Methane Mitigator – Development of a Scalable Vent Mitigation Strategy to Simultaneously Reduce Methane Emissions and Fuel Consumption from the Compression Industry

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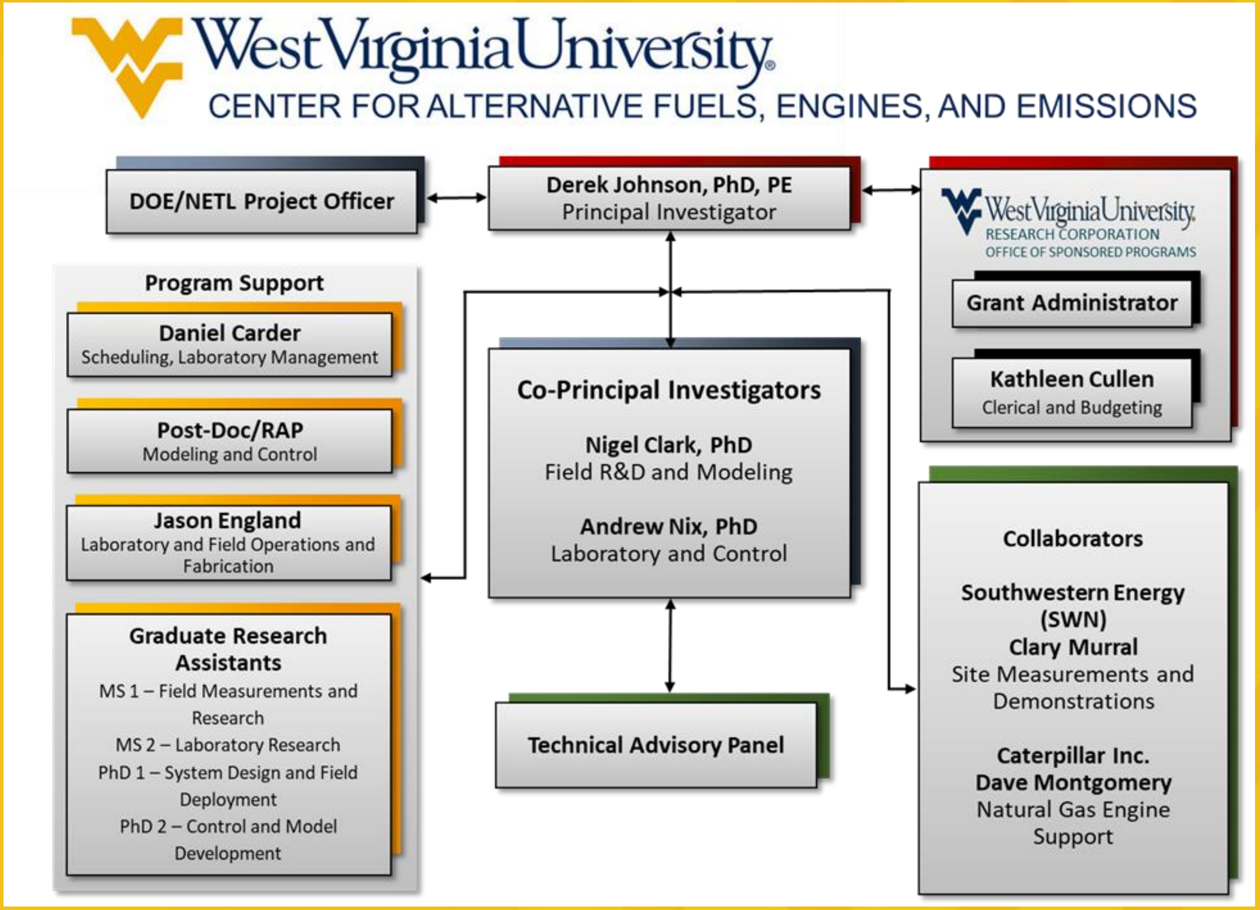
Project Team

