A 200 TPD MODULAR WATERWALL COGENERATION FACILITY IN NEW HANOVER COUNTY, NORTH CAROLINA

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The plant described in the paper is innovative with respect to the use of package or modular waterwall boilers in service with unprocessed municipal solid waste for fuel. This concept is of considerable interest since the potential exists to employ modular waterwall boilers at lower costs and with shorter construction schedules as compared to field erected units of similar rating.

Our firm has had the opportunity to make a technical review of the modular Keeler “CP” units for use with solid waste on two occasions in connection with other projects. In both instances, it was found that consideration had been given to the design features known to be critical to the successful operation of a refuse fired boiler. Some of these features are described in the paper.

The paper indicates that design features at the New Hanover facility were drawn from the design and operating experience at the Hampton plant, which is generally considered to be an example of a successfully operating plant.

While many of the features of the two plants are similar, some differences do exist which may be of interest in connection with the operation of the new facility as follows:

1. The boilers at the Hampton plant are field erected Keeler “MK” cross drum units. The furnace is quite high compared to its width or depth. The modular Keeler “CP” units at the New Hanover plant, on the other hand, have less furnace height due to shipping limitations. The furnace width and depth are comparatively greater to obtain the required volume.

2. While the furnace heat release for the two units is approximately the same (reported to be 13,300 Btu/ft³ for the “MK” unit versus 14,200 Btu/ft³ for the “CP” unit), the physical configuration of the boilers is quite different. The outlet steam conditions at the Hampton plant are 365 psig, saturated while the New Hanover boilers will produce superheated steam at 455 psig, 650°F. The later conditions are considered acceptable for refuse fired boilers as far as superheated steam temperature is concerned. However, given the differences in furnace design between the two boilers in combination with the addition of superheat, some thermocouples on the superheater during startup would seem prudent. Further, the method to be used for controlling superheat temperature at the New Hanover plant was not mentioned in the paper but would be of interest.

3. The Hampton plant generates steam only while the New Hanover plant will produce steam and electricity. The addition of a superheater, along with electrical generation, increases the complexity of the project due to limitations at the turbine with respect to steam temperature as well as allowable rates of change for both steam flow and temperature.

In summary, while the design of the New Hanover plant employs conservative design criteria and relies heavily on the Hampton experience, the design takes a step in the development of refuse to energy plant technology.
This paper describes a modular, 200 TPD, mass burning, waste combustion plant, that utilizes two excess air furnaces, stoker style, with a water wall boiler above each furnace, and each module rated at 100 TPD design capacity. The produced steam is routed on a fairly standard configuration through either a back-pressure or condensing turbine (or through both) connected to a generator to produce electric power. The system is designed to match steam flow from the boilers to steam demand of the customer, while permitting the production of electric power on a maximized basis. While this configuration involves additional expense in turbine-generator and electric accessories in the power plant, the economics have been proven feasible in several other small (220–430 TPD) waste energy plants that have been designed in the past four years.

The basic furnace-boiler design is modelled after the Hampton, Virginia plant and apparently incorporates certain improvements in controls and equipment configuration, based on the operating experience at Hampton.

While the paper lacks much of the detail a reviewer would like to know, and is basically a description of the furnace-boiler equipment and the fast track approach to design and construction, it raises certain questions about the project's viability.

First, no real design criteria data is given concerning the plant. Without this we are not certain as to why the specific technology, equipment and power train was chosen; nor are we certain of the redundancy and availability factors. We are left with the impression that the original consultants merely decided that the client should own a waste to energy plant. They threw open the door to any and all technologies on a turnkey basis. The low bidder got the contract to design and build the plant. However the price works out to $65,420 per ton of design capacity, which is about 38% higher than the 1983 average for plants of this size with electric cogeneration add-on. Further, there is no information as to whether this price includes the cost of interconnection to Carolina Power and Light, which could run as high as one million dollars to meet utility company requirements.

Nowhere in the paper is there any mention of a mass and energy balance having been performed, and hence the myriad of factors that must be firmly set in place as part of the design criteria before designing and constructing a plant of this particular energy producing style. We trust that before the fast tracking of design and construction commenced, such an exercise was carried out in detail. If not, serious technical and financial problems can arise.

On the design specifics, while the information is rather sketchy, except for the description of the boiler-stoker units, we would question at least one point listed. The tipping pit is uncovered and exposed to the elements. Hanover County gets its fair share of heavy rain. We are not certain how the holding pit accommodates a fall of 10 in. or more of rain, and how this water and accompanying leachate is disposed of. There is a zero discharge of the ash quench water. Does the holding pit water follow this purity?

The process control of the steam flow follows a fairly standard method used in other operating modular plants that have condensing systems. Unfortunately there is no detail on the electric power plant design, so we can not comment on it and its tie in to the steam control system on one hand and the electric split and use on the other end.