
Directed Inspection and Maintenance for Transmission Compressor Station Leak Reduction: Program Focus Supported by Subpart W Data

**Natural Gas STAR Annual Implementation Workshop
November 18, 2015
Pittsburgh, PA**

Theresa Pugh



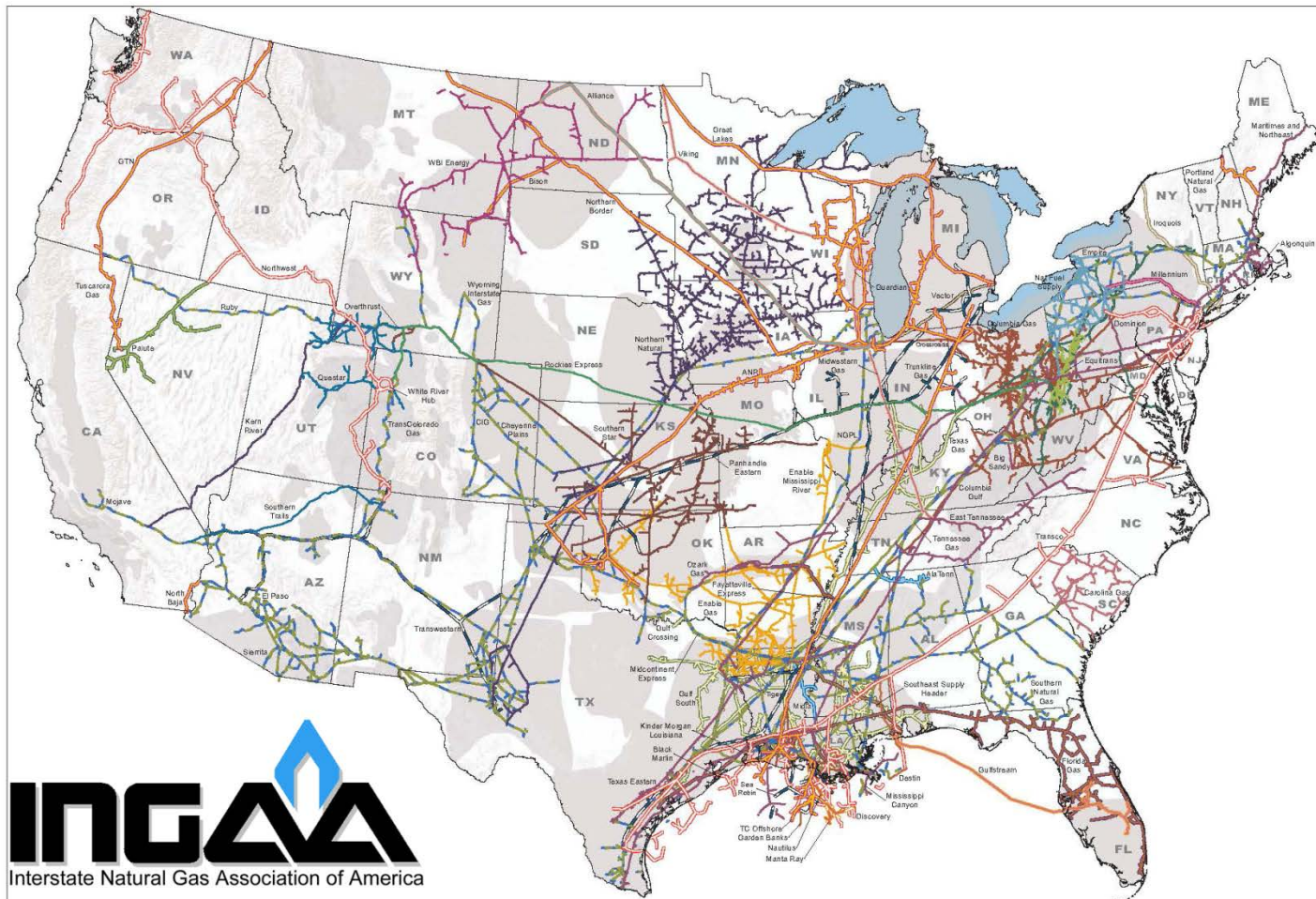
Interstate Natural Gas Association of America

Jim McCarthy



innovative environmental solutions,inc.