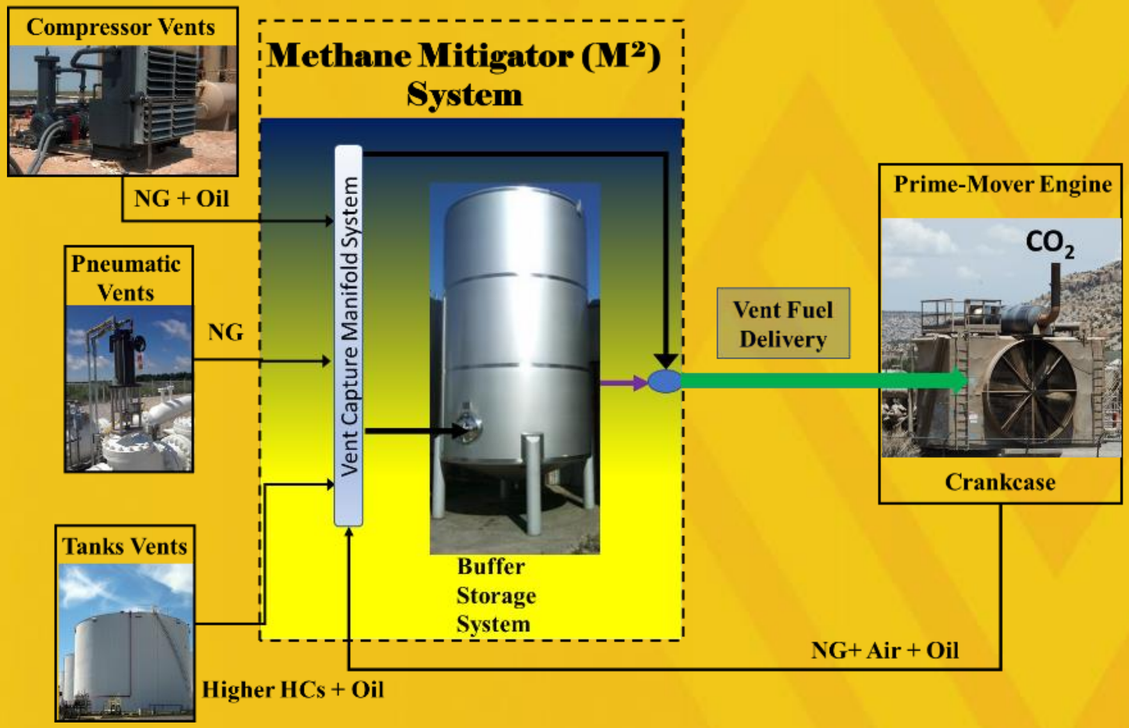
WVU – Team – 3 faculty, 4 GRAs, Post-doc

TAP –
- WVU
- CAT
- Bryan Marlow – Ariel
- Tracey Footer – ERG
- Nathan Fowler – Cenergy
- Richard Atkinson



Project Goal

Project Goal: *Develop a stand-alone vent mitigation system and fuel delivery control system capable consuming transient vent gas emissions in well site engines to reduce GHG and other pollutants.*

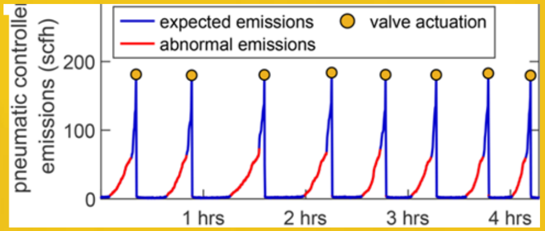


Focusing on well site components: compressor engine crankcases, seals/vents, pneumatic vent manifolds, produced water and condensate tanks

Literature Summary

Sources

- **Engine crankcases**
  - Vary with engine load and age
  - Short term steady
  - Inerts, oil vapor, and methane
  - ~ 1 SCFM of CH_4
- **Compressor vents**
  - Vary with load and age
  - Short term steady
  - Gas with oil vapor
  - ~ 4.3 SCFM of CH_4



- **PCs**
  - GPUs – collocated
  - Short term variable
    - Stovern, et al. - 4.9 PC per well
    - CPC up to 9.9 SCFH (time average)
    - IPC 0.1 up to 31.3 SCFH (time average)
    - Luck, et al. - 0.2 SCFM (time average)
    - Peak rates up to 200 SCFH (3 SCFM) (instantaneous emissions for actuations)
- **Tanks**
  - Variable composition – high VOCs
  - Short term variable
  - Variable based on gas, condensate and water production
  - ~13.7 SCFM CH_4 – time average

Field Equipment Update

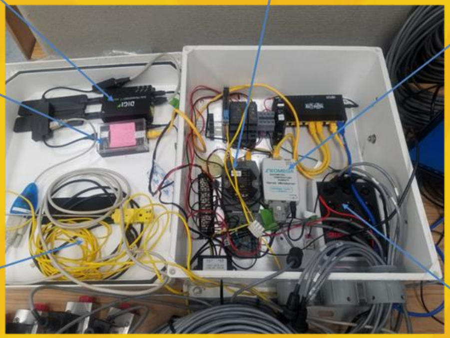
Engine Crankcases and Compressor Vents

- Full Flow Sampler
- Vehicle mounted system as in other ONG audits
- Excessive dilution – laser based , 4 gas analysis
- Samples – GilAir
    - Class 1 Div. 1 sampler to fill 10L Tedlar bags – dilute and raw

Field Equipment Update

Long Term

- Centrally located, solar powered DAQ trailer – safe perimeter location
- Uses in-house Scimitar
- Auto-record
    - 1-4 hr files
- Beagle bone platform
- Cellular notifications
- SD card storage



Field Equipment Update

PCs

- 6 – 250 SLPM Whisper MFM
  - o Low pressure drop for atmospheric vents
- 2 – 50 SLPM Whisper MFM
  - o Lower flows
- Class 1 Div. 2
- Sealed 50’ cables to DAQ trailer
- 1-10 Hz – serial com recorded

Field Equipment Update

Tanks

- 1 – Kurz 2” thermal based
  - Low pressure drop
  - Up to 250 SCFM methane
- 1 – 2” LFE viscosity based
  - Low pressure drop
  - Up to 100 SCFM air
- 1 – 4” LFE viscosity based
  - Low pressure drop
  - Up to 400 SCFM air
- 1 – 6” LFE viscosity based
  - Low pressure drop
  - Up to 1000 SCFM air

Sensors for LFEs

- 1 – Intrinsically safe DP
  - 0-10”
  - 4-20 mA
- 1 – Intrinsically safe DP
  - 0-1”
  - 4-20 mA
- 1 – K-Type TC
  - Isolation barrier for IS

