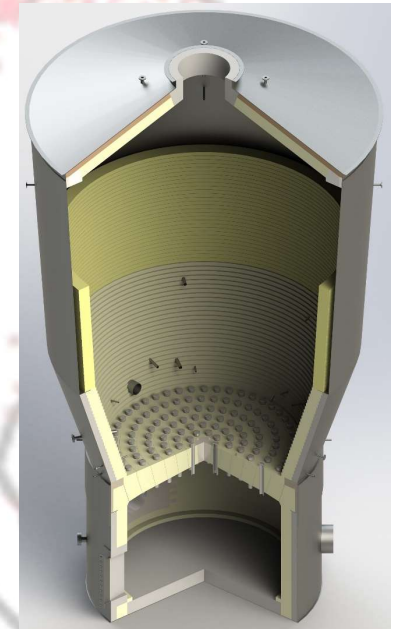
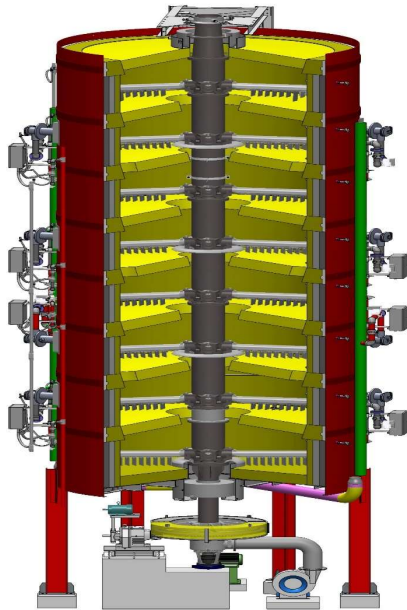




# INDUSTRIAL FURNACE COMPANY

MHF SERVICES • INDUSTRIAL INCINERATION INC. • INDUSTRIAL SCAFFOLD COMPANY, INC.

## Sewage Sludge Incineration: MHF or FBI



Michael Hilton

VP, Engineering / International Sales



## Company Overview

- Industrial Furnace Company, Inc. (IFCO) is a family owned company founded in 1948.
- Headquarters in Rochester, New York and division in Atlanta, Georgia
- Broad background in refractory construction and steel erection, IFCO began building furnaces over 70 years ago.
- Leading experts in furnace engineering, construction, maintenance, operations, and repairs.
- Industries we service : Mining, Wastewater, Mineral Recovery, and Refinery.
- World leader in Multiple Hearth Furnace engineering, repairs, parts, and construction.
- We have serviced most of the MHF's and FBI's in the U.S.
- International Mining presence starting in 2011 (Canada, Brazil, Greece, Turkey and Europe)
- International Processes using MHFs, Horizontal and Vertical Shaft Kilns.
- Mechanical Engineering services since 1982 / Electrical & Integration department since 2006.
- MACT upgrades and annual MACT operator training requirements.
- In-house pilot facility with cyclones and bag house, and fully automated controls.



# INDUSTRIAL FURNACE COMPANY

MHF SERVICES • INDUSTRIAL INCINERATION INC. • INDUSTRIAL SCAFFOLD COMPANY, INC.

