DISCUSSION by J. I. Frankel

To the best of my knowledge and belief this is the first privately financed, designed and operated regional industrial waste disposal facility that has reached an actual threshold of initial operation. It will therefore be watched with great interest. It is comforting and encouraging to see that this important first comprehensive effort is in such good hands engineering wise. We should be deeply indebted to Charlie Hescheles for presenting this very thoroughly prepared paper.

There appears to be a number of unusual design features which I would like to see clarified and the rationale behind them revealed.

In a large regional facility like this, the operator will have to accept almost any kind of combustible solid waste. Indeed the paper lists among other things such items as demolition wastes. In such a large heterogeneous accumulation there will inevitably be a significant fraction of large heavy objects, tramp metal, glass and other similar items. I wonder why the kiln type was selected in preference to Charlie Hescheles for presenting this very thoroughly prepared paper.

Although the fine flow sheet does not show it, I imagine that suitable strainers will be interposed between the holding tanks and any burner. I recently saw in operation a design of an air atomizing burner which could take gobs of up to \( \frac{1}{2} \) in. particle size. The normal commercial burner will not accept particle sizes in excess of \( \frac{1}{4} \) in.

It will be interesting to see how the neutralization of combustion gases by chemical means, as compared with the system of neutralizing effluent waste waters, will work out. I would be very much interested in the rationale behind this decision.

For the quite high combustion gas temperatures expected I imagine that the operation will provide for no more than 20 percent excess air in the liquid burner and at least 100 percent excess air in the kiln. All of the combustion air (other than that coming in with the burner) is apparently injected in the front wall of the kiln structure. With the burning of the light paper and cardboard we may expect quite a bit of fly ash entrainment in the gases which will impose a burden on any scrubber. There appears to be more than the usual subsidence volume incorporated to settle out the large butterflies.

The scrubbing here appears to be a simple set of sprays unless impingement baffles are contemplated. I suppose air pollution regulations in the area are not yet very stringent as I do not think we can expect any better dust collection performance than say 0.85 lb per 1,000 lb of flue gas corrected to 50 percent excess air. There is no area however that won't be faced with much more stringent regulations in the foreseeable future. More sophisticated control equipment can later be installed. The stack and I.D. Fan design should anticipate this. The 90 deg turn from the scrubber to the I.D. Fan with a generous length of gas travel is a good way to help settle out entrained water droplets. I can testify to expensive maintenance of I.D. Fan casings and impellers caused by too short and too direct gas passage.
DISCUSSION by Han Liu, Air Preheater Co., Inc., Wellsville, N.Y.

The rapid increase in volume of refuse generated by our expanding population and industry has resulted in a corresponding decrease in available landfill space for disposal of refuse near many urban areas. Management in industry today is even more frustrated in facing an ever increasing demand to find new or better ways to dispose of its process wastes in compliance with various pollution control standards. The disposal facility and its operation discussed in this paper suggest a new approach to the problems encountered by industrial organizations who cannot economically justify their own operation of such a facility. It will not only solve the disposal problems but may also create a new service industry with expertise in waste disposal.

Incinerators offer a solution to the solid waste disposal problems if, and only if, the stack emission is controlled. It is well known that the primary air pollution concern in incineration is with particulate emission rather than gases or odors. Therefore, the fly-ash reduction is generally emphasized on the design of the incinerator. As the result of this emphasis, multi-chamber design with wet scrubber has been adopted as the accepted standard. Our experience has indicated that design parameters, such as chamber and afterburner temperatures, primary and secondary air distribution, and chamber burning rates, are equally important, especially when the unburned hydrocarbons and all the condensables are to be included as part of the stack emission.

Since there is no detailed description of the operation of a rotary kiln solid waste incinerator provided in this paper, it is very difficult to assess its performance in burning high Btu materials such as polymers, rubber, oil residues and other man-made materials with high heat release and low decomposition temperatures. Our experience shows that a standard off-the-shelf incinerator designed to burn general plant waste and refuse may not be able to incinerate the high Btu materials smokelessly and odorlessly. I would very much appreciate it if the author could share some of his general design criteria of this incinerator for burning industrial high Btu wastes. I would also like to be posted for any further discussion after the unit is in operation.

DISCUSSION by Robert L. Merle, Eastman Kodak Co.

It is most encouraging to see that Mr. Hescheles and his colleagues are striving to correct a portion of our nation’s industrial waste disposal problem through the use of private money in a commercial venture. A venture such as this contains a certain amount of risk, and the persons involved must be commended for their efforts.

