

# Fluidized Bed Incinerator Upgrade Project (2005-2011)

Improves Energy Recovery, Burn Performance, and Reduces Maintenance

## BACKGROUND

The Manchester Environmental Protection Division constructed a fluidized bed incinerator (FBI) in 1992 for thermal destruction of their Wastewater Treatment Facility (WWTF) sludge. The WWTF has no back up incinerator, so reliable operation and minimization of incinerator shutdowns for inspection and/or repair is critical to minimize the operating costs. In order to increase reliability, reduce maintenance, and reduce the potential for unexpected and long duration shutdowns of the incinerator, in 2011 the City completed the Fluidized Bed Incinerator Upgrade Project.

## UPGRADE ELEMENTS

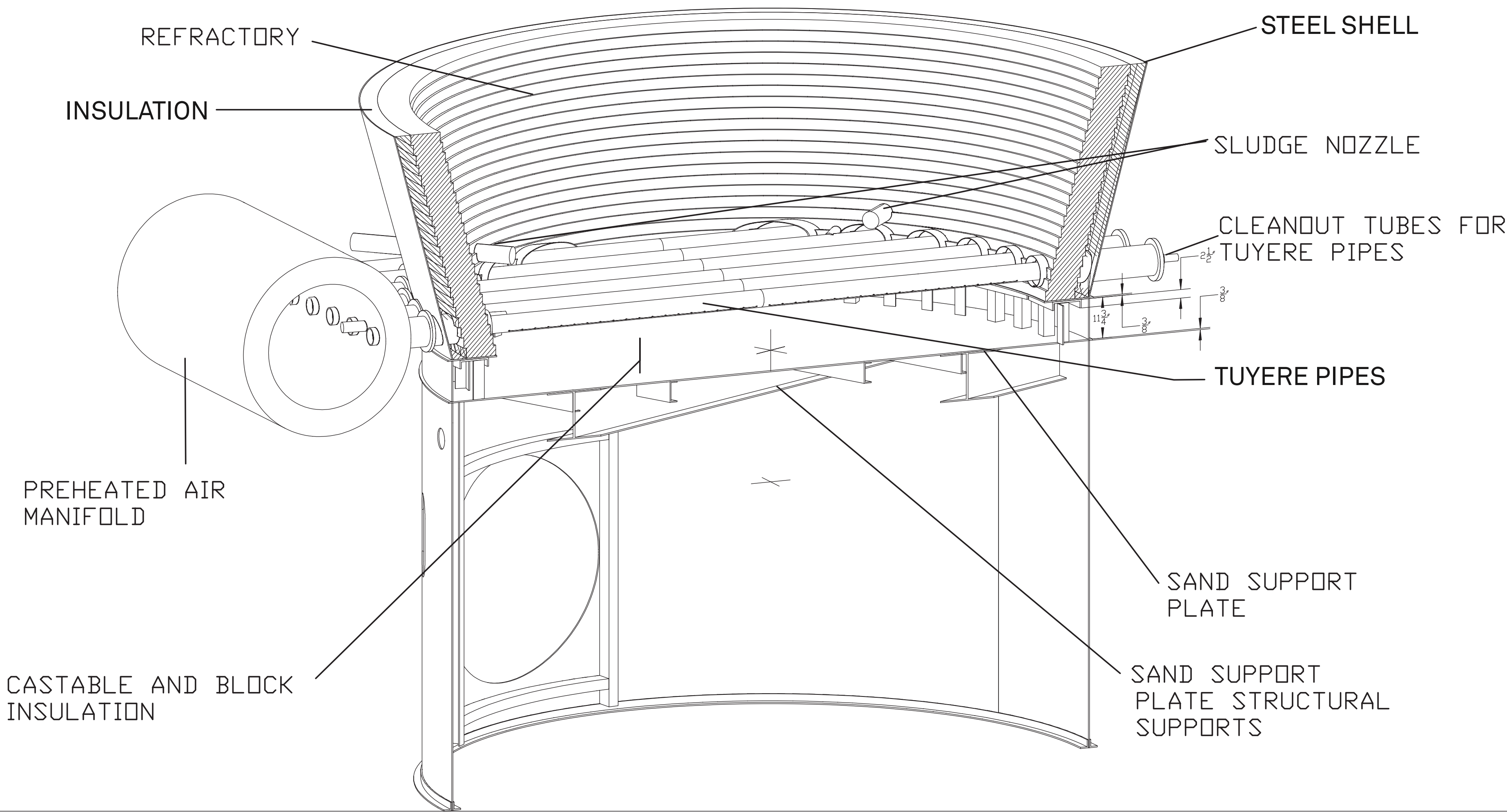
To address the issue with the repeated failure of the existing sheet metal tuyeres, a pipe tuyere system was installed. In addition a new air to water heat exchanger (economizer) was installed to allow for beneficial use of the waste heat. Also, significant portions of the FBI air piping system as well as the main vessel shell, penetrations, and internal insulation and refractory systems had suffered heat, corrosion, or erosion damage during its years of service. These elements of the FBI were upgraded to provide extended service life and to increase the heat, erosion, and corrosion resistance of the system.