## ORGANIZATIONAL CHART

**William T. Lill Jr.**  
President

**Jake Lill**  
Vice President  
Southeast Region/Sales

Construction  
Foremen  
GA based  
Construction  
Crews

**Michael Hilton**  
Vice President  
Engineering/Sales

Process    Mechanical    Electrical  
Engineering    Engineering    Engineering

**Jim Lill**  
Vice President  
Operations/Secretary/Sales

Construction  
Foremen  
NY based  
Construction  
Crews

**MANPOWER TOTALS:**  
OFFICE PERSONNEL: 25 PEOPLE  
CONSTRUCTION CREWS: APPROXIMATELY 95-125 PEOPLE

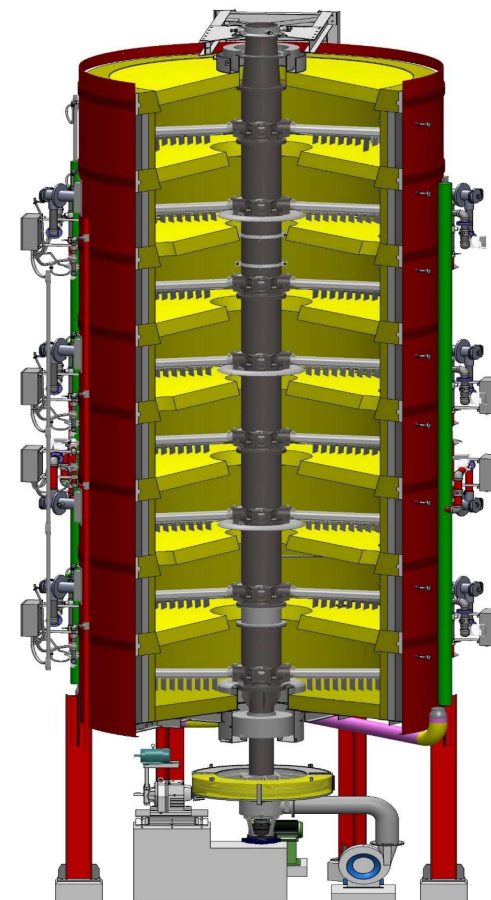


# INDUSTRIAL FURNACE COMPANY

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## Multiple Hearth Furnace

- Some other names for a multiple hearth furnace are
  - ✓ Multiple Hearth Incinerator
  - ✓ Multiple Hearth Roaster
  - ✓ Retort furnace
  - ✓ **MHF**
  - ✓ MHI
  - ✓ Calciner
  - ✓ Roaster
- A multiple hearth furnace is typically used when a **large volume** of material needs to be thermally processed at **different stages, at a steady and continuous rate.**