U.S. Natural Gas Transmission Pipelines: A Robust Infrastructure



Source: Interstate Natural Gas Association of America, Pennwell MapSearch

Who is INGAA

- **INGAA is the national association representing 25 interstate pipeline companies across North America with more than 200,000 miles of pipelines**
- **INGAA member companies are regulated by FERC, EPA and Pipeline Hazardous Materials Safety Administration (Dept. of Transportation) along with other agencies**
- **PHMSA regulates the pipeline sector for leaks**

Topics

- **EPA proposed methane reduction programs**
 - » **Natural gas transmission sources and mitigation**
- **Leak reduction background**
 - » **Leak Detection and Repair (LDAR)**
 - » **Directed Inspection and Maintenance (DI&M)**
- **INGAA DI&M Guidelines – Focused program**
- **Subpart W data: Measurement and leak survey data for gas transmission compressor stations**
 - » **Emission categories and leak sources**
 - » **Measured data and leak distribution – i.e., prevalence of large leaks**

EPA Methane Reduction Programs

- **Proposed Methane Challenge Framework for existing sources includes five BMPs for natural gas transmission**
 - » **Compressor station emission sources and relative emissions discussed in upcoming slides**
 - » **INGAA comments submitted November 13**

- **Proposed NSPS (Subpart OOOOa) includes methane reductions for reciprocating compressor rod packing, centrifugal compressor wet seal degassing vents, leaks, and continuous bleed pneumatic devices**
 - » **Comments due December 4**
 - » **Some issues in common with Methane Challenge because the programs focus on similar equipment at compressor stations**

EPA Key Methane Sources and Mitigation Approaches for Natural Gas Transmission

- **2012 Subpart OOOO (proposed rule included transmission), 2014 Oil and Gas Sector Methane White Papers, July 2015 Methane Challenge Framework BMPs and October 2015 Subpart OOOOa Proposed Rule include common mitigation for natural gas transmission**
 - » **Reciprocating compressor rod packing maintenance**
 - » **Centrifugal compressors – dry seals or control of wet seal degassing vents**
 - » **Leak reduction (includes leaks from compressor sources)**
 - » **Low bleed pneumatics (or air systems)**
 - » **Methane challenge includes *pipeline* pump down BMP to reduce planned pipeline blowdowns (“Lessons Learned” highlighted by Natural Gas STAR)**

**Perceptions driving requirements
are primarily from transmission
GHG inventory based on 1996
EPA/GRI Report (early 1990's data)**

**...plus limited data in the last decade
regarding wet seal degassing**

***It's 2015. Do we have data to re-assess
our understanding of emissions?***

Leak Reduction Program is Included in All EPA Proposals

- **LDAR is the historical regulatory standard**
 - » Leak survey technology advancing to add Optical Gas Imaging (OGI) – e.g., infrared camera
 - » Subpart OOOOa proposal *requires* OGI: visible = leak
 - » Fix all leaks within 15 days unless shutdown is required
- **2003 EPA Natural Gas STAR Lessons Learned document acknowledges DI&M as an alternative approach for leaks**
 - » Premise continues to be documented in recent studies – vast majority of leak emissions are from a limited number of leaks: super emitters, gross emitters, etc. vernacular
 - » So... find and fix large leaks (along with easy fixes for smaller leaks – e.g., station AVO / safety programs)
 - » **What do we know today? Subpart W data can help!**

INGAA DI&M Guidelines

- **INGAA developed DI&M Guidelines as a framework for transmission company implementation**
- **Focus on sources with a higher potential of larger leaks**
- **Leverage measurements conducted for GHG Reporting Program Subpart W annual survey**
- **Demonstrate breadth of coverage based on Subpart W data – where INGAA members have conducted *thousands* of vent measurements and hundreds of leak surveys since 2011**

