



Start Up, Operation, and Performance of the Durham AWWTF Brown Grease Receiving and Cogeneration Facilities

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Water Environment School 2017**



Agenda

- **Project Background**
- **Systems Overview**
- **Brown Grease Facility**
- **Cogeneration Systems (Engines)**
- **Digester Gas System**
 - Gas Storage
 - Gas Purification
- **Startup challenges**
- **System performance**





Project Background



2008 Facilities Plan

- **Move active digestion to Digester Complex 2**
- **Use Digester Complex 1 as storage**
- **Construct new Cogeneration Facility**
 - Deteriorating condition of existing engine
 - Policy to increase utilization of digester gas to reduce power and heat costs at the plant



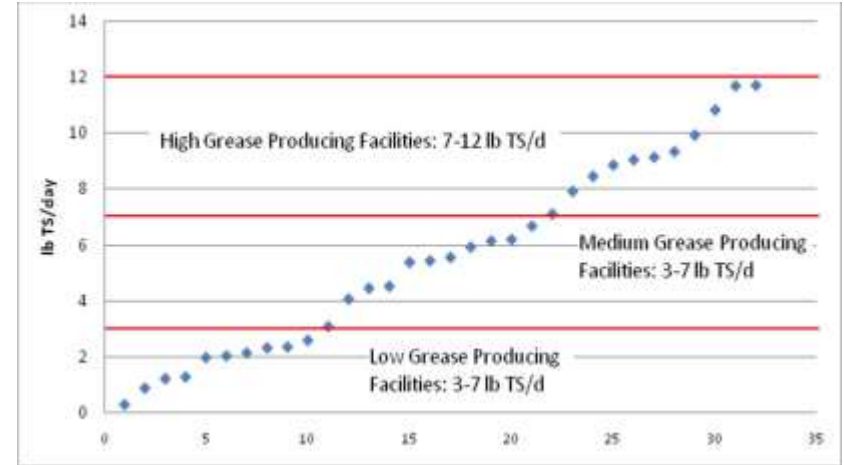
Increasing Gas Production

- **Digestion of Municipal Sludge had limited gas production**
- **District interested in find new waste resources to recover**
- **How much grease is out there?**



Brown Grease Study

- **2010 Study by Kennedy Jenks evaluated grease production in Washington County**
- **Focused on restaurant grease production using sampling and statistical analysis**
- **Determined up to 22,700 GPD of Grease “Available”**



Project Development

- **Contracted with CH2M to design new facilities in 2012**
- **District staff and CH visited similar facilities to develop concepts and learn lessons.**
- **Pre-selection of Engine and Gas Treatment vendors**
- **JW Fowler selected as construction contractor**