## COMPLETED PROJECT BENEFITS

As a result of the incinerator modifications project the following benefits have been realized:

- Improved FBI reliability and reduced maintenance.
- The Economizer's winter heat recovery reduced heating oil use approximately \$50,000 per month or \$250,000 per year.
- Reliable batch thermal destruction of the WWTF sludge (eliminated the need for unexpected off-site sludge disposal).
- With a total project cost of approximately \$4.5 M (not including temporary sludge hauling and heating oil costs) the payback is approximately 3 years vs. offsite disposal and heating oil use.
- The new pipe tuyere design allows for blow out of sand between the WWTF batch sludge burning operations. This allows for more uniform air distribution and reduced slagging potential.
- Improved vessel heat retainage (more than a 25% improvement) between batch sludge burns.

FBI Vessel and Air Distribution System Cross Section



## Fluidized Bed Incinerator Statistics

### FBI Vessel Size

19 ft. 3 in. Diameter  
24 ft. High

### Fluidizing Sand Quantity

48 Tons  
6 ft. Depth

### Exhaust Stack

3.5 ft. Diameter  
115 ft. 10 in. High

### Sludge Oxidation Rate

3,500 lbs/hr, dry  
15,910 lbs/hr, wet @ 22% solids

### Operating Temperatures

Normal 1,300-1,500°F  
Maximum 1,600°F

### Fluidizing Air Blowers

1 @ 350 HP - 1 @ 400 HP

### Tuyere Pipe Material

CT15C ASTM A-351 (19-21%  
(Chromium 31-34% Nickel)

**Maximum Waste Heat  
Recovered for Beneficial Use**  
12,200,000 BTU per Hour

## OTHER PROJECT UPGRADE ELEMENTS

Other project upgrade elements include:

- Fluidizing Air Blower Reduced Voltage Starters (soft starts) for improved 350 HP or 400 HP air blowers starts (no dimming of WWTF lights).
- New recuperator bypass and freeboard water spray system for FBI over temperature control.
- FBI Burner System Upgrades allows use of natural gas in lieu of oil for FBI cold start ups improving the burner's temperature control and eliminated previous burner blow out problems.
- A continuous emissions monitoring system (CEMS) replacement to maintain emissions reporting compliance.
- A new venturi scrubber provides reliable exhaust ash removal to maintain air permit compliance.

Tuyere Clean Outs for Sand Removal



Pipe Tuyeres for Reliable and Uniform Air Distribution



New Economizer Allows for Beneficial Use of Waste Heat



External Air Distribution Manifold Improves Maintenance Access



New Internal Vessel Improves Heat Retention and Abrasion & Corrosion Resistance



## SUMMARY

The Fluidized Bed Incinerator Modification Project has increased reliability, reduced maintenance, improved burn performance and improved energy recovery of the EPD's thermal sludge destruction operations. This project reduced the WWTF heating costs by approximately \$250,00 per year and the sludge disposal cost by \$1.5M per year.

|                     |               |
|---------------------|---------------|
| Study:              | 2005          |
| Design:             | 2005-2008     |
| Construction:       | 2009-2011     |
| Total Project Cost: | \$4.5 Million |

Contractor: **KINSMEN**  
CORPORATION  
CONTRACTORS • ENGINEERS



Engineers: **AECOM**  
**CBE**