Subpart W Methane Emission Sources for Transmission

- **Subpart W of the GHGRP requires reporting of leakage and venting from six sources at transmission compressor stations**
 - » **Compressors include multiple emission source-mode combinations**
 - » **Reciprocating compressors: including rod packing (operating mode), blowdown valve (operating mode, standby pressurized mode), and unit isolation valve (shutdown depressurized mode)**
 - » **Centrifugal compressors: including blowdown valve (operating mode), unit isolation valve (shutdown depressurized mode), and wet seal oil degassing vent (operating mode)**
 - » **Pneumatic devices (high bleed, low bleed, intermittent bleed)**
 - » **Equipment leaks from components in compressor service (e.g., fuel system) and other components (e.g., yard piping)**
 - » **Blowdown emissions within the compressor station boundary**
 - » **Storage tank emissions (condensate tank dump valve leakage)**

Subpart W Methane Emission Sources for Transmission

- Subpart W of the GHGRP requires reporting of leakage and venting from six sources at transmission compressor stations
 - » Compressors include multiple emission source-mode combinations
 - » Reciprocating compressors: including rod packing (operating mode), blowdown valve (operating mode, standby pressurized mode), and unit isolation valve (shutdown depressurized mode)
 - » Centrifugal compressors: including blowdown valve (operating mode), unit isolation valve (shutdown depressurized mode), and wet seal oil degassing vent (operating mode)
 - » Pneumatic devices (high seal, low seal, interface vent line)
 - » Equipment leaks from components in compressor service (e.g., fuel system) and other components (e.g., yard piping)
 - » Blowdown emissions occurring outside of emission boundary
 - » Storage tank emissions (storage tank dump valve leakage)

Measured

Measured

Device count and emission factor (EF)

