



It's All in the Numbers: A Look Into Emission Factors Used in GHG Permitting and Reporting

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Presented by:

Jill Hecht

Mark J. Bareta

Overview



- > Introduction
- > Engine and turbine emissions
 - Required reporting
 - Approaches to emissions estimates
 - Results of internal examination
 - Conclusions
- > Glycol dehydrator emissions
 - Required reporting
 - Emission factors
 - Other options
 - Conclusions
- > Conclusion



Introduction

- > **Regulatory Implications**
 - > GHG Reporting Program
 - > Information for decisions about emissions reduction
 - > GHG Tailoring Rule
 - > Information for permitting
- > **Disclaimers (Natural Gas Processing Viewpoint)**
 - > Subpart C
 - > Subpart W
 - > GHG Tailoring Rule

Engine and Turbine Required Reporting



> Subpart C reporting

- > Fuel use and emission factors derived from carbon content of the fuel
- > Single emission factors pros/cons
 - Easy to use – a single emission factor
 - Easy to track – metered fuel use / hours of operation
 - Not as accurate – doesn't account for source differences, sizes, types, fuel slip, fuel quality

> Tailoring rule

- > Accuracy of emissions estimates – Permitting vs. GHGRR
 - Fuel Based Emission Factors
 - Equipment Specific Emission Factors
 - Stack Testing
 - Manufacturer Provided Information

Tailoring Rule Emissions Estimates

- > **Fuel Based Factors (Subpart C)**
 - Conservative approach to CO₂ emissions
 - Not equipment specific – ignores factors such as fuel slip
 - Leads to questionable CH₄ results
- > **Equipment Specific Fuel Based Factors (AP-42)**
 - Conservative approach to CO₂ emissions
 - Equipment type specific (rich burn, lean burn) – accounts for fuel slip, combustion efficiency
 - General estimate, not model specific (Waukesha vs. Caterpillar)
- > **Stack Testing**
 - Representative of a point in time, often of a ‘best operational scenario’
 - After the fact, expensive, difficult to do
- > **Manufacturer Emission Factors**
 - Very specific to scenario (altitude, temperature, etc.)
 - May not be complete at this time (incomplete data)
 - Often represent “guaranteed emissions” and may be overly conservative

Emissions Comparisons



> CO₂ Emissions

| Type | Model | Subpart C Emissions (MTPY) | AP-42 Emissions (MTPY) | Manufacturer Emissions (MTPY) |
|------------------------|-------------------------------|----------------------------|------------------------|-------------------------------|
| Rich Burn Engine | Waukesha L7042GSI | 5877.98 | 4981.77 | 5812.17 |
| Ultra Lean Burn Engine | Caterpillar G3516B 0.5gNOx | 5199.51 | 4406.75 | 5733.98 |
| Turbine | Mars 100 1500S | 57971.96 | 49733.04 | 58139.47 |

> CH₄ Emissions (CO₂E Emissions)

| Type | Model | Subpart C Emissions (MTPY) | AP-42 Emissions (MTPY) | Manufacturer Emissions (MTPY) |
|------------------------|-------------------------------|----------------------------|------------------------|-------------------------------|
| Rich Burn Engine | Waukesha L7042GSI | 0.11 (2.31) | 10.42 (218.82) | 22.06 (463.26) |
| Ultra Lean Burn Engine | Caterpillar G3516B 0.5gNOx | 0.10 (2.10) | 50.08 (1051.68) | 48.99 (1028.79) |
| Turbine | Mars 100 1500S | 1.09 (22.89) | 3.84 (80.64) | 13.96 (293.16) |

Buyer Beware



- > When evaluating the various methods, be aware of the intended function and match to your requirements
 - 40 CFR 98 → Regulation Provides Factors
 - Requirement of the regulation
 - Use Subpart C factors for Subpart C reporting
 - GHG Tailoring Rule Permitting → Manufacturer Emissions Data
 - Manufacturer emissions provide arguably best available data
 - May place facility in a better position for later regulatory actions or required stack testing
 - *** Evaluate all regulatory requirements for triggering permitting and reporting. You may trip a permitting or reporting threshold using manufacturer data, but you may not using Subpart C methodologies *** Use the correct program emission factors for each program.
- > You may be reporting/permitting different values for each source or facility
 - State Reporting / Federal Reporting / Other Reporting / EIQs