In the end, industry must be responsible for its wastes irregardless of whether they dispose of it themselves, contract with a commercial waste disposal organization, or dispose of it through some municipal organization. I believe that industrial or commercial organizations are best suited for performing the industrial waste disposal function. I feel that they can adapt easier and quicker to production changes and either have, or can acquire, the technical talent required to accomplish this operation.

It is very encouraging to see that methods other than incineration are involved. We are professionals and should not necessarily employ the easiest solution but use the solution best suited for the problem. I did not note any considerations for salvage operations. In looking into the future, we must strive to salvage wherever possible the materials which nature has created for use by future generations.

I was a bit dismayed to note that untreated sludge was being placed in a landfill. I feel that wherever a landfill is used, it is only a very short-range venture. Land is one of our most valuable resources, and as Will Rogers once said, "They ain't making any more of it."

Mr. Hescheles notes the necessity of flexibility in processing different wastes. This is very important because the mix of wastes can change drastically if a new product is added, a product is dropped, a production line is in service or out of service, or by any number of production variables.

The kiln employed by Mr. Hescheles offers a definite advantage in disposal of industrial wastes mainly because it provides a solid hearth for burning. This is important for certain wastes because some materials melt and can cause problems such as ash pit fires on some types of incinerators.

Water from the scrubber should be clarified and treated so that it can be reused or disposed of without causing a water pollution problem.

Industry must solve its waste disposal problems or Government will step in and do it for us. At the top of the list, I would place products of industry which the public has discarded such as junk autos, bottles, and cans. Industry must definitely strike out with new bold approaches to solving these problems or eventually their choice will be taken
DISCUSSION by Robert E. Zinn, P. E., Dallas, Texas

The author has presented an interesting design concept for the incineration of miscellaneous complex industrial wastes. There has been a great need for this type of installation.

In the interests of understanding and clarity in the technical literature, the following comments are offered:

1. The author refers to the scrubbing of flue gases in two stages with the inference that alkali or pH controlled water is supplied to the first spray system to reduce the gas temperatures to 675°F. This is followed by a second scrubbing chamber to cool the flue gases to 300°F without reference to the use of alkaline scrubbing water. Will desorption occur at these temperatures without ample alkali at the interface to fix the acid components?

2. In the proposed disposal of excess biological sludge in landfill, will there be undesirable odor emissions from the landfill area?

3. Although in many instances it may be undesirable, industrial process wastes can and are being disposed of in municipal incinerators, contrary to a statement in the paper.

4. The use of landfill areas for recreational purposes is understandable, but with reported experience of about 1 percent settlement per year and with low load bearing capacity of landfill area, it would seem dangerous to suggest building and particularly industrial building on the reclaimed area.

5. Since the induced draft fan is proposed to be located after the scrubber, will there be excessive corrosion from scrubber spray entrainment?

6. Is the facility sufficiently flexible to handle heavy residues which cannot be removed from 55 gal drums? If not, how is it proposed to handle such drums of industrial waste?

7. A description of the "impingement scrubber" would be appreciated. What are the materials of construction and how will corrosion be avoided?

8. Reference is made to operating the rotary kiln and the Loddby furnace in parallel with exhaust gases discharged into a common chamber under draft control from a damper at the induced draft fan. Will this system provide adequate draft control for both the kiln and the furnace without separate dampers in the flues to the afterburner? Would use of dampers in the hot gas flues entering the afterburner present some serious design and operating problems?

DISCUSSION by Leo J. Cohan, Combustion Engineering, Inc., Windsor, Conn.

The complex described as an Ultimate Waste Disposal System by Mr. Hescheles serves a very vital need. Many of the wastes that this plant will handle cannot be classified as clean waste.

Industrial wastes such as chlorinated hydrocarbons and others have always presented a disposal problem to industry. While municipal disposal has been available for many types of solid industrial wastes, liquid waste has been considered a more specialized problem. The already overburdened municipal disposal facilities have reinforced the need for private industry to seek immediate and viable solutions to their problems.

While the capital cost for incinerator equipment might be acceptable to an industrial, the attendant labor and nonproductive characteristics of such a plant would justify industrials to either pool their efforts or seek help from a contact source.

Private facilities designed on a broad concept and strategically located, convenient to industrial complexes offer a logical solution. Private facilities are unencumbered with the same political problems facing many communities. With the emphasis on land, air, and water pollution, regulatory agencies will look with favor on a well planned and operated central facility, if for no other reason than one of control.

The centralized facility can provide a maximum of services at a minimum of expense. The staff of competent technical personnel and the ability to avail themselves of outside services is a luxury that a small industrial has not been able to afford. The large professionally operated central facility can fill these needs.

This disposal facility is currently undergoing its initial shake down and we look forward with interest to subsequent reports covering operation.