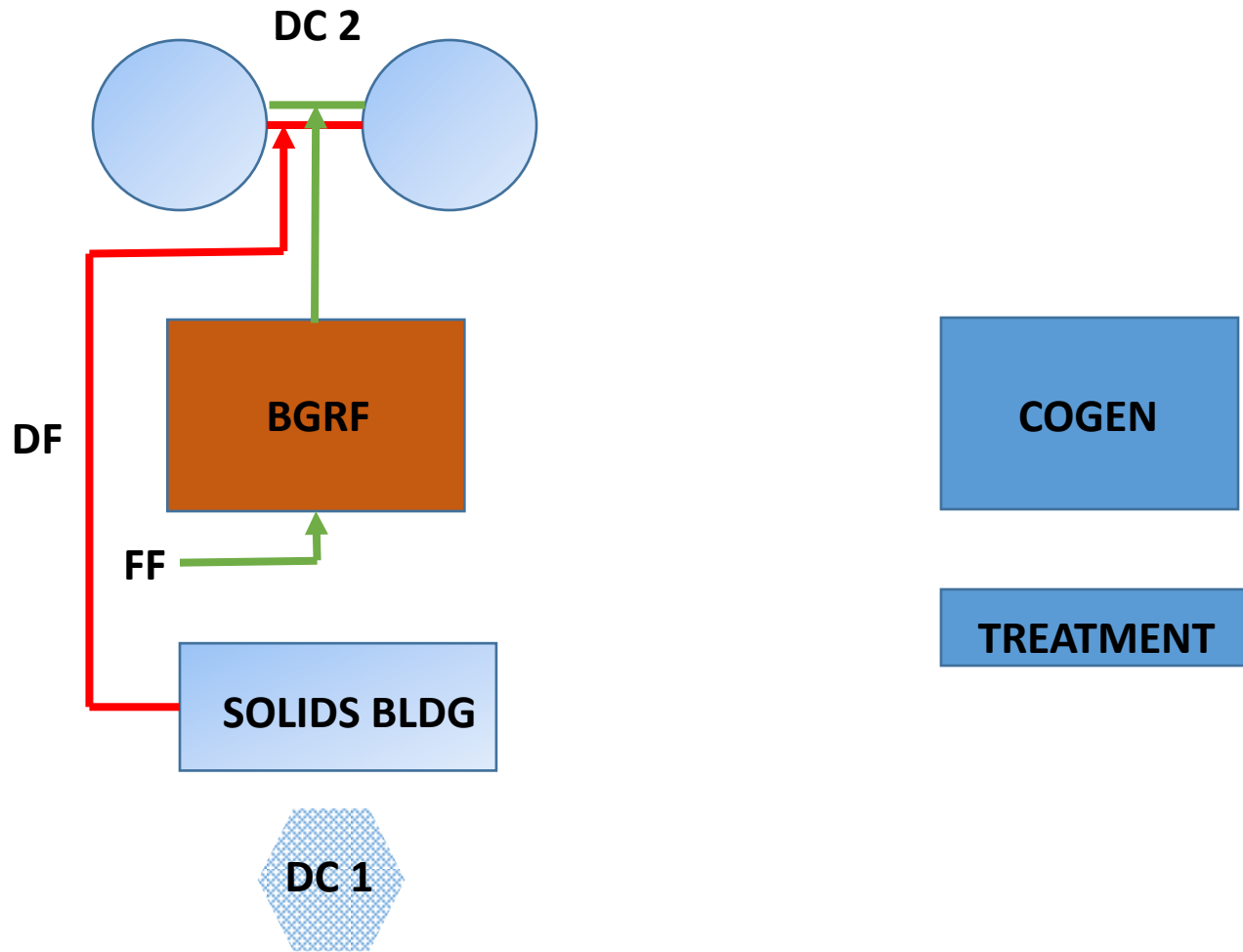




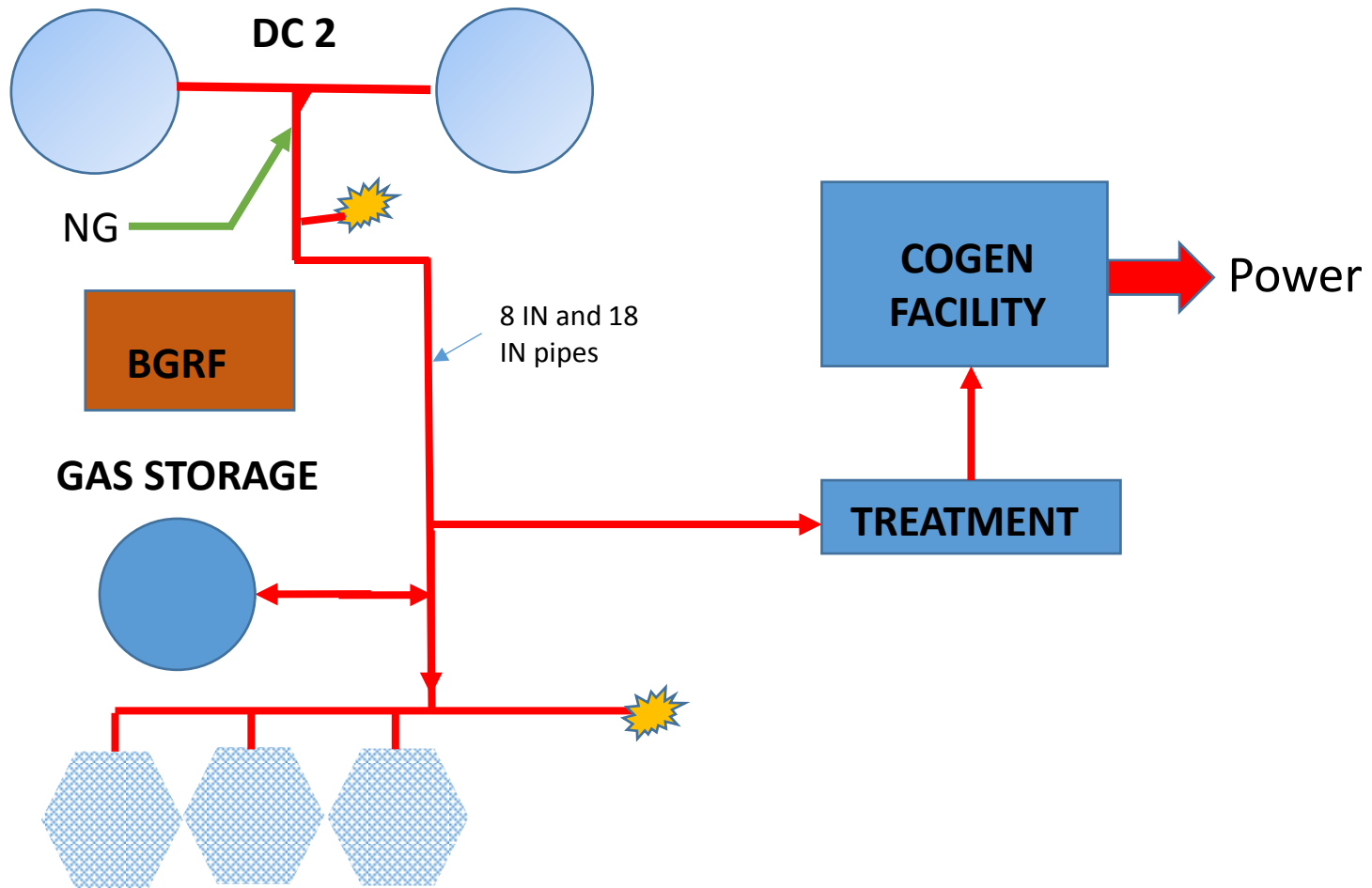
Systems Overview



Digester and FOG Feed Systems



Gas Systems





Brown Grease Receiving Facility



High Strength Waste Sources



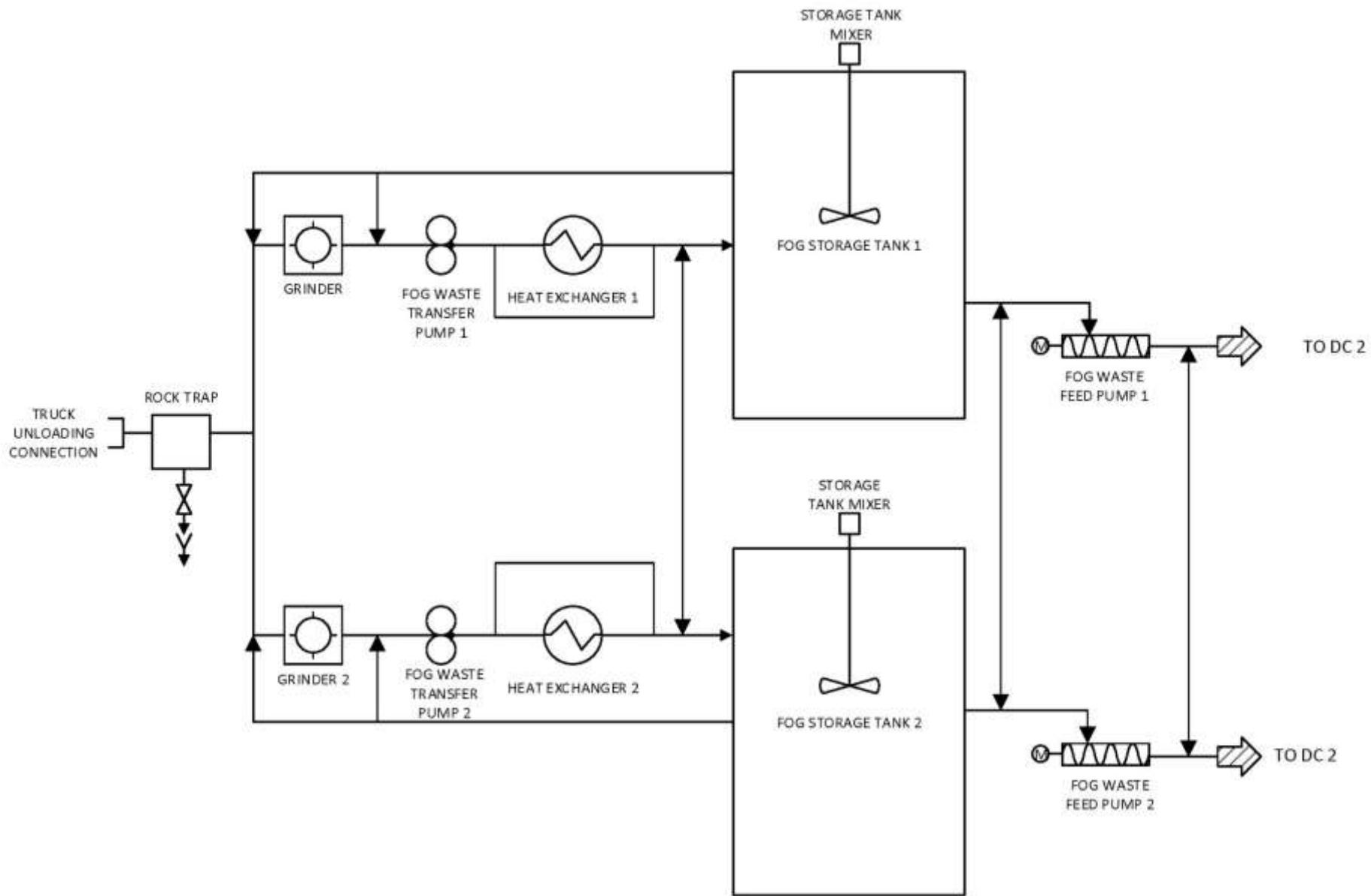
- **FOG from Haulers**
 - Individual haulers are pre-certified
 - Haulers under contract
- **High strength COD waste**
 - Waste sugar from expired beverages
- **Food Processing Waste**
 - Waste goes through a dissolve air flotation thickener prior to hauling
 - Waste was removed from the collection system to prevent overflows