Glycol Dehydrator Emissions Reporting

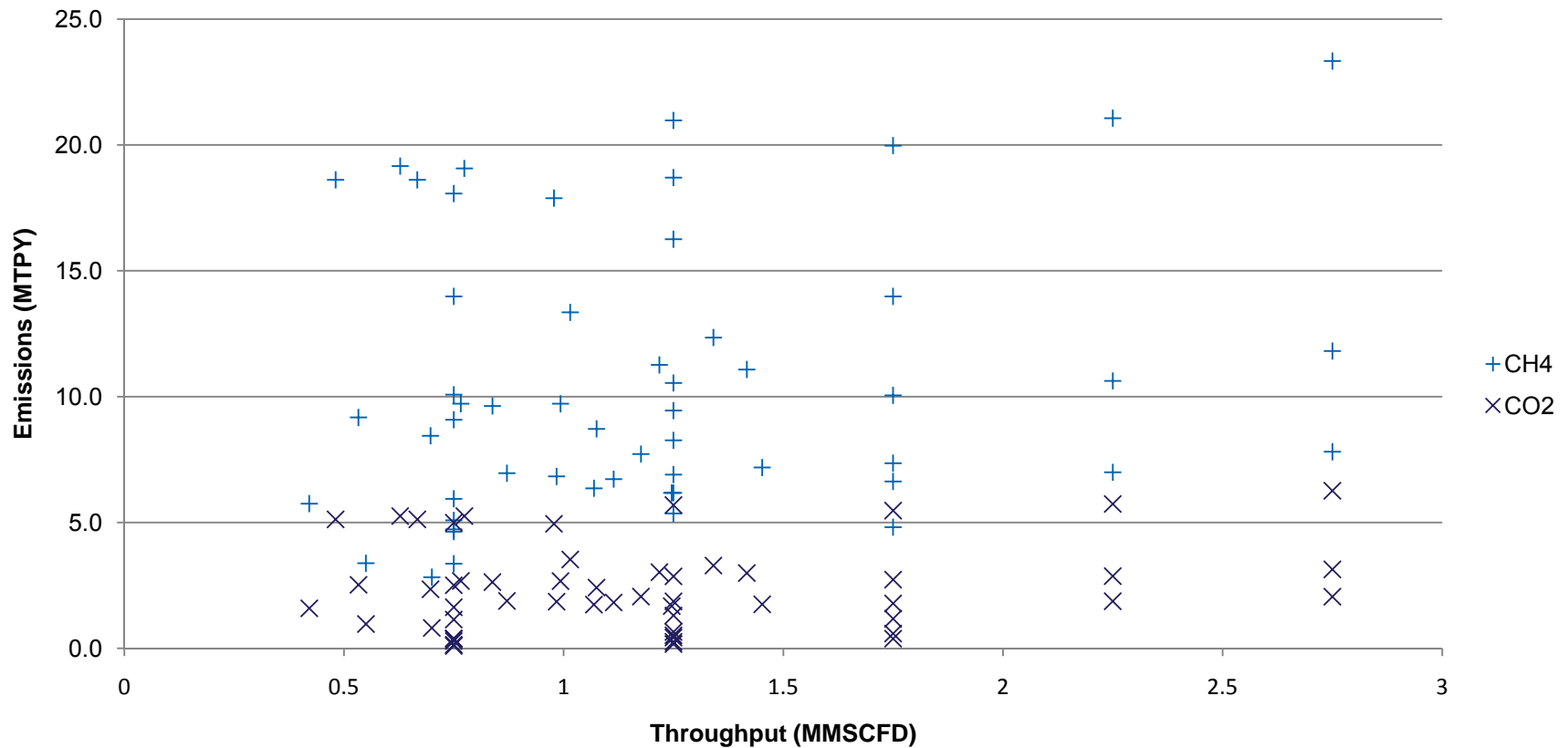


- > 40 CFR 98 Subpart W
- > Emissions calculations for field dehydrators are responsibility of the owning/operating entity
 - Williams has over 3,500 dehy's at field locations; approx. 2000 will require a run
 - 2000 dehy runs x 15 minutes/run = 12.5 work weeks
- > Dehydrators *under* 0.4 mmscf/day use emission factor
 - Count based emission factor
- > Dehydrators *above* 0.4 mmscf/day require GRI GlyCalc runs
 - Dehydrators above 3.0 mmscf/day already require GRI GlyCalc Run under 40 CFR 63 Subpart HH
 - API, GPA, others have requested any dehy under 3.0 mmscf/day use an API throughput based factor
 - EPA refuses to use the factor due to concerns over accuracy – and *we agree*