Leak Survey and "leaker" EF

Engineering calculation

Measured

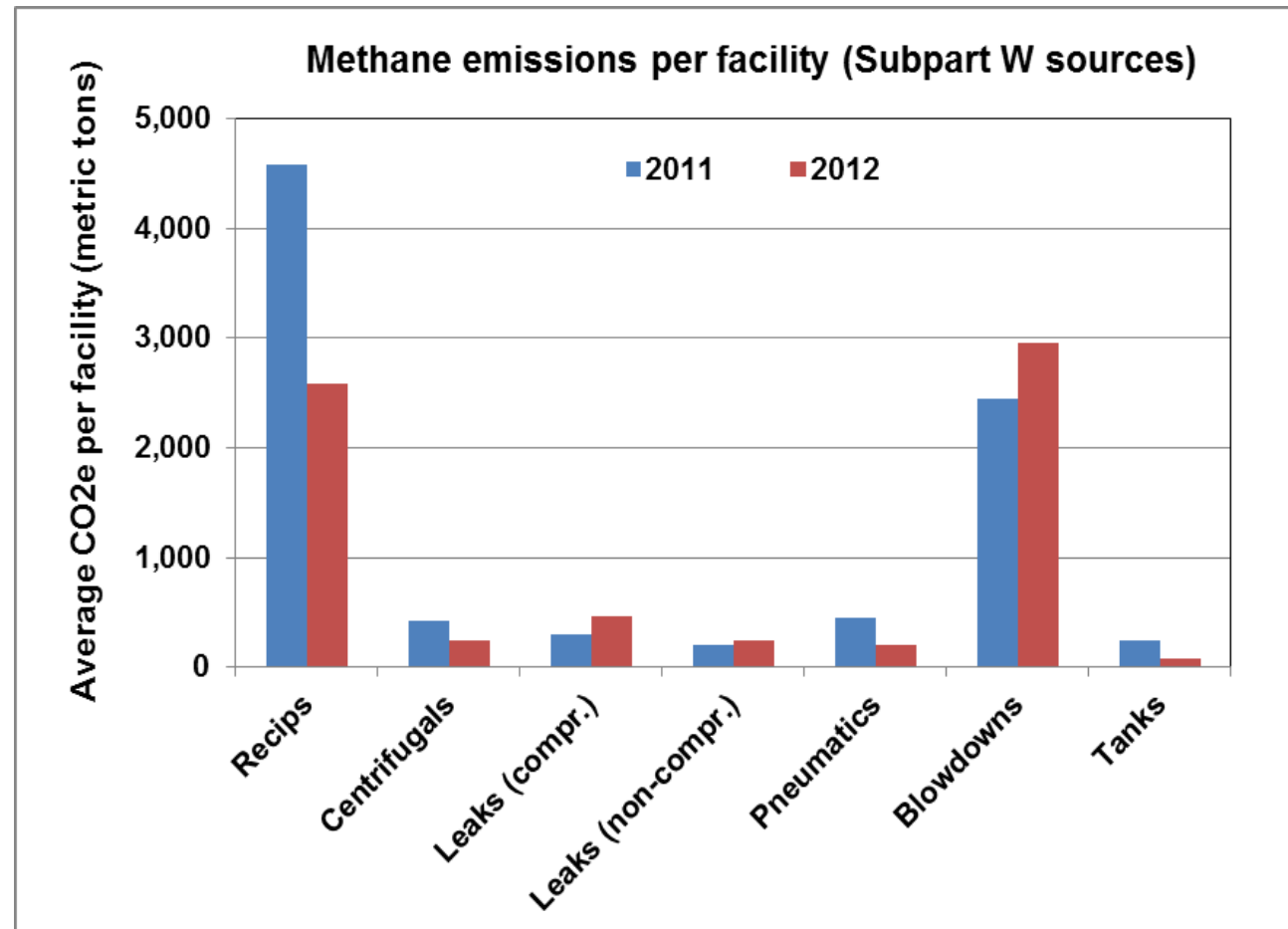
Subpart W Data Compilation

- Pipeline Research Council International (PRCI) project is gathering Subpart W data reported data (from PRCI member companies) along with supplemental data from transmission & storage on equipment, operations and measurement methods
 - » 2011 and 2012 data presented in following slides
 - >75% of all GHGRP facilities in 2011 and ~65% in 2012
 - » 2013 data collected and being compiled
 - » 2014 data will be collected & data gaps from earlier years are still being filled – i.e., this dataset will grow
- Understand and utilize Subpart W *measurement data*
 - » A key GHGRP objective: *Inform future policy decisions*
 - After four years of reporting, little use of T&S data to date
 - » PRCI project objectives: (1) Technical analysis to facilitate dialogue; (2) Update emission factors for key sources

Methane Emissions by Subpart W Source Type

- Methane emissions for all Subpart W sources for transmission compressor stations

- » GWP of 21 used in these plots; GWP increased to 25 starting with the 2014 reporting year
- » Since different facility counts from year to year, presented as emissions per facility

