Design of the Northwest Incinerator for the City of Chicago

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Everyone in the incineration industry is watching the progress of this important project with a great deal of interest. I am sure that the author’s willingness to frankly discuss several administrative aspects of this project at this time is greatly appreciated.

At the end of the section entitled “Overall Refuse Disposal Problem”, the author indicates that, as the heat content of the refuse received at the plant increases beyond 5,000 Btu/lb, the furnaces will be derated or the tonnage of refuse burned in the furnaces will be reduced. It is encouraging that there is a plant in the United States where this very important aspect of limiting heat release in a furnace will be recognized in operation.

It is hoped that the results of the City’s refuse compression and baling studies will be made available soon in the literature.

The operating experience of this plant will be interesting to watch, especially from the standpoint of tube metal wastage. Saturated steam temperatures are only some 50°F lower than those in another plant burning municipal refuse which has experienced very serious tube metal wastage problems.

I wonder if the author has an explanation for the extremely wide variation in bids received for this plant’s mechanical construction?

I wonder if the author could indicate under what definition of particulates the precipitator guarantee was furnished and was the method of test for determination of guarantee compliance specified?

DISCUSSION by Peter J. Scott, City Engineer’s Department, Coventry, England.

When I read Mr. Fife’s paper and followed the stages through which his thoughts had passed and the nature of the economic appraisal made for the Northwest Chicago Plant, I was struck by the similarity of the process which he had completed and of his conclusions to those which we have recently used in a similar appraisal for a refuse incineration plant for Coventry. Our own exercise led us to the view:

1. That a boiler system for flue gas cooling would have advantages over spray tower cooling.

2. That the operating pressures for the boilers should be within the non-corrosive range — we have chosen 18 atmospheres.

3. That steam should be used to power the major station auxiliaries and that, although the greater part of the heat would be dissipated to waste until an industrial user could be found, the station use goes a long way toward justifying the steam raising on the saving in the cost of bought-out electricity alone.

These conclusions are almost identical with those reached by Mr. Fife. We have designed the plant with three streams of 300 tpd each as compared with four streams of 400 tpd each in Chicago, but in each case one of the streams represents stand-by capacity. The configuration of the plant layout in Coventry is also generally similar to that under construction at Chicago.

We have also chosen to follow a generally similar contractual process with a series of six or seven main contracts for the full project. We are following this course (which is as unusual in the United Kingdom as I understand it to be in the United States) for the reasons set out by Mr. Fife, that is, the opportunity which it gives to the engineer of maintaining greater control over the development and construction of the scheme. In one respect we have gone further than Mr. Fife in that the air pollution control equipment is a separate contract from the furnace and boiler contract. Tenders were first received from the furnace and boiler makers who were required to state
and guarantee maximum gas volumes and dust burdens. Competitive tenders were then obtained from five precipitator manufacturers all of whom were required to guarantee a stated dust burden in the discharged gas against the flue gas characteristics guaranteed by the appointed furnace and boiler maker. We estimate that this course may have led to a saving of 10 percent to 15 percent in the cost of the flue gas cleaning equipment.

The cost of the completed Chicago plant appears to be about $11,000 per installed daily ton. Rates of exchange and differing working conditions between the United States and England make any comparison difficult but the target price for the Coventry Plant, converted at present rates of exchange, is about $5,500 per installed daily ton. Up to the present time — and tenders have been received for all of the mechanical equipment so far — we are hopeful that we can achieve the target.

A further similarity between the Chicago and Coventry plants is that the appointed furnace contractor for both plants is the licensee or associate in the respective countries of Josef Martin Feuerungsbau GMBH of Munich.

In all our work related to the Coventry Incinerator Project we have been concerned to keep costs as low as may be whilst ensuring a viable plant with an acceptable availability. The development of refuse incineration on the Continent of Europe has largely been by the use of refuse to fuel power station and thermal station equipment. Our attitude in the United Kingdom has been somewhat different and is, I think, more akin to that in the United States, namely that the object is to dispose of refuse and the use of produced heat is a secondary concern. The highly sophisticated boiler plants which one finds in plants in Germany, Switzerland and France are not entirely appropriate to our purpose.

The scheme which is being developed in Coventry is an attempt at a less sophisticated approach and consists essentially of a water wall combustion chamber followed by a smoke tube heat exchanger. This development is at an early stage but, if it proves to be as successful as the makers claim, a significant step will have been made in improving the economics of steam raising plant associated with refuse incinerators. Perhaps in two years' time when the next National Incinerator Conference is held we shall be in a better position to tell what can be achieved with this type of equipment. The equipment which has been offered cost only about one third of the price of a conventional European four-pass boiler.