AUTHOR'S CLOSURE

AUTHOR'S REPLY to J. I. Frankel

Mr. Frankel wanted to know the rationale behind some of the design.

The kiln was selected for its versatility to handle a variety of wastes such as solids, sludges and liquid
wastes. The facility was designed primarily for industrial process wastes. Normal refuse can be processed in municipal incinerator plants. In a municipal operation the ash handling system has to cope with the removal of all kinds of heavy objects. Even though an industrial operation does not expect these heavy objects, provision has been made to remove such heavy objects, if necessary, from the ash sluicing system.

The initial design was primarily concerned with good operation and not necessarily with heat recovery. A direct gas fired air preheater was selected for its ease of operation. Should the cost of fuel be high due to continuous preheating of combustion air, the system could then incorporate waste liquid firing instead of natural gas firing, or if necessary it could install a heat recovery unit for air preheating.

The waste liquid pumping systems have dual strainers for removing pipe scale and/or foreign matter in the waste liquid.

 Provision has been made for prevention at the source to neutralize combustion gases by chemical pre-mixing of waste liquids and additives in addition to chemical control of effluent waste waters. The neutralization of combustion gases has been installed, but has not been placed in operation as yet.

The system has been designed to burn wastes with excess air as follows:

- Rotary Kiln 100%
- Lodby Furnace 25%

This operation has been designed to burn industrial wastes. The burning of paper and cardboard is normally taken care of in a municipal installation.

The present installation removes particulates with wet impingement baffle scrubber. Should this be inadequate, provision has been made in the I.D. Fan capacity to incorporate additional wet gas scrubbing in the future.

**AUTHOR'S REPLY to Han Liu**

Dr. Liu raises the question of burning high heating value wastes in a rotary kiln.

The burning of industrial wastes concerns itself with both the high heating value and the high volatile content of wastes. The design has to provide means to volatilize the wastes first and then burn completely the volatile gases before entering the wet scrubber. The rotary kiln volatilizes the gases but does not provide complete combustion. The final combustion takes place in the afterburner. Rubber and other materials high in volatile contents fed into the rotary kiln have burned without smoke, as long as the after burner temperature was high enough to complete the combustion.

**AUTHOR’S REPLY to Robert L. Merle**

Mr. Merle brings up the question of landfill, salvage, etc.

Any of the sludges sent to a landfill area will be either treated or incinerated and made inoffensive before being shipped to a landfill area. Proper landfill operation will create new usable lands.

The facility has been designed to recirculate the scrubber water. Water from the scrubber is clarified, treated for re-use and losses are made up from deep water wells.

The first phase of the project has made no provision for salvage of materials. The second phase of the project will consider improvements such as salvage to increase the annual revenue.

**AUTHOR’S REPLY to Robert E. Zinn**

Mr. Zinn brings up some interesting observations. Scrubbing of flue gases — pH controlled water can be introduced to the pre-cooler as well as to the scrubber to fix the acid components.

Landfill operation — Biological sludge will be pre-treated and industrial sludge will be incinerated. No biological sludge nor industrial sludge used for landfill will give off undesirable odor emission, especially under good controlled landfill operation.

Most municipal incinerator installations have not been designed, nor have the capacity, to burn industrial wastes without causing air pollution.

The use of any landfilled area for building construction has to be designed taking into consideration settlement of the fill. The professional engineer who designs a structure on fill land is cognizant of this fact.

I.D. Fan Corrosion — The I.D. fan is epoxy coated to prevent excessive corrosion from the scrubber spray entrainment.

Handling 55 gal residue containers — At the present time the residue is transferred from the 55 gal containers into the rotary kiln hopper. Changes are being made to provide feeding the entire 55 gal drum into the kiln without a transfer.

Wet Scrubber Operation — The flue gases are cooled to about 700 F by the first set of sprays. The
second set of sprays cool the gases to approximately 300 F or lower. The second set of sprays spray water into the incoming flue gases and toward the wet baffle walls. The particulates are picked up by the wet baffle walls and sluiced away to a holding pond. Provision is being made to separate entrained water particles before reaching the I.D. fan by the installation of a Chevron separator. The effluent is continuously pH controlled, and all the metal surfaces are epoxy coated to reduce corrosion to a minimum.

Draft Control – The draft in the afterburner is automatically controlled by the I.D. fan inlet controller at a point which maintains a negative pressure in the rotary kiln. The draft loss between the kiln and the after burner is very small and any changes in kiln operation do not affect the kiln draft. The Loddby furnace controls the secondary air automatically, independently of the after burner draft and seems unaffected by kiln operational changes. As a result, the after burner draft is maintained constant with the I.D. fan inlet controller and seems to operate very satisfactorily.