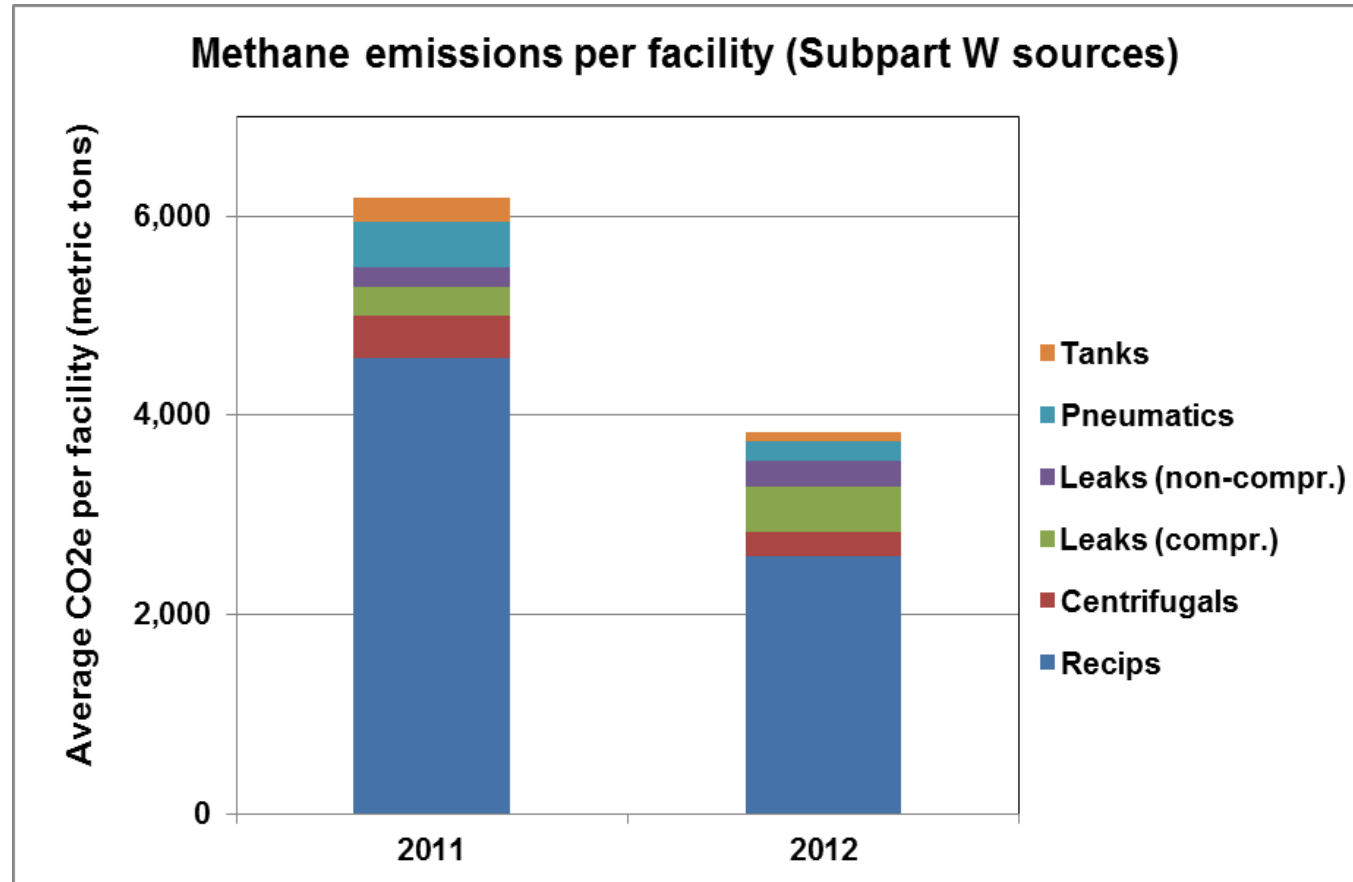


Focus on Leak Sources

(Include pneumatics – Mitigation proposed)

- Data excluding event-based emissions from *blowdowns*
 - » Other than pneumatics, these are leak sources
 - » Pneumatics included in this slide because Subpart OOOOa and Methane Challenge BMP propose mitigation

— Proper focus?



INGAA DI&M Guidelines Leak Sources

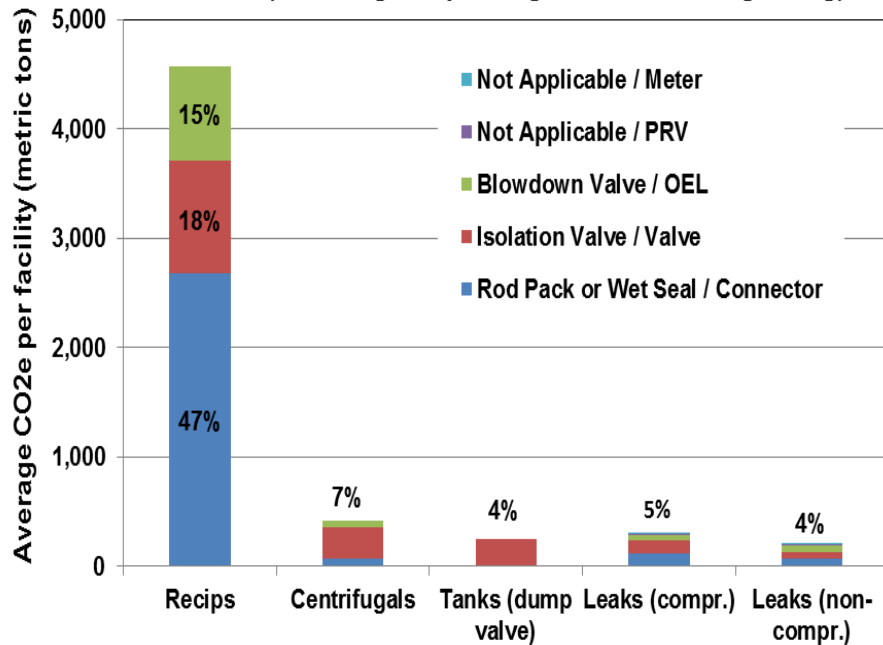
Focus on sources in Subpart W measurement program that have a higher risk of large leaks – typically released to atmosphere through elevated vents **(includes modes not in Subpart W)**