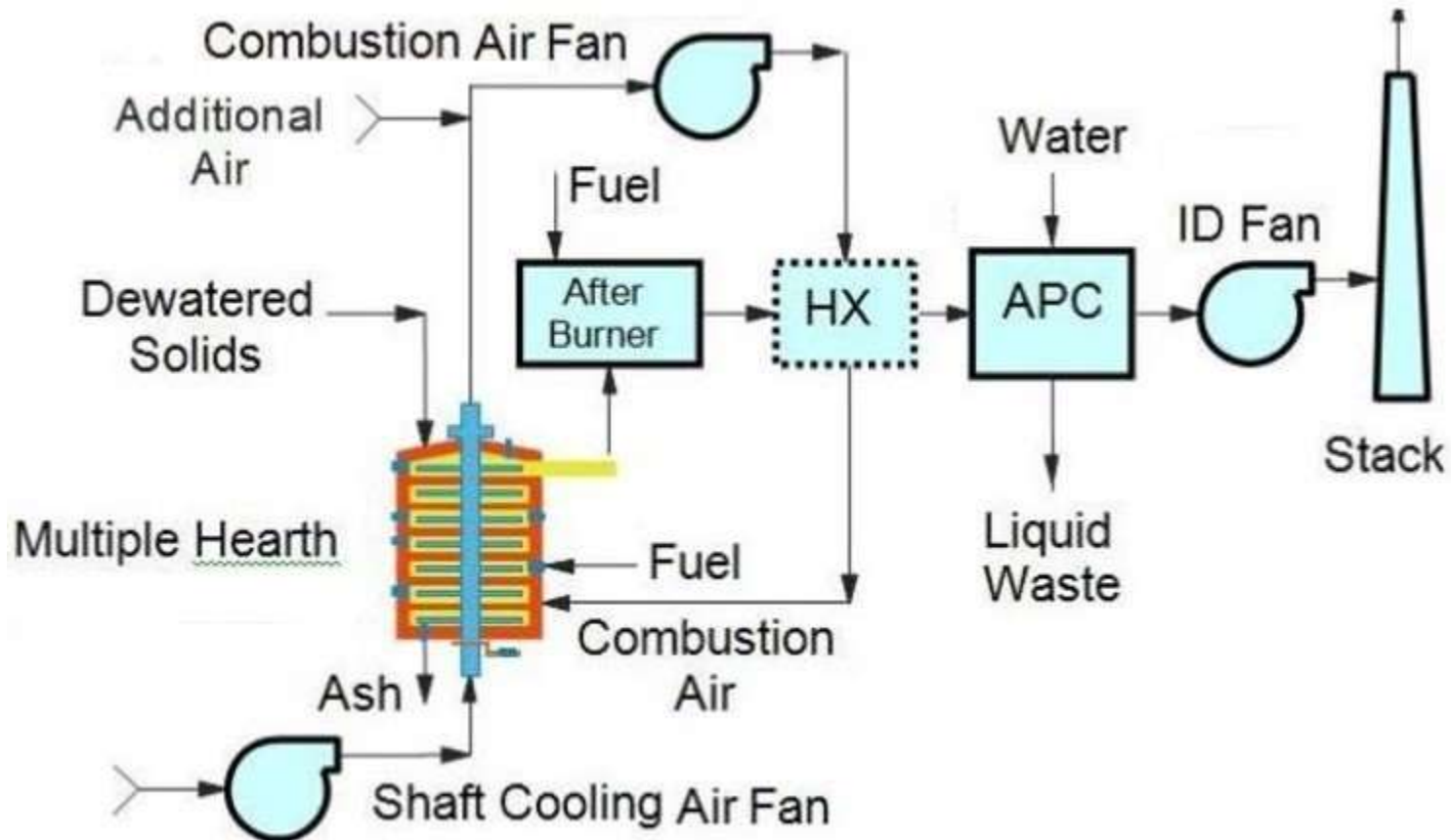




# INDUSTRIAL FURNACE COMPANY

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## MHF Process



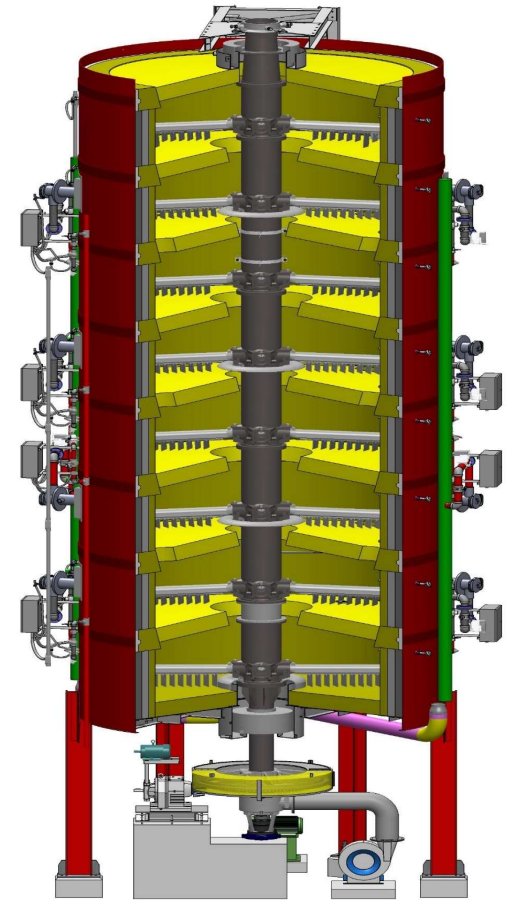


# INDUSTRIAL FURNACE COMPANY

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## MHF Financial Advantages

- ✓ Cheapest from a capital cost standpoint
- ✓ Very small footprint, so space required can be minimized
- ✓ Turndown: ability to run throughputs of 20:1.
- ✓ Smallest “mass and quality of hauled material” requirement
- ✓ With good dewatering process upstream, MHF can be operated with little to no gas use (autogenous)
- ✓ Best process for incorporating power generation.