Throughput vs. Emissions



Figure 1: Throughput vs. Emissions



Other Options



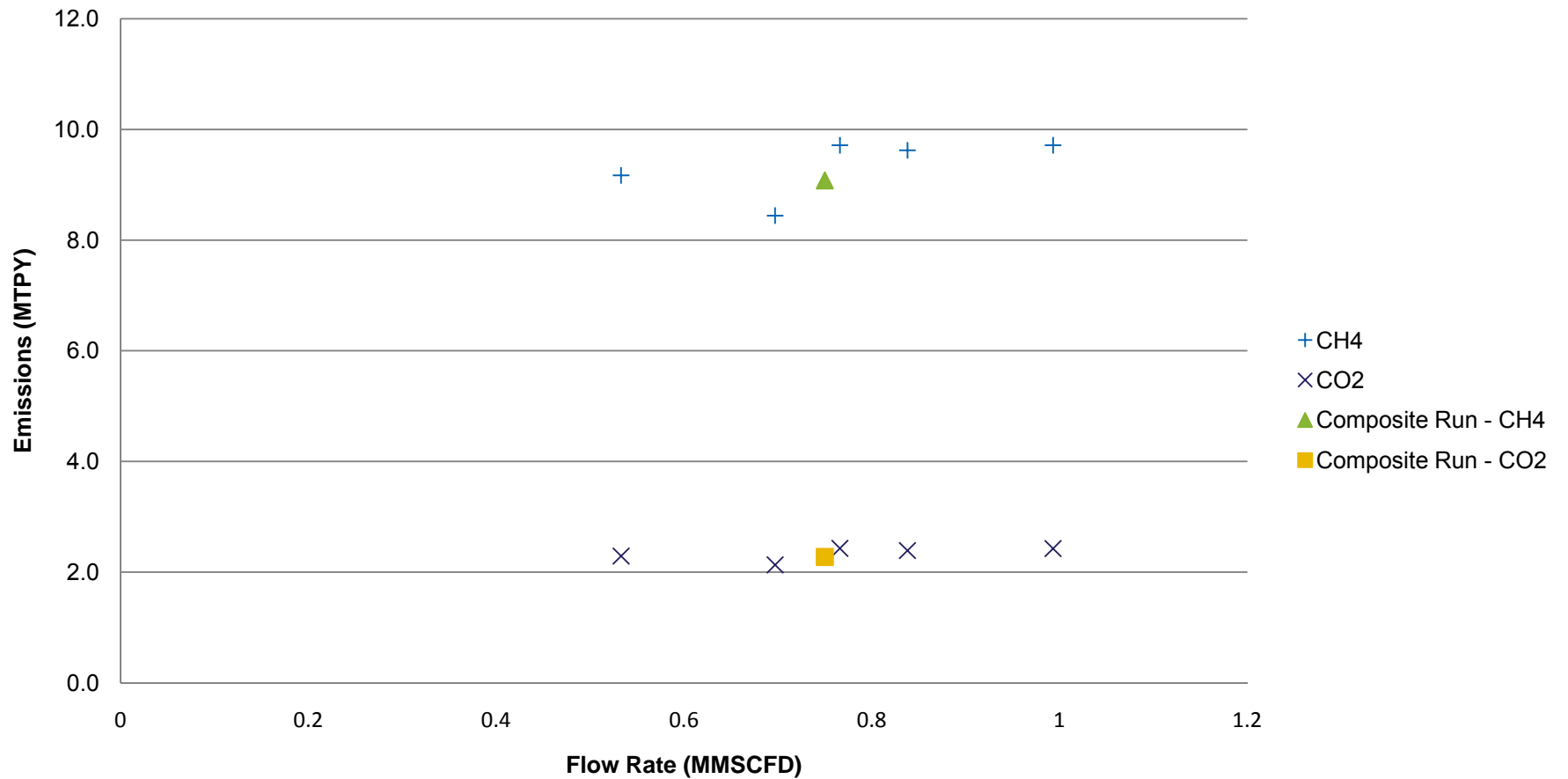
- > The Rule allows for engineering estimates and representative samples
 - Rule states that, “A minimum of the following parameters determined by **engineering estimate** based on **best available data** must be used...” [40 CFR 98.233(e)(1)]
- > Representative Runs allow for the most significant factors to be specifically accounted for while allowing representative data for other factors that may not have a significant impact on emissions
 - Group dehydrators based on the following factors
 - sub basin gas composition
 - wet gas pressure by sub basin and flow rate
 - glycol type
 - pump size/type
 - maximum circulation rate.

From 2000 runs to 45+ runs, plus dehy runs being performed for 40 CFR 63 Subpart HH compliance

Representative Run Comparison



Figure 2: Representative Run Comparison



Conclusions



> Engine and turbine emissions

- Recognize that different emission factors may impact reporting and permitting
- Recognize that the tailoring rule may require manufacturer emissions data
- Match the purposes of the emission estimates to the purposes of your programs

> Glycol dehydrators

- Emission factors are not the answer for reporting
- Representative runs for groups of dehydrators may be a viable option to reduce the burden of reporting and still achieve the accuracy required from the regulation



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Contact Information

- > Jill Hecht
 - Jill.Hecht1@Williams.com
- > Mark J. Bareta
 - Mark.Bareta@Williams.com