DTE Energy®

Transmission and Storage Operations

Natural Gas Infrastructure R&D and Methane Mitigation Workshop

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November 12, 2014

Agenda

- DTE Gas Snapshot
- NOx & CO
  - Combustion stability
- Methane
  - Packing
  - Blowdowns
    - Capture vs Flare

SNAPSHOT

- DTE Gas
  - 41 Units
    - Age Range: 8-59yrs (Average 45yrs)
  - 118,200HP
    - 1,000-15,000HP
  - 7 different manufacturers
    - Cooper-Bessemer, Solar, Waukesha, DeLaval, IR, CAT, Ariel
  - Complete Mixture
    - Integral, Separable, 2-Cycle, 4-Cycle, Reciprocating, Centrifugal, High Speed, Mid Speed, Low Speed, Rich Burn, Lean Burn, Air Start, Gas Start

Combustion Stability!!

- Combustion Stability Initiatives
  - Pre-combustion Chambers
  - Trapped Equivalency Ratio (Air/Fuel Curve Modification)
  - Catalysts
    - 98% Reduction in CO
    - NO Reduction in NOx
  - Ignition system upgrade
    - 81% Reduction in NOx
    - 15% Increase in CO

- Challenges
  - Technology resulting in less than 2g NOx emissions
  - Emission regulations dropping
  - Stability control with combining technologies
  - Cost

Methane Release Reduction

- Sealing Technology Limitations
  - Compressor rod seals require designed clearances to allow for independent rod and piston motion
    - Best industry standards sit around 10scfh, but range drastically
  - They are often shut down, but required to remain in operational, pressurized condition
    - Static vs Dynamic
  - Rod seals utilize cylinder pressure to activate the packing rings
    - DTE operational variations range between 230psi to 1250psi suction pressure

- Compressor Configuration
  - Leakage is inherent in all reciprocating compressors
    - Standard Packing (Currently seeing up to 60scfh in dynamic mode with new packing)
    - Low Emission Packing (Expecting to see less than 30scfh in dynamic mode)
    - Zero Emission Packing (Expecting to see minimal to none in static or dynamic mode)
  - Rates are dependent on size, mechanical wear and operating pressures
    - PM
    - PdM

Methane Release Reduction

Can the gas be captured or repurposed??

- Release Levels
  - Station
  - Unit
  - Component
- Capture Technology
- Flare Technology
  - Conversion of methane to CO2
    - Reduction of 95% methane emissions

Closing

- DTE Gas TSO Operations is continually looking for ways to upgrade our system and all equipment within

- We look forward to input, feedback and recommendations on all items mentioned

- Any follow up inquiries:
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QUESTIONS??