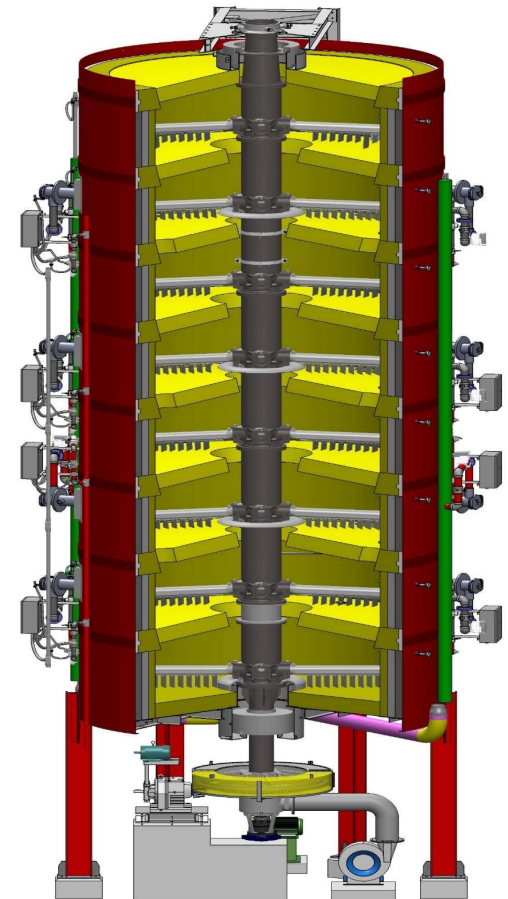




# INDUSTRIAL FURNACE COMPANY

WASTE SERVICES • INDUSTRIAL ENGINEERING INC. • INDUSTRIAL SCAFFOLD COMPANY, INC.

- ✓ Process runs on negative pressure, simplifies entire system and keeps combustion gasses inside incinerator.
- ✓ Proven process for sludge incineration utilizing Advanced Process Controls via burners, furnace draft and water.
- ✓ Furnace can be operated in “hot standby mode”
- ✓ Ash removal system helps to protect downstream equipment.
- ✓ Retention times for Sludge (Feed) is 60 to 90 minutes and Hot Gases, 1300 DegsF or greater, is 15-60 seconds.





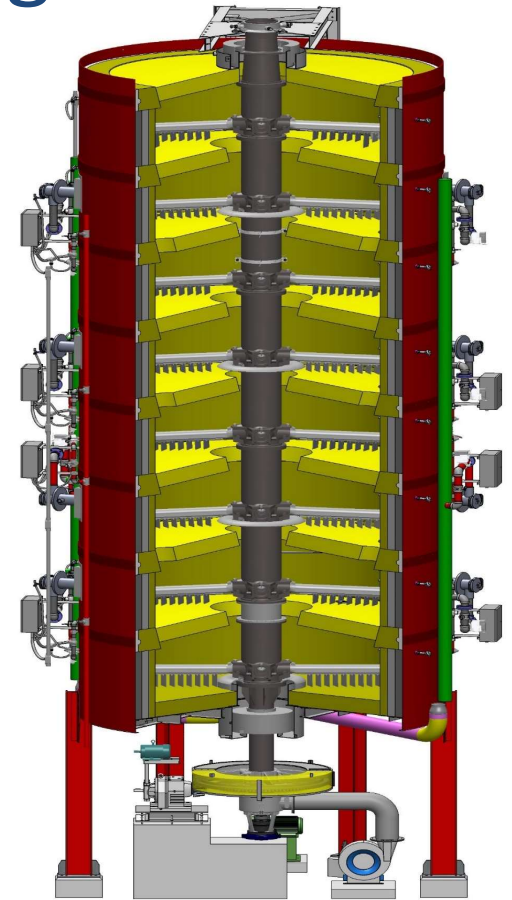


# INDUSTRIAL FURNACE COMPANY

MHF SERVICES • INDUSTRIAL INCINERATION INC. • INDUSTRIAL SCAFFOLD COMPANY, INC.

## MHF Operational Advantages

- ✓ Multiple Hearths (chambers) that can be individually controlled.
- ✓ The product bed can be different in each hearth, both on height and width
- ✓ Individual hearth doors provide ability to look inside each earth while operating to see process
- ✓ Can still run product if a hearth is lost.
- ✓ Currently the best available option for destroying PFAS