Brown Grease/High Strength Waste Processing and Feeding

- Receiving
- Rock Trap
- Grinder
- Pumping
- Heating
- Storage
- Digester Feed

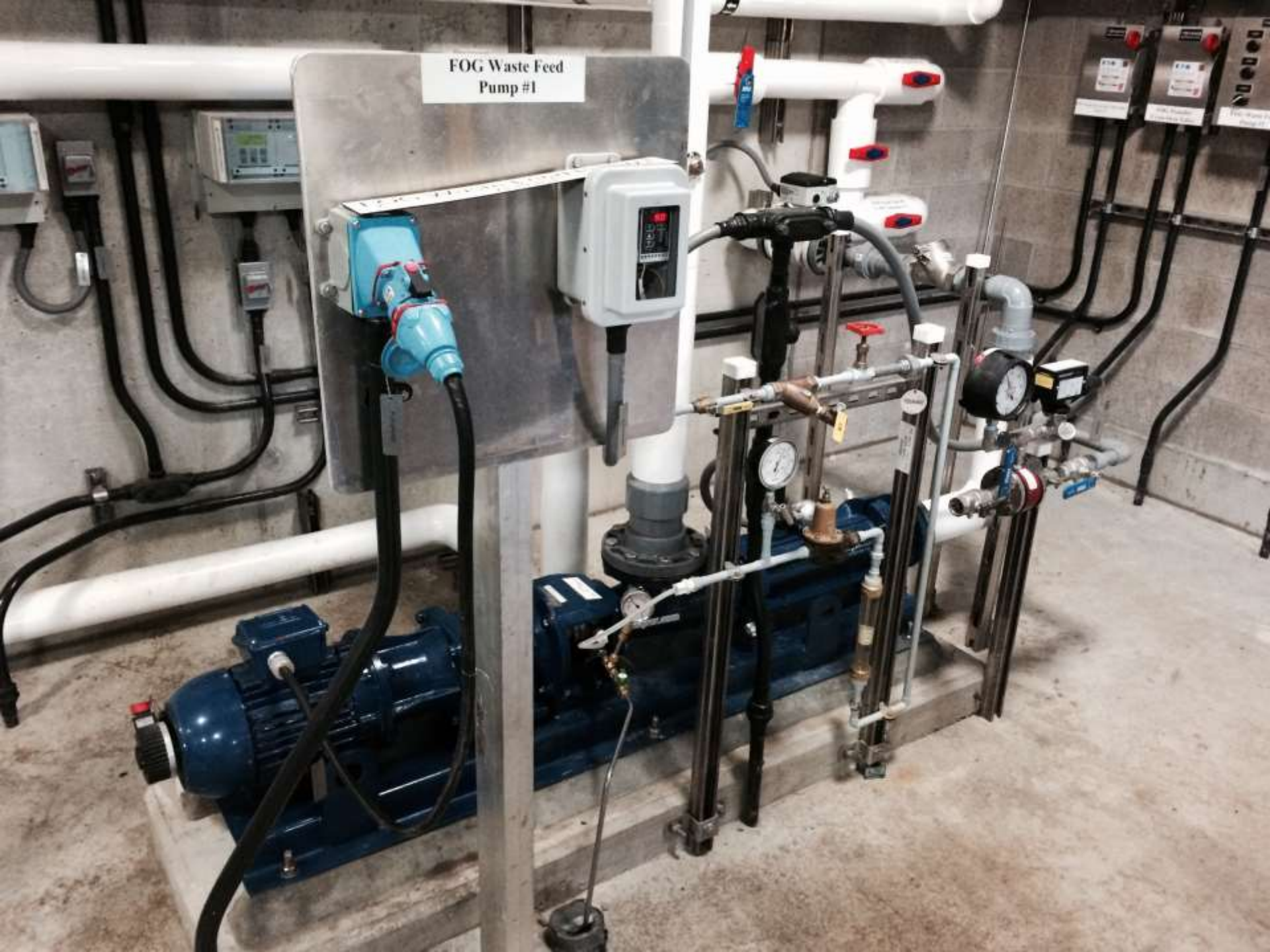








FOG Waste Feed
Pump #1





