age a paper reporting results of emission tests should describe the test train and procedures, or preferably include a test train schematic. It should indicate what part of the test train catch-filter, impingers, etc. is included in computing results and determining compliance with regulations.

DISCUSSION by Robert S. Rochford, Babcock & Wilcox Company, North Canton, Ohio

The Multiple Hearth Furnace is one of the most widely used incinerators employed for disposing of sanitary sludges. The subject paper is very timely and should have a great deal of reader-interest for it deals with two of the most critical facets of this method of waste disposal, namely heat recovery and stack gas emission control. The author is to be commended for sharing his analysis and findings with the rest of the industry.

Our recent energy crisis has caused all associated with incineration of wastes to search for new methods of conserving fossil fuel usage. One of the methods now being strongly considered by many in the industry is to apply waste heat boilers to multiple hearth sanitary sludge incinerators. While it is reported that there are a couple of installations with waste heat boilers that have recently gone into operation and several that are in various stages of construction, the use of waste heat units for this service is quite new and little has been written about the subject. It was fitting that the author made mention of the attention which must be given to the design of the heat recovery equipment for such service, as it is reported the gases can be quite dirty and fouling in nature. Should there be a need for elevating the multiple hearth’s exit gas temperature to, say, 1300 to 1400°F for odor control purposes, the waste heat boiler becomes of even greater value, however, in this case more attention must be given to the fouling tendency of these gases. Making these provisions in the design adds to the cost of the equipment. In this regard it would be interesting to know for the case cited, how long it is expected to take to recover the cost of this heat recovery system from the fuel cost savings.

It has been reported in the literature that with properly designed gas clean-up equipment it is pos-
sible for present multiple hearth sanitary sludge incinerators to meet most present emission codes. It was reassuring, based on the data presented, that a low energy scrubber of the type described could comply with these regulations. In some cases wet scrubbers for this service have experienced severe corrosion problems. It would be interesting to know what materials of construction were employed on this project and if any corrosion has been observed.

**DISCUSSION** by Francis X. Reardon, Metcalf & Eddy

It is noted on page 4 that the process is “Self Sustaining” in most cases. This is true for “heat treated sludges” with excellent dewatering made possible by the treatment. It is not true for the majority of sewage treatment plant sludges.

A question which is going to be seriously asked by many engineers is, “Why were the furnaces tested at rates so high above the furnace design capacity?” This should be considered in the reply to this discussion.

**DISCUSSION** by William H. Wechter, Burns and Roe, Inc.

Clarification or specific mention should be made relative to the nomenclature for the SI units following the English units. Unless the listener or reader knows exactly what the author is attempting to delineate or explain, he will become lost.

**AUTHOR’S CLOSURE**

The comments offered by the discussors are constructive and very much appreciated for they permit presentation of additional material which was overlooked in the paper, but provided in the presentation at the National Solid Waste Processing Conference in Boston, as follows:

1. The four multiple hearth furnaces are arranged in pairs with a common belt feed and water supply to the scrubbers for each pair. Accordingly, it was considered desirable to operate and test only one unit at a time to establish exact feed input and scrubber water supply. However, the size of the vacuum filters in the plant are such that the feed capacity with one filter operating is considerably less than the furnace design capacity of 27.2 x 10^6 Btu/hr. (8.0 J/s E+06); or in excess of design capacity using two filters. To properly establish capability of the air pollution control system, it was deemed desirable to operate at overload capacity rather than operate at less than 100% of design capacity. This procedure proved worthwhile as the system demonstrated it could operate within the Local, State, and Federal Emission Regulations for opacity and particulate.

2. The SI units used in the paper follow the format adopted by ASME as detailed in “ASME Orientation and Guide for Use of SI (Metric) Units”, publication SI-1. Any clarification desired may be obtained by referring to this guide.