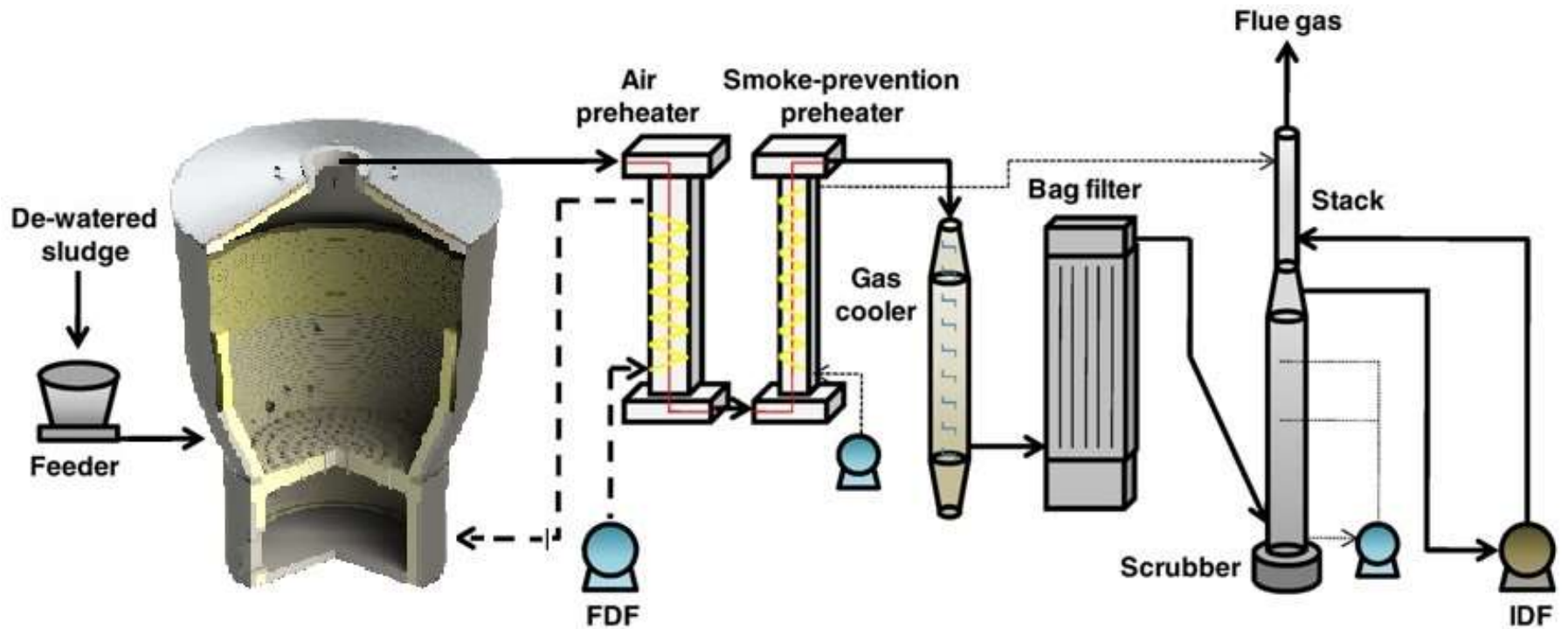




# INDUSTRIAL FURNACE COMPANY

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## FBI Process



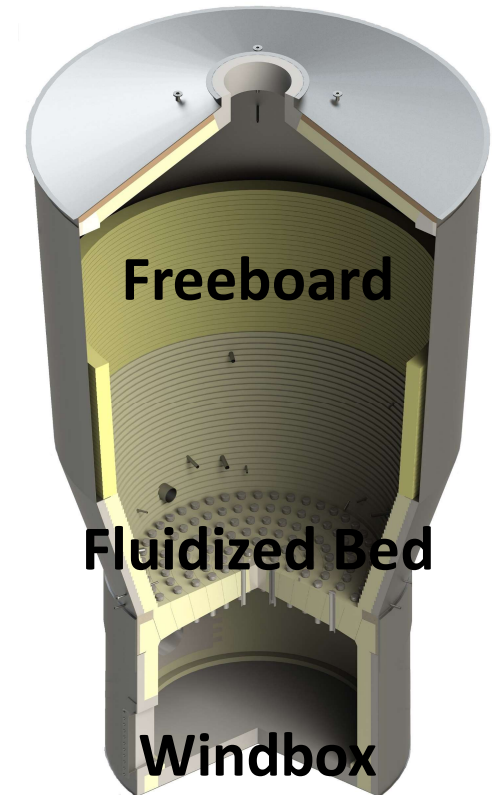


# INDUSTRIAL FURNACE COMPANY

MHF SERVICES • INDUSTRIAL INCINERATION INC. • INDUSTRIAL SCAFFOLD COMPANY, INC.

## Fluidized Bed Advantages

- ✓ Large combustion zone (freeboard) to aid in achieving complete combustion
- ✓ Uniform heat transfer (only one zone)
- ✓ Efficient at breaking up product via sand
- ✓ Relative pressure drop.
- ✓ Operational efficiency based on various parameters like bed temperature, sand bed height, feed rate & cake solids %, and fluidizing air rate, among others.