Cogeneration Facility

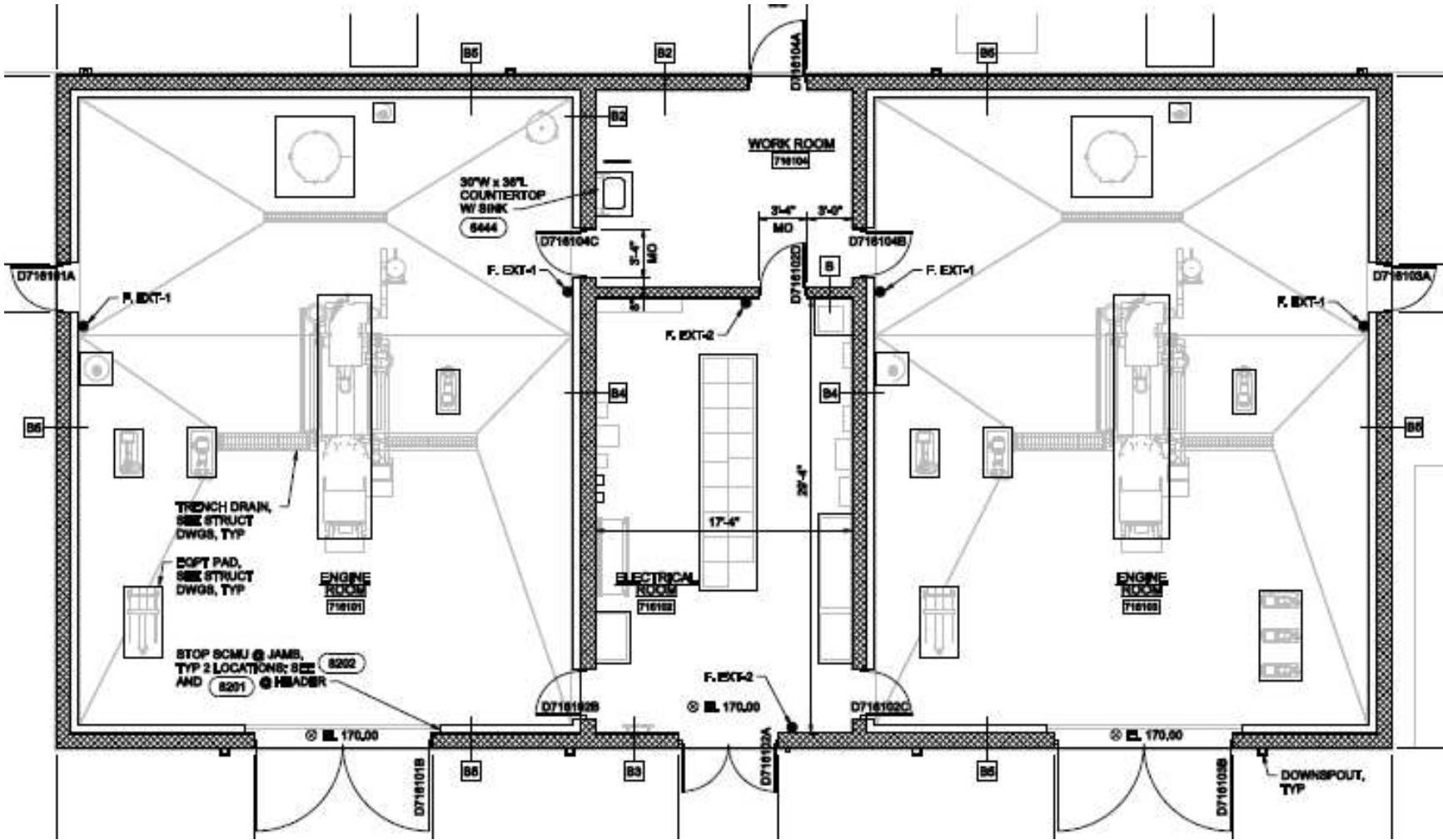


Cogeneration Facility

- Fuel Supply
- Engine & Auxiliaries
- Hot Water Interface
- Lube Oil Systems
- Engine Room Ventilation
- Engine Room Cranes



Cogeneration Facility



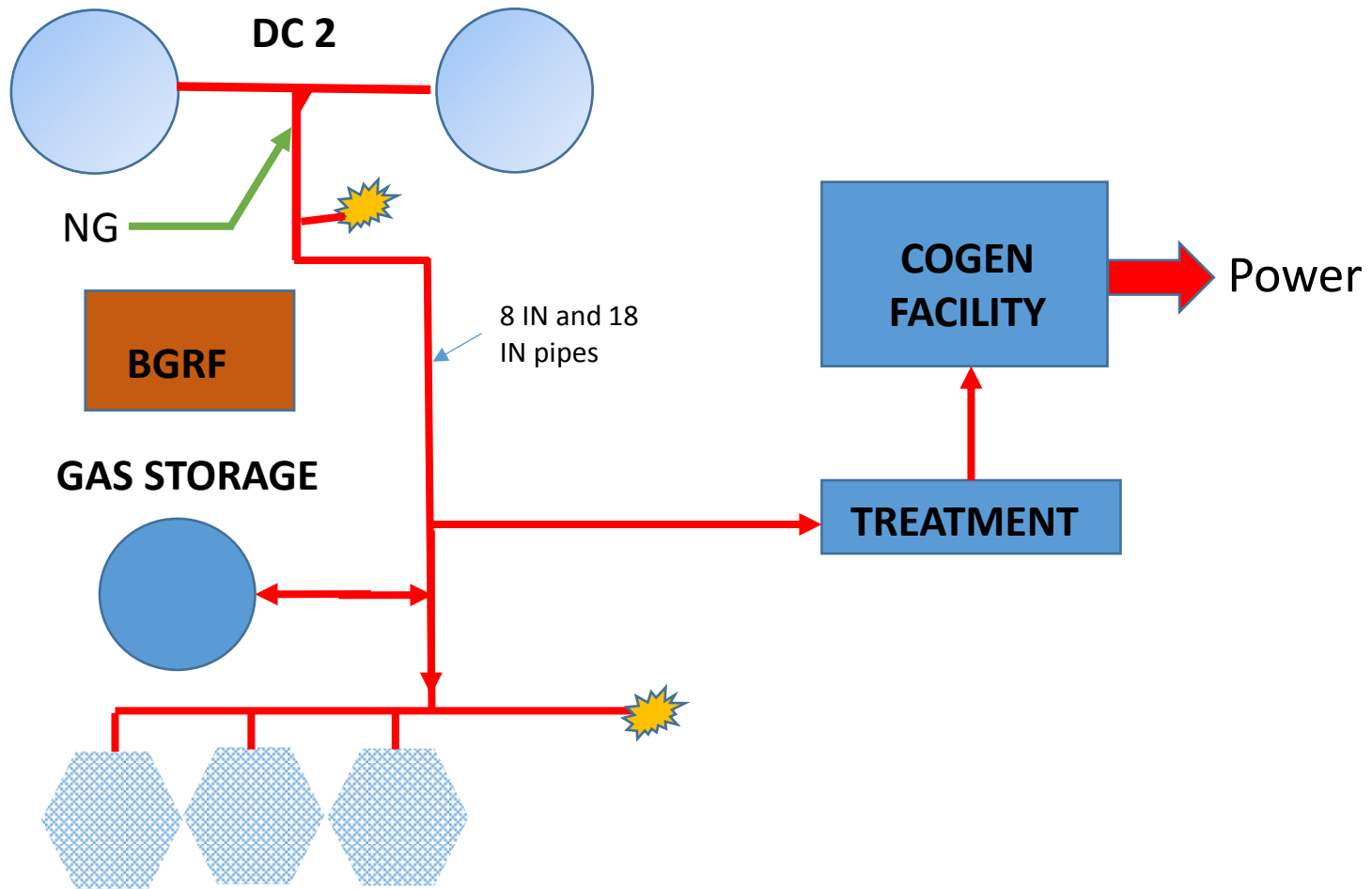




Digester Gas System



Gas System



Gas Storage

- **Westech**
- **25,000 cubic feet**
- **Provides approx. 50 minutes of storage**
- **Improves operation (wide spot)**
- **On top of existing digester and tank is still usable**





Gas Purification

- **Unison System**
- **H₂S, Moisture, and Siloxane Removal**
- **Compresses gas to 5 psi**
- **Sulfatreat Media for H₂S**
- **Activated Carbon for Siloxane**







Startup & Operational Challenges



If you build it, they will dump

- **CWS contracted with 4 different FOG haulers**
- **Haulers were very anxious to use the facility**
- **Training every driver presented challenges**
- **Metering calibration**



Vibration, seals, and leaks

- **Rotary lobe pumps are a different animal**
- **Get the right lobes!**
- **Vibration can be significant**
- **Double mech seals needed for FOG application**



The FOG Fountain!

- **Rock trap worked very well at removing rocks, but messy to clean**
- **Does not remove grit well**
- **Hot water added to facilitate cleaning**
- **Not pressure rated!!**



FOG Stinks!

- **FOG is a challenging odor source**
- **Switched to passive odor control system for FOG tank**



FOG is very Aggressive

- **FOG varies greatly, but typically has a pH of ~4**
- **FOG is also heated and kept at ~90F**
- **Tank coating completely failed in less than a year**



FOG has True Grit

- **Grit is inevitable but challenging to manage**
- **Caused damage to pumps**
- **Filled up the tank**
- **Packed the digester feed lines**



FOG is hard on equipment





System Performance

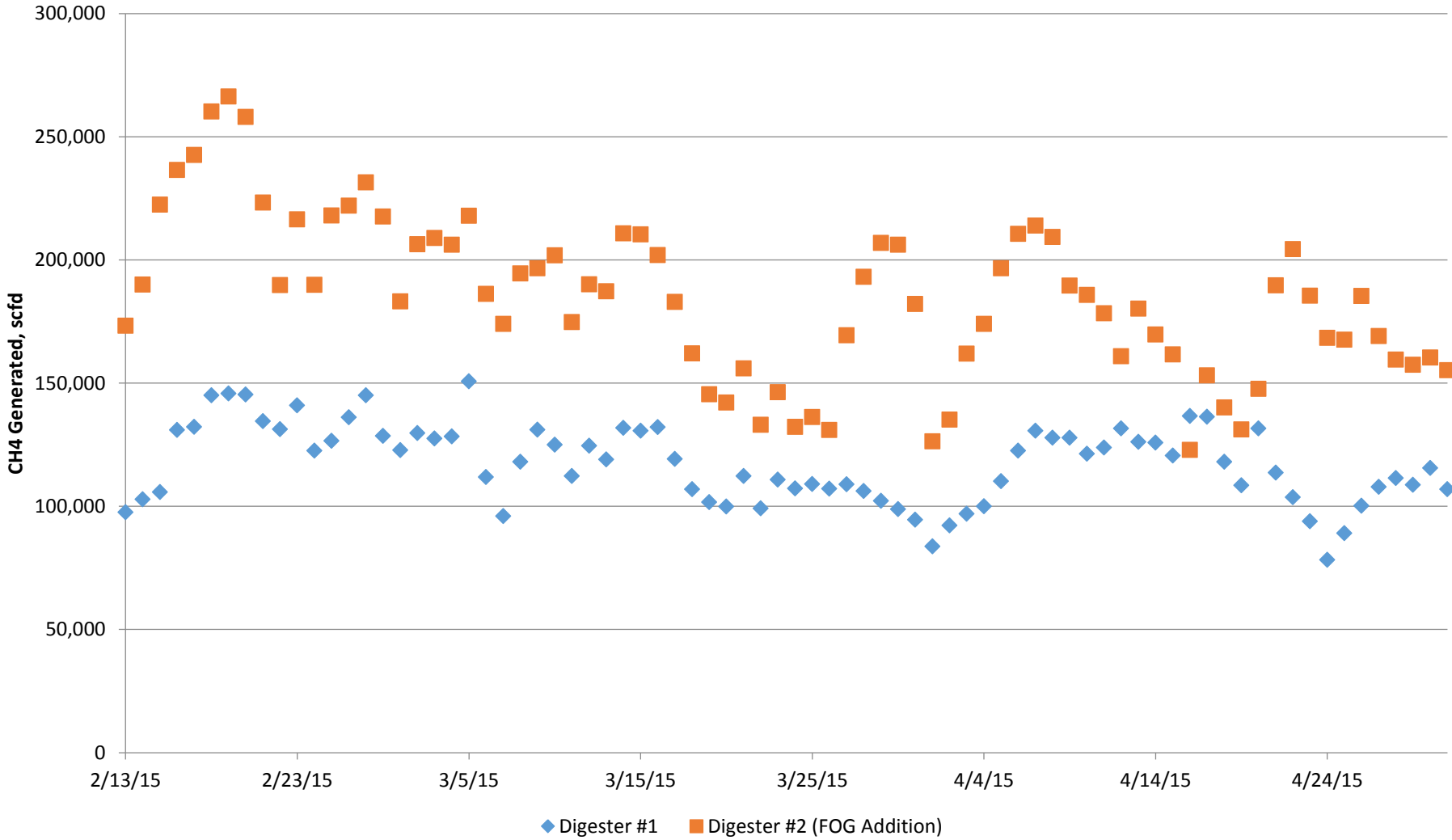


System Performance to date

- **FOG Receiving works well**
- **Grit accumulation**
- **Increase in gas production from codigestion aligns well literature values**
- **Gas treatment media effective**
- **Engines are workhorses, but require attention**
- **Hot water system provides most of demand**
- **Plant upsets can limit production**