I note that at Chicago it is proposed to have electrically driven main auxiliaries for start up purposes. We are following a different course in Coventry. It is intended that start up shall be by steam and a package boiler has been included capable of raising sufficient steam to start one furnace line. Additionally each main boiler has been provided with oil firing equipment capable of raising it to operating temperature in a few hours. In this way it has proved possible to avoid the large scale use of electricity which, in England, is charged by tariff related mainly to maximum Kva demand.

I hope that my observations may have been of some interest to you this morning. As I said at the beginning I have been impressed and pleased at the similarity between Mr. Fife's conclusions and our own. When we came to Cincinnati I knew nothing of the Northwest Chicago Plant or of Mr. Fife but this Conference has brought our thinking together. On Sunday evening when I arrived I had to stand in the airport coach for most of the journey but I eventually sat down next to a gentleman with whom I exchanged a few words. It was only this morning that I discovered that that gentleman was Mr. Fife. I have found this a most interesting conference and this morning's paper particularly so. May I wish Mr. Fife and his associates a smooth and trouble-free commissioning period for the Chicago Plant.


Mr. Fife has outlined in his excellent paper a new basis for design of an American Incinerator plant resulting from the continuously growing demand for improvement in our environment, to reduce the pollution of air, water and soil to a practical minimum, as well as to recycle, or to utilize the heat and by-products resulting from the incineration of the refuse in the best possible manner with today's technology.

The new approach to establish more stringent specifications has resulted in selection of equipment with some new features which have previously not been widely used for incinerator construction in this country. The system design is based to a great extent on experience gained with European incinerator technology with careful consideration of the differences
between American and European refuse.

Many visitors to this convention have heard Mr.
Nowak's presentation "Consideration in the Construc-
tion of Large Refuse Incinerators" in which operating
and design problems have been discussed with un-
usual frankness.

It should be of interest at this point that the design
improvements suggested by Mr. Nowak have been
covered in the new Chicago specifications and, in
fact, additional new improvements have been included
in the design of the Northwest incinerator plant for
the city of Chicago.

Furnace gas velocities have been reduced to well
below 15 fps and the volumetric release rates in the
primary furnace are less than 14,000 Btu/cu ft. The
.7 in. O.D. convection tubes are spaced on 7 in.
centers in an "in line" arrangement to permit
thorough cleaning for long uninterrupted operation
and minimum outages. Residue discharge, siftings
recovery and fly-ash collection are automated as far
as feasible so that the incinerator plant should now
be in the category of a modern power plant in cleanli-
ness and ease of operation. The operators are no
longer subjected to menial and dirty tasks as in old
fashioned incinerator plants. The cleanliness and
odorfree operation will make it desirable to work in
such a plant and the 98 percent dust collection ef-
ficiency should make the incinerator plant a good
neighbor in any region.

Mr. Fife should be congratulated for the thorough-
ness with which he leads modern incinerator design
into a new progressive direction and the actual opera-
tional performance of this new plant should prove in
the near future that incineration is no longer a dirty
word.

AUTHOR'S CLOSURE

Mr. Velzy, in his discussion, has asked two ques-
tions, the first of which relates to the wide variation
in bids which were received for the refuse burning
system contract. He asks whether there is a known
explanation for this variation, and the answer to this
is that nothing has come to light as yet which might
explain this. Mr. Velzy's second question inquires
as to the definition of particulate matter used in the
specification for the precipitator performance, and for
information on the method of test for refuse burning
system fly ash emission. This question would relate
to the new NAPCA definition for particulate matter
which did not exist at the time of preparing the
specifications for the plant. Accordingly, the defini-
tion of particulates and the test method were in ac-
cordance with traditional ASME methods, namely,
PTC-27. The specification additionally required that
where the referenced standard is permissive (and there
are several such instances), "the following specific
requirements would apply." The specification then
detailed procedures to be used in these areas, and
required the submission of a definitized test plan for
approval prior to the making of tests.

The City has since adopted the NAPCA definition
of particulates, and it is intended that the specified
test procedure be modified so that tests will actually
be made in accordance both with ASME PTC-27
methods and with NAPCA methods.

The discussion by Mr. Scott is particularly ap-
preciated. It is certainly nice to know that although
we each reached our conclusions independently, we
found fundamentally the same answers as a result of
our investigations.