Direct Steam Injection for Anaerobic Acid Phase Digester Heating
- Family owned – third generation
- Wide range of installs from food to heavy industrial
- 85+ years of proven technology
- Over 20,000 heaters installed globally
- Integrated engineering, manufacturing, assembly, testing
  - 25+ full-time engineers on staff
  - 15 active patents (4 pending, 40+ process patents use our products)
  - Made in the US– sourced locally when possible
  - Manufacturer/machining of all components of our heaters, heater bodies are castings from local foundries
Borough of Chambersburg
Waste Water Treatment Plant

- Case study on the implementation of Direct Steam Injection Technology at the Waste Water Treatment Plant.
- About 7 million GPD are treated at the plant.
- Operating Parameters
  - Steam Pressure: 75psig steam
  - Sludge: Inlet: 98F Outlet: 106F
  - Flow rate: 400-500 gpm
  - Normal operating conditions: 40,000 gallons added to acid phase digester – Retention time = 1.5 days
Why Direct Steam Injection

- Direct Steam Injection (DSI) heater installed as a redundant heat source to the Heat Exchanger.

- DSI heater achieves complete heat load when the methane boiler is struggling to provide hot water to the Heat Exchanger.

- Heat Exchanger is supplied with hot water at 180F from the methane Boiler. Steam boiler installed to supply DSI Heater.

- Consistent Bio Gas generation in winter months using DSI Heater as it can maintain precise temperature control.
Introduction to
Steam Injection Technology
Steam Heating Technology

Indirect

External Modulation

Advancing Technology

Direct Heating

Low

Medium

High

Internal
Indirect Heating: Heat Exchangers

- Best for heat recovery: liquid-liquid
- Prone to fouling and scale
- Requires condensate return
- Footprint requires space for maintenance
- Issues with response time and tight temperature control
ADVANTAGES OF DSI OVER EXISTING HEAT EXCHANGER:

- More robust, much smaller foot print.

- Extremely small investment compared to a new HX.

- Heating is achieved much faster with DSI-Precise temperature control.

- Maintenance: Difficult to maintain and replace pipes of HX. Seals wear out periodically.

- NOH can be directly installed on to existing piping.
Applications Overview

Plant overview - Anaerobic Digesters
Progression of Technology

Heat Exchanger → Solaris → Non-Obstructing Heater (NOH)
How the Solaris Works

- Steam injected using diffuser technology
- Mixes into cross flow of fluid
- Utilizes rotary actuator
- Straight-through flow path for fluid
- Able to handle viscous, particulate slurries
HOW THE SOLARIS WORKS

- Steam control internal at point of mixing
- Full steam pressure
  - Choked steam flow
  - Constant density
  - Constant mixing velocity
- Instantaneous steam condensation
- Precise temperature control
- Large steam turndown capability
- No steam hammer
• The Solaris was initially installed as a redundant heat source with the Heat Exchanger.

• During the design phase, it was confirmed that the sludge was screened before entering the Solaris.

• In actual operation, there were rags in the process that would wrap around the diffuser clogging the line in 12 to 18 hours. This would require them to shut-down, remove and clean diffuser.
Hydro-Thermal decided to install the NOH (Non-Obstructing Heater) with the benefit of a straight-through flow design that could handle large particles in the sludge.
How the NOH Works

- Product flow completely unrestricted
- Steam surrounds exterior of diffuser tube
- Modulating internal plug
- Servo motor driven gear box for precise control of steam injection
- ANSI 300# body design
The NOH was installed in November 2017 as a replacement to the Solaris.

The heater ran without any clogging or product build-up with the same amount of large particles being pumped through it.

An inspection showed that there was little to no wear on the internals of the heater.
Inside the Plug
INSIDE THE DIFFUSER
Interior hole (product contact side)

Exterior hole (steam contact side)
Installation Guidelines
Applications:
• Compact skidded system
• Digester heating
• Pre-heating waste sludge
• Sludge recirculation loop heating
Questions?

Thanks!

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