Durham Digester Gas Production Methane Generation

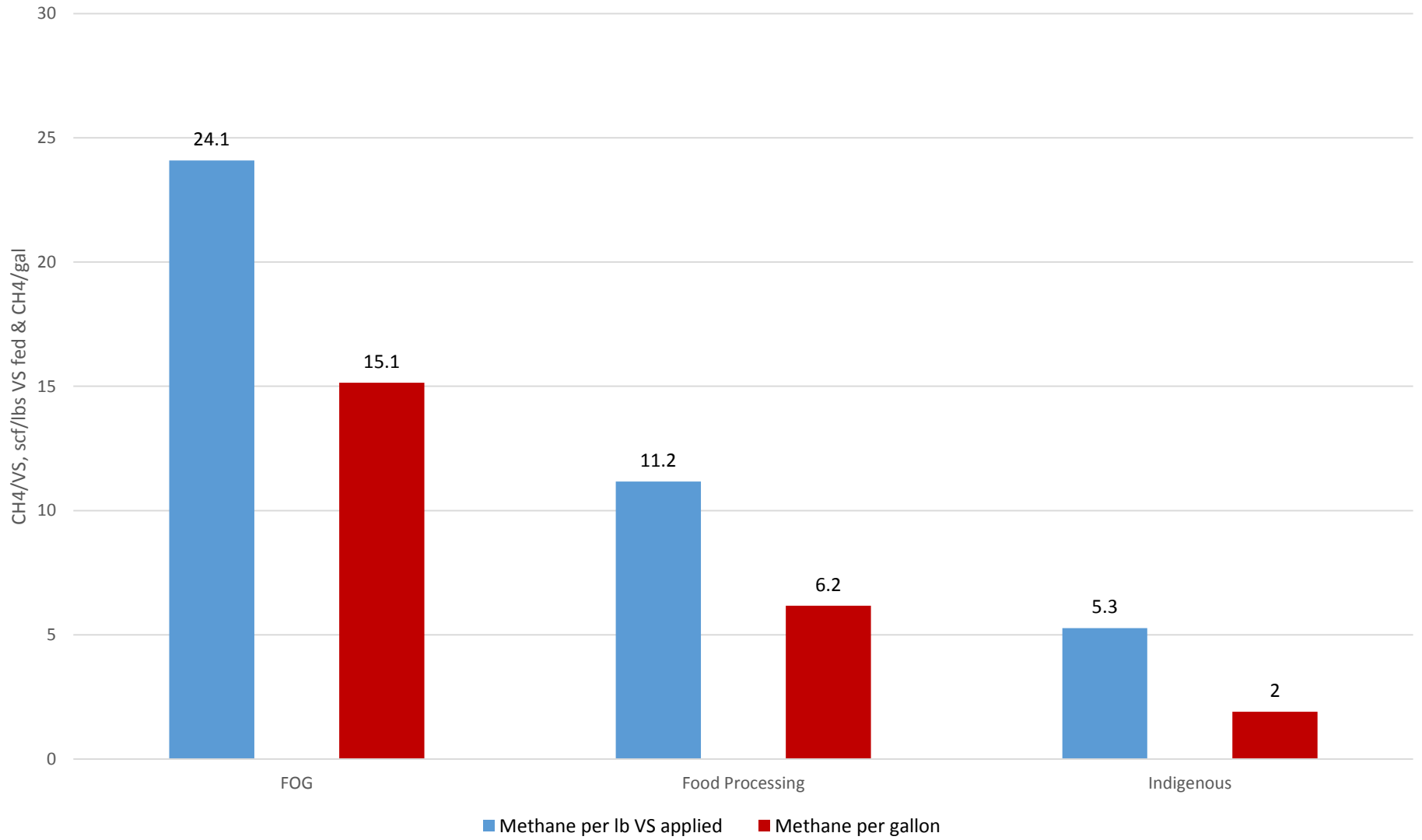




Is it worth it?



Gas Generation Based on VS Applied



Economic Benefit



	FOG	Food Processing Waste
CH ₄ scfm/gal	15.1	6.2
% CH ₄ in biogas	65%	65%
Biogas scfm / gal	23.3	9.5
\$/cubic ft of biogas	\$0.0044	\$0.0044
Tipping Fee	\$0.074 /gal	
Gas Benefit	\$0.103 /gal	\$0.042 /gal
Total Benefit	\$0.177 /gal	\$0.177 /gal
Required Tipping Fee		\$0.135 /gal





Questions?

