DISCUSSION by Robert E. Zinn, P. E., Dallas, Texas

This paper is an excellent presentation of technical design procedure and other items that should be considered in the design of a new type of incinerator, as well as in the design of an incinerator for a special application. It is refreshing to note that the authors have used the mol concept in their design calculations. However, the preprint should be modified to show pound-mols where specific quantities are used, since the mol can be any of several units such as pound-mol, kilogram-mol, gram-mol, etc. Mol ratio or mol percent are dimensionless.

The following quests for additional information may clarify several items in this paper:

1. If the unit is in operation, have anticipated collection efficiencies been obtained?
2. What is the static pressure across the induced draft fan and how does this compare to the induced draft fan requirement for the previous furnace?
3. It is noted that Figure 3 has an excess air factor of 2.46; for the same conditions, it appears that Figure 2 shows an excess air factor of about 3.0. If these observations are correct, what is the cause of the different ratios?
4. Mention is made that interlocking-type-refractory construction was used; was this a gravity wall with sprung arch, or was a suspended arch used? Is the furnace encased in a steel shell to avoid uncontrolled air inleakage?
5. It is recognized that it is vital to have small particles in the water spray, and the authors have used two-fluid nozzles with compressed air to atomize the water. While it is recognized that pressure spray nozzles of 1 gpm capacity cannot produce all fine droplets, it is possible to obtain fine atomization if the pressure nozzle has an orifice of less than approximately 1/16 of an inch diameter when operating at about 100 psig.

DISCUSSION by Alexander W. Luce, P. E., Consulting Engineer, Springfield, Vt., and Visiting Professor, Tennessee Technological University, Cookeville, Tenn.

How fortunate we are that all wastes are not so valuable as that covered by the authors! But, would it not be wonderful for design and improvements if every new unit had an equal incentive for finding the best. Similarly, I am sure that we would all welcome a magic wand which could be waved to give our municipal incinerators such a high degree of uniformity in their feed. Noting the efforts made by the authors, and some of their difficulties, should cheer us as we consider our successes with conventional units.

The authors' experience with problems from unevaporated water droplets is not new. Their efforts to avoid these difficulties, and their reported solution, should be of real help to many designers.

In noting that most of the feed is chopped, one wonders if this is because of convenience in prior handling, for security, or as a purchased contribution to the burning. Large flat sheets encountered in some industrial incineration pose real problems on the grate. Does the dumping grate catch very much weight of unburned rolls?

Can the authors tell us if any percentage of the grate is surplus? That is, could the grate handle a higher rate of feed? What percentage of combustible is in the ash? How fortunate to be able to keep it dry!

The fan capacities purchased in relation to calculated needs seem realistic. The velocities of 30, 9, and 1.3 fps at different stages are indicative of the care given the entire design.

We appreciate the corporate contribution to our knowledge in making so much design information available to us. Many of us will welcome a later report.
on operating experience. We will rejoice with the authors if performance is right on target.

AUTHORS’ REPLY to Robert E. Zinn

1. To date, we have had difficulty obtaining the quoted precipitator efficiency of 99.8 percent. Measured efficiencies range from 94.5–99.5 percent. The difficulty is believed to be the result of lower voltage operation than anticipated. It is believed that this is caused by the high conductivity of our precipitator dust. A development program is under way to alleviate this problem.

2. Although the actual differential has not been measured, it is in the range of 2-3 in. W.C. This compares with a total differential of 50 in. W.C. across the two ID fans in series on the previous furnace.

3. Figure 3 gives a different ratio of excess air to theoretical air at 0 water flow than Figure 2 does. This is because five additional assumptions were added for Figure 3 to make it more closely resemble anticipated production conditions. These assumptions are listed on page 227 of the proceedings.

4. The interlocking-type refractory was used throughout the furnace except for a small amount of castable used around doors and the charging area. The walls of the furnace are steel encased. A castable insulation was poured over the suspended roof instead of using a steel shell to insure a leak-proof furnace.

5. Hydraulic atomization was considered, but it was felt that two-fluid atomization offered the best opportunity of obtaining a very fine spray with no large droplets. It is necessary that all droplets be evaporated before they reach the precipitator.

AUTHORS’ REPLY to Alexander W. Luce

About 90 percent of the paper fed to the incinerator is chopped. Chopping was begun prior to the installation of the new incinerator primarily to facilitate transportation of the paper to the incinerator.

However, the chopped paper does burn faster and more evenly than unchopped paper. Film and other miscellaneous materials are not chopped.

The dump grate does catch unburned rolls which may cascade down the inclined grate. When these rolls burn out, the ash falls through the dump grate arms which have about 3 in. spaces between them. The weight of rolls caught varies depending upon the amount fed, but is certainly less than 5 percent of the feed.

At the design conditions of 4500 lb/hr, and 1400 F about 80–90 percent of the total grate area is utilized. A good specific burning rate for this material is 55 lb/hr/ft² of grate area.

The furnace ash contains less than 1 percent combustible material. The precipitator ash, which may be one-eighth to one-third of the total ash, contains about 15 percent carbon. This would be combustible if temperatures were high enough.