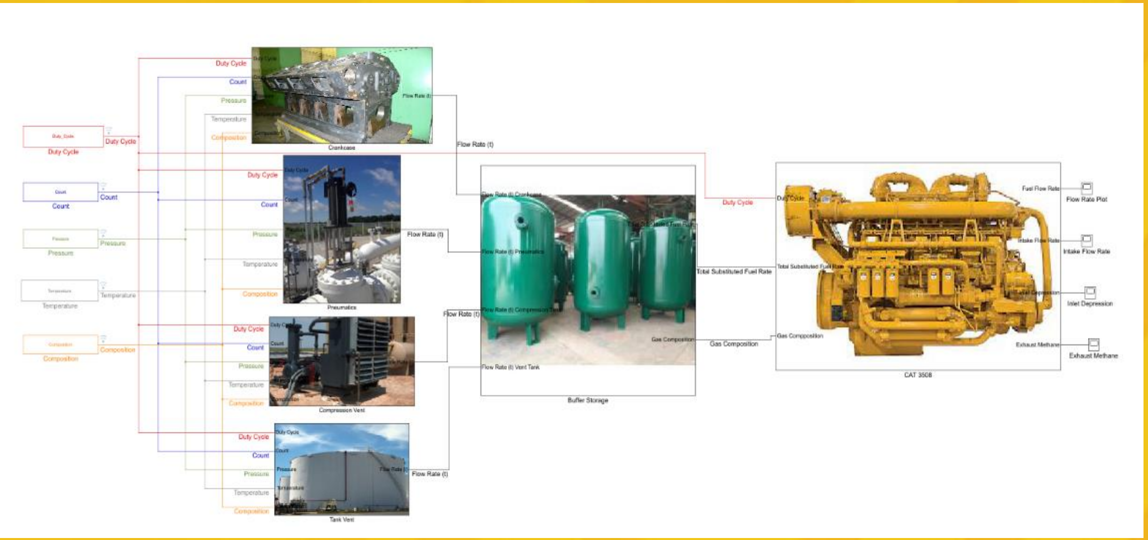
Modeling Summary

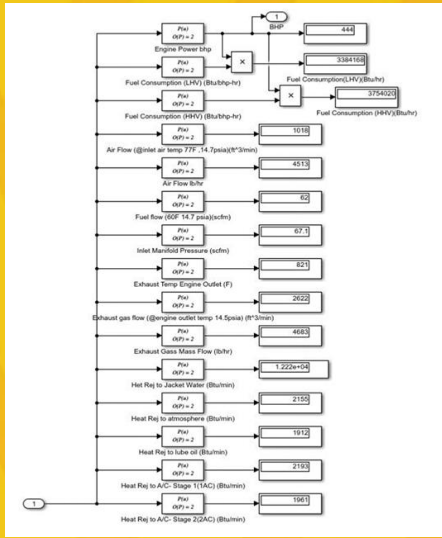
Basic Model

- CAT G3508J
  - 1200 RPM

- Inputs
  - Engine load
  - # of GPUs per site
  - Compositions
    - ❑ C1-C9, CO_2, CO, O_2, N_2

- Modeling goals
  - Assess various potential scenarios
  - Aid in the development of the methane mitigator, its control, and buffer/processing
  - A tool to assess various site/engine/designs