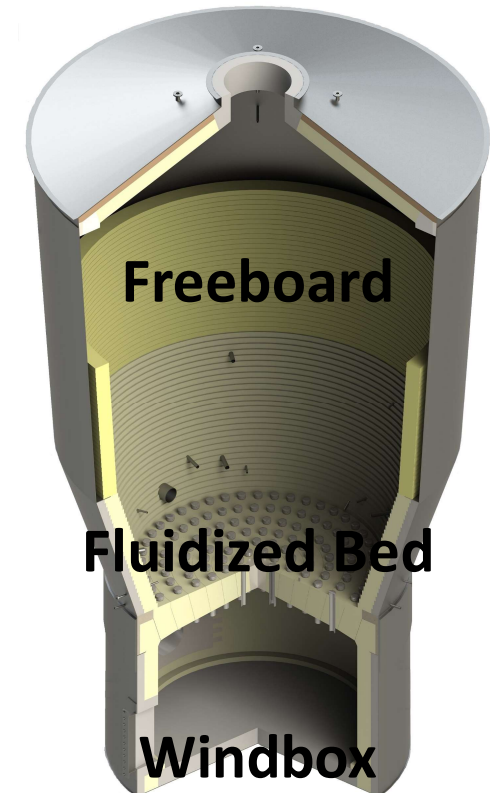


# INDUSTRIAL FURNACE COMPANY

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## Fluidized Bed Disadvantages

- ✓ A Positive Vessel (2psi +) requires more subsystem equipment to support the process.
- ✓ Very large footprint with all the support equipment. This equipment includes blowers, heat exchangers, ash handling and scrubber.
- ✓ Limited to one zone for processing materials.
- ✓ Subject to formation of hot and cold spots.
- ✓ Retention times for Sludge (Feed) is 1 to 5 minutes and Hot Gases, 1300 DegsF or greater, is 5 to 8 seconds.



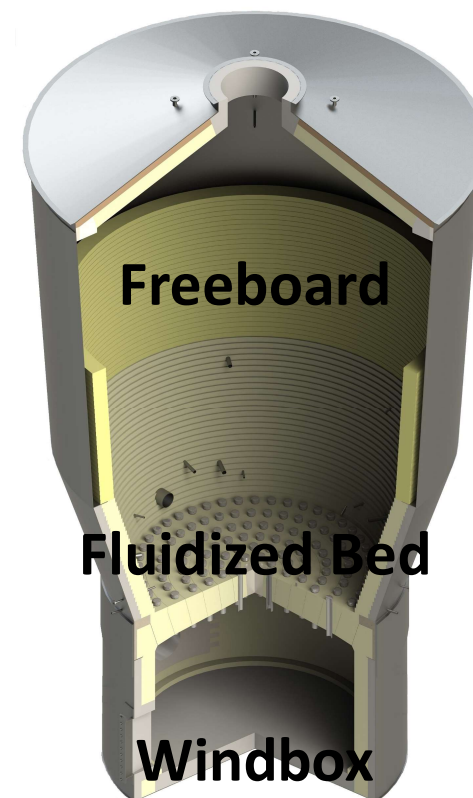


# INDUSTRIAL FURNACE COMPANY

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## Fluidized Bed Disadvantages

- ✓ Less direct O<sub>2</sub> control due to single zone of operation
- ✓ Subject to sand drop-out into lower chamber when process stopped.
- ✓ Refractory Dome is made up of all special shapes, which are costly and have long lead times.
- ✓ If refractory lining is loose or damaged, the process must be stopped and brought offline for repairs.
- ✓ Temperature capabilities of FBI are limited by downstream equipment.
- ✓ Higher loading of air pollution particles. Ash is removed via the Flue Gas then separated in the Scrubber.







# INDUSTRIAL FURNACE COMPANY

MHF SERVICES • INDUSTRIAL INCINERATION INC. • INDUSTRIAL SCAFFOLD COMPANY, INC.

## Compare MHF vs. Fluidized Bed

Item	Multiple Hearth	Fluidized Bed
Cost (CAPEX)	Very Good	Poor (Very High)
Cost (OPEX)	Very Good	Good
Footprint	Excellent	Good
Turn Down	Very Good	Good
Processes	Up to (5)	Can do (2)
Temperature Control	Excellent	Excellent
Heat Transfer / Feed Rates	Excellent	Excellent
Refractory	Very Good	Good
Fuel / O <sub>2</sub>	Excellent	Good
Feedback / Instrumentation	Excellent	Very Good



## Closing Comments

THANK YOU

Questions