



Industrial Furnace Company, Inc.

## **EXISTING MULTIPLE HEARTH FURNACES OR NEW SOLUTIONS?**

### **LEVERAGING YOUR EXISTING (PAID FOR) CAPITAL ASSETS**

#### **ABSTRACT**

Many municipalities have existing multiple hearth furnaces that are satisfactorily providing thermal treatment of the sludge generated at the local wastewater treatment plant(s). Most of these thermal processing units have been in service a long time. Many are showing their age, but some have been upgraded over the years and are functioning as well as new MHF's. The introduction of new EPA regulations in May of 2011 have put a spotlight on the existing multiple hearths (Although crosshairs might be a more appropriate term). A lot of misinformation has been floating around regarding the ability of existing MHF's to survive under the new regulations. Contrary to the opinions of many, it has been demonstrated that proven upgrades are available to bring any municipal sludge MHF into compliance with the new regulations. These upgrades can be accomplished for less than 1/4 of the capital cost of a new fluid bed incinerator (FBI). Plus, on larger units (2 to 3 dry tons/hour and up), low-maintenance power generation equipment (no steam) can be installed that will pay for itself in a few short years. Longevity should not be a question. There are MHF's still operating that were installed in the 1920's.

#### **INTRODUCTION**

In May of 2011, after months of discussion and controversy, the EPA introduced new emissions regulations for Sewage Sludge Incinerators (SSI's). These have often been referred to as "129" regulations because they are based on a requirement of section 129 of the Clean Air Act for the EPA to establish emissions limitations for "solid waste incineration units". However the actual regulations are included in the familiar "Part 60" as new Subparts "LLLL" for new installations, and "MMMM" for existing installations. Some now refer to these as the new "Quad-L" or "Quad-M" requirements.

Included were regulations for new fluidized bed units, new multiple hearths, and for existing installations of each. There are significant differences in allowable emissions among all 4 categories. The regulations are somewhat stricter for new multiple hearths when compared to existing multiple hearths. The regulations are much tighter for new fluid beds versus old fluid beds, and are generally much tighter for fluid beds than for multiple hearths.

The new emissions limits raised concerns for all SSI owners, but the level of anxiety seems to be particularly strong for owners of multiple hearth furnaces. This was fueled in part by some

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highly flawed articles/papers that were circulated prior to the new rules being issued. The general conclusions of these reports commonly were either that multiple hearths would be regulated out of existence, or that even a new fluid bed was cheaper than retaining an existing multiple hearth. These ideas became articles of faith for much of the SSI industry. Fortunately for the owners of multiple hearths, and for the wallets of their ratepayers, neither case is true.

A few wastewater plants have been ahead of the curve in developing the technology and infrastructure that can deal with the latest requirements, and have actually been doing so for years. New emissions controls have been installed and tested, so we do have real-world examples of successful remedies to consider.

### **EXISTING MHF's INTENT OF THE EPA AND OF THE NEW REGULATIONS**

It is clearly not the intent of the EPA, through the new regulations, to shut down existing multiple hearths, or fluid beds. In Section II.A (Page 14) of the Preamble to the new regulations, the EPA notes that the Clean Air Act requires the EPA to “*establish technology-based emission standards that reflect levels of control EPA determines are achievable for new and existing units, after considering costs, non-air quality health and environmental impacts and energy requirements associated with the implementation of the standards.*” The discussion in the Preamble returns to this several times in the 183 pages of notes, comment/response, and impact analyses.

In particular, so-called “Beyond the Floor” Mercury emissions limits were originally considered. The term “floor” is defined as the lowest level of emissions achieved by the average of the best 12% of all similar units. The EPA initially considered limits for Mercury that were found to be beyond-the-floor. After more investigation and consideration of the Clean Air Act requirements above, particularly of costs and floor limits, the final limit was set at 0.28 mg/dscm, which is well within achievable limits. This is discussed on pages 52 and 126 of the Preamble.

Similar analyses were conducted for the other pollutants, and final limits were established. Actual experience at existing installations has proven that these limits are achievable.

### **DESIGN FOR COMPLIANCE – PROVEN PERFORMANCE**

The fact that existing multiple hearths can be brought into compliance with the new regulations is not in question. Several have done so, some as many as 10 to 12 years ago. We will discuss 2 plants in different localities and with different forms of governing authority. One is in the Northeast (Hartford, CT), and is operated by an independent district, the Metropolitan District or MDC. The other plant is in the Southeast (Atlanta, GA), and is operated directly by the City of Atlanta.

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Hartford has three furnaces, 22'-3" O.D. x 11 hearths, built around 1970. Upgrades began in 1998 on 2 of them and were completed a couple of years later. The work was done under a traditional Design/Bid/Build contract. Montgomery Watson was the Engineer, and Industrial Furnace Company (IFCO) was the Contractor.

Major components of the Hartford improvements were:

- Conversion of the top 2 hearths to an afterburner
- An "EnviroCare" multi-venturi wet scrubber
- New Induced Draft Fans with VFD's
- A Flue Gas Recirculation (FGR) system
- Upgraded Controls system to integrate the new equipment.

In addition, new low-NO<sub>x</sub> "MHF" burners were installed under an existing maintenance contract with IFCO. As with all furnaces of this vintage, the I.D. fans were small due to the very low pressure drop across the scrubbers typical of that era. New fans were required as part of the emissions control upgrades to handle the increased pressure drop across the modern scrubber.