3. At the time the tests were conducted, the plant was only processing digested sludge which requires supplemental fuel for incineration under some conditions. With operation of the secondary treatment plant now in the final stage of completion, incineration of the combination of digested and thermally conditioned sludge — dewatered by the vacuum filters — will be self-sustaining in most cases. Other plants may not have this type of processing and may require the use of supplemental fuel.

4. Type 316ELC stainless steel material was used in the construction of the scrubbers, induced draft fans, and stub stacks. Experience at other plants established that the use of polymer which is low in chlorine content as a thickening agent results in minimal corrosion to the scrubber, induced draft fan, and stack. When ferric chloride and lime are used for thickening, Hastalloy or Inconel 625 must be specified as the material for construction to minimize the rate of corrosion in the scrubbers, induced draft fans, and stacks.

5. All testing was undertaken using EPA Method 5 and the emission results reported included the impinger catch.

6. The design factors for the waste heat boiler units limited gas velocities through the convection bank tubes to a maximum of 40 feet/second (1.22 m/s) to minimize the possibility of ash accumulation on tube surfaces or erosion of tubes by the particulate carried by the flue gas.

7. Although not reported in the paper, the design incorporates equipment to recover heat in the 810F (705K) exhaust gas from the engine generators as 15psi (103 kPa) steam to heat feedwater and the Incinerator and Vacuum Filter Building. The savings resulting from heat recovery from the
incinerators and exhaust gas of the engine generators comprise:

- Yearly saving in fuel oil by heat recovery from the exhaust gases of the engine generators for heating feedwater is 150,000 gallons (5.68 E+00 m³) which reduces the fuel oil requirements by 4% for the oil fired boilers serving the thermal conditioning sludge process.
- Yearly saving in fuel oil derived by heat recovery from the exhaust gases from the multiple hearth furnaces for thermal conditioning of sludge is 750,000 gallons (2.84 E+01 m³) which reduces the fuel oil requirements by 45% for the oil fired boilers serving the thermal conditioning sludge process.
- Yearly saving in fuel oil by heat recovery from the exhaust gases from the engine generators for heating the Incinerator and Vacuum Filter Building is 45,000 gallons (5.03 E-01 m³) which reduces the fuel oil requirements by 70% for the oil fired boilers supplying heat to the building.

TECHNOLOGIES AND EQUIPMENT FOR REMOVAL OF INDUSTRIAL RESIDUES AND WASTES, PARTICULARLY RESIDUES FROM CHEMICAL PROCESSES

Bernard Sinning

DISCUSSION by Lester L. Nagel, EPA-Region II

The author(s) have compiled a somewhat limited review of the existing “State-of-the-Art” in the selection of the types of equipment available for the disposal of industrial and the complimentary air pollution control techniques also available.

In the review of this manuscript there were numerous areas of mutual agreement, however, there are other areas which will involve the author(s) with those who believe the equipment evaluations given are considered controversial subjects.

A more extensive search and analysis of other incineration systems involving the disposal of such wastes would have given this presentation greater technical weight.

Additionally the reviewed drafts were presented without the flexibility of giving the various parameters in both metric and English measurements.

The format presented also failed to:
(a) Present a title page
(b) Utilized a slide identification means instead of drawing figure numbers with corresponding drawings in an appendix.

This reviewer hopes that these brief comments will help the author(s) to expand their initial work so that a more completely comprehensive evaluation of the various systems available can be described and discussed in the same detail that this presentation has accomplished within the limited areas discussed.

DISCUSSION by Alex M. Jumpeter, AMTEK Process Systems

In general, it is felt that the paper is of current interest and of an acceptable nature. There are, however, many grammatical errors and groupings of thoughts which do not constitute sentences in the English sense. In addition, some of the writeup, while correct in form, is very awkward English and reflects an attempt by the writer of direct translation from the language in which originally written.

The rewriting is obviously the author’s responsibility, but in this case the author is German and he will need considerable help with his word usage if the paper is to stand further dissemination. It is also to be questioned as to the need for conversion of the metric units to English for this presentation.