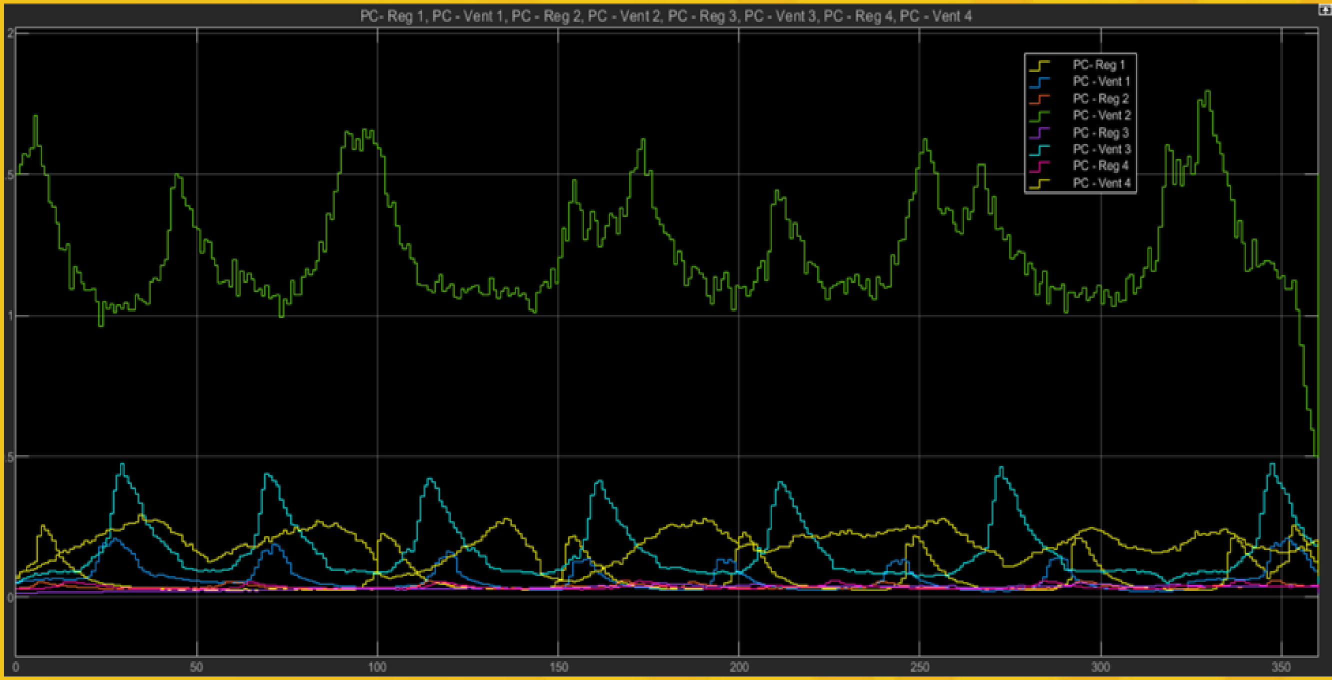




Modeling Summary

- Sub models
  - Engine
  - CC, CV, PCs, Tanks
- Captured Stream
  - Temporally varying parameters
  - Fuel flow rate
  - Capture flow rate
  - MN and HV

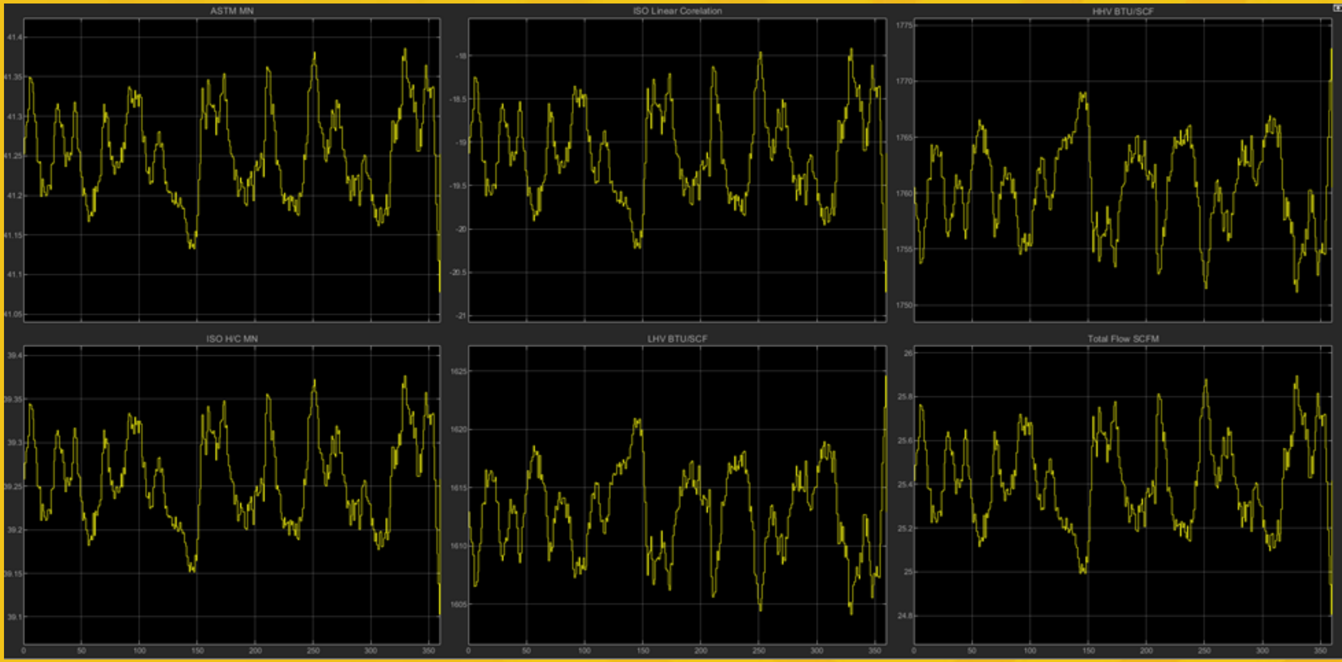
Example Sub-Model for 2 GPU Site



Modeling Summary

- Methane Number
  - ASTM
  - ISO H/C
  - ISO linear check
- Total volume
  - Relative fuel percentage
  - P, T

Total Capture Stream Properties



Equipment and Laboratory Update



Engine Equipment

- CAT G3508J
    - 1200 RPM for gen
- SR4 500 kW generator
- Cooling Skid – SCAC
    - Remote
    - 50 HP WEG
    - VFD
- Simplex Mars 700kW load bank
- 8” LFE – intake flow
- Bacharach gas monitoring for safety


Thank you!!!

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