In 2009, the MDC made the decision to upgrade the third furnace. The plant was permitted for only two furnaces, but it was able to update the permit to allow for any two of the three furnaces to operate at one time. Since the plant processes a lot of "Merchant" sludge, it was important to have some backup, which the third furnace would provide.

Atlanta has two furnaces, 22'-3" O.D. x 10 hearths, built in the early 1970's. In late 2000, the City was under a consent order to do something about emissions. There were plans for other solutions, including a large drying and pelletizing plant. However, at a minimum, an interim solution was needed quickly. The existing MHF's presented the best option. They were already operational, they were permitted, and the necessary feed and ash handling systems were in place. The decision was made to bring in an experienced contractor under what amounted to a design/build contract to upgrade one furnace. IFCO was chosen to perform the work, the City provided field inspection, and Black & Veatch was chosen to provide engineering oversight. In addition, Gene Waltz of Incinerator Rx conducted optimization of the equipment/process and provided operations training.

The major improvements were similar to those for Hartford, and included:

- Conversion of the top 2 hearths to an afterburner
- A multi-venturi wet scrubber
- New Induced Draft Fans with VFD's
- A Flue Gas Recirculation (FGR) system
- Low-NO<sub>x</sub> "MHF" burners, capable of burning both natural gas and digester gas

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- State-of-the-Art Control system to provide monitoring, reporting, and ease of operations and maintenance.
- Ambient air inlet ports on hearth 10

After the improvements were added, the furnace easily passed all of the 503 requirements. The permitted capacity was increased from 0.7 dry tons/hour before the upgrade up to 2.4 dry tons/hour, and with all visible plume eliminated, public pressure on the plant faded. With a substantial decrease in sludge going to landfill, the cost of processing sludge was lowered significantly. After the (unexpected) success of the first project, the City awarded a second contract to IFCO for the second MHF. That furnace was upgraded in a similar manner, with the same operational and permitting success.

It became clear that the MHF's were the best available solution, certainly for the short and medium term. Atlanta scrapped plans for the dryer system, saving capital expenses in the range of 200 million dollars. The furnaces have continued to operate into 2013, with no additional capital expenditures, only minor maintenance issues, and are still in compliance. The plant has not yet performed testing for the new requirements, but it is anticipated they can pass with little or no additional capital upgrades. There are other systems which need to be upgraded to enhance operability, such as sludge dewatering, feed transport, and ash handling, but the cost of these improvements is small compared with the major cost of developing a new system.

### Formal Test Results

The MDC at Hartford has been in the forefront of MHF emissions control solutions. They were one of the first to install the multi-venturi wet scrubber (the VenturiPak from EnviroCare), and were also one of the first, along with New Haven, Ct and Woonsocket, RI, to install FGR systems. As early as 2006, Hartford was testing emissions of all of the pollutants specified in the new regulations, including Dioxins/Furans. Testing in 2006 and again in 2011 produced impressive results. Not only were the furnaces in compliance with the existing 503 regulations, but they also passed the appropriate Quad-M regulations with flying colors!

A chart is attached showing the Hartford results compared to the various levels of the 129 MACT regulations. As expected, the first section of the chart shows the emissions levels for all of the pollutants are in compliance with the requirements for existing MHF's.

What may be surprising to some is that the next two sections of the chart show that emissions are in compliance with the Quad-L requirements for new MHF's, and existing FBI's, excepting only carbon monoxide (CO). A somewhat higher temperature in the top hearth afterburner would lower the concentration of carbon monoxide to meet the more strict requirements if ever necessary. This would mean more fuel costs, but not a significant number when compared to the costs of new alternate disposal methods. This information is not important for present-day issues,

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but it does provide a comfort factor if worries arise of about the future possibility of new and more stringent regulations.

## **Implementation**

Schedule: The first Atlanta upgrade was fast tracked due to regulatory constraints. The project went from award of contract to completion of testing in 8½ months. The official stack permit tests were started 2 days after the mandated deadline for compliance. Cutting it this close is not recommended. A more reasonable time frame would be about 12 months between notice to proceed and completion of permit stack testing. If two or more MHF's are involved, 4 additional months should be allocated for each furnace after the first. Naturally these are generalizations, and schedules will vary with individual situations.

Contract arrangements: The two successful examples demonstrate that existing MHF's can be brought into compliance, and operability enhanced remarkably, using either a design/build or a design/bid/build approach. Each has its advantages and disadvantages, which, like scheduling, will depend on local circumstances. It would be advisable for any owner to consider not only the question of whether to continue with MHF thermal processing, but also how to approach MHF compliance.

Nuts & bolts: For those who would like more details of the various improvements referred to above, a file is attached which contains descriptions of each. More detailed information can be obtained by contacting IFCO directly or on-line via our website.

Costs: For a furnace that has none of the improvements above, the cost to go "from-zero-to-compliance" should be in the range of \$4 to 6 million. Compared to the typical cost of a new fluid bed incinerator, that is a savings of 10's of millions of dollars.

## **Summary**

Multiple hearth furnaces remain a valuable asset. Regulators have made it clear that they are not trying to regulate them out of existence, and it has been demonstrated that MHF's can meet all regulatory goals for the foreseeable future. For plants with one or more existing units, continued thermal processing is most likely the least expensive solution.