- **Reciprocating Compressors**
 - » Rod packing when compressor is operating **or in standby pressurized mode** (1 source with 2 modes)
 - » Blowdown valve when compressor is operating or in standby pressurized mode (1 source with 2 modes)
 - » Unit isolation valves when unit is not operating / de-pressurized
- **Centrifugal compressors**
 - » Same as above for blowdown valve and isolation valves, but **include standby pressurized mode**
 - » Wet seat degassing vent **and dry seal vent**
- **Condensate tanks (leaking dump valve)**

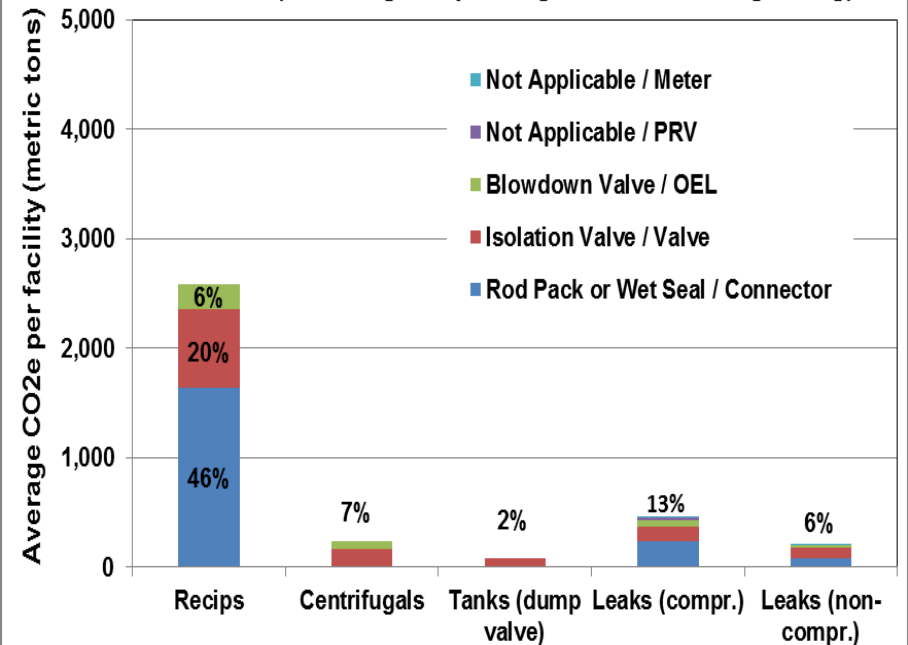
2011 and 2012 Leak Emissions by Category and Source

- Emissions by category (e.g., recip) and source (e.g., isolation valve)
- “Other leaks” categories consider whether the component is in compressor service and include 5 component types within the category
- Categories in INGAA Guidelines: >91% in 2011 and >81% in 2012

2011 CO₂e LEAK emissions per facility - By emissions source (including rod packing and wet seal degassing)



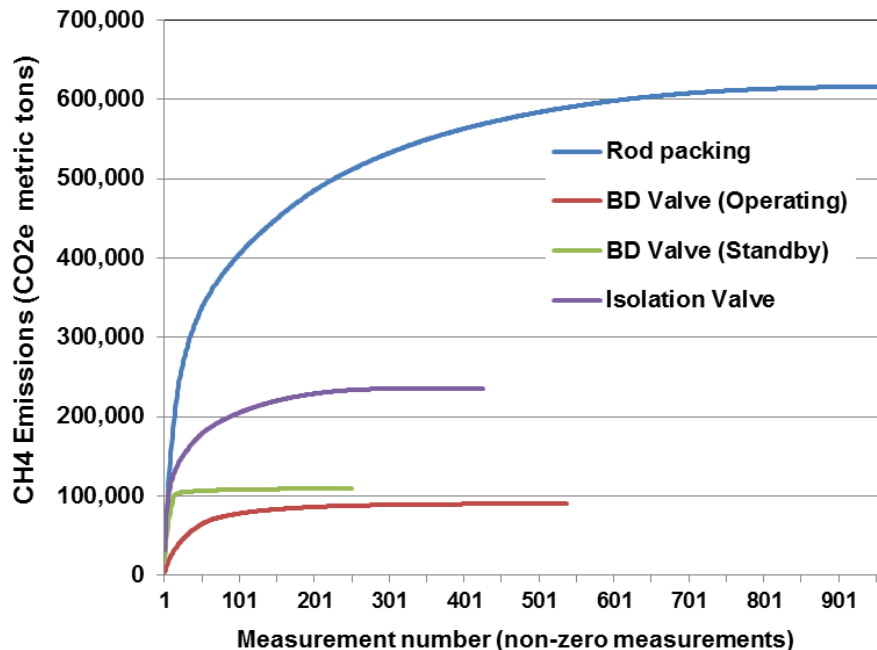
2012 CO₂e LEAK emissions per facility - By emissions source (including rod packing and wet seal degassing)



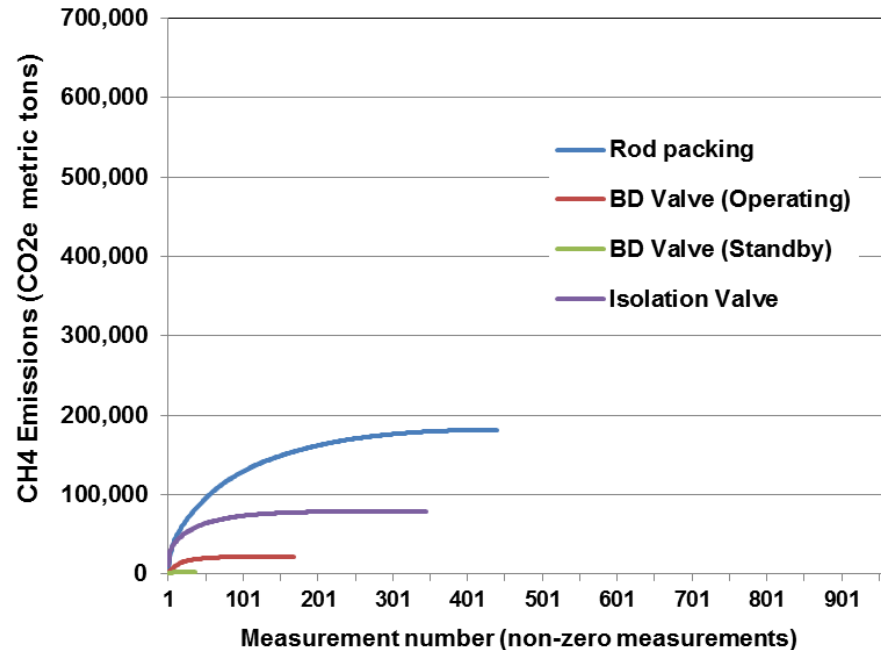
Relevance of Larger Leaks: Reciprocating Compressors

- Leakage from rod packing, unit isolation valves, blowdown valves
 - » Number of measurements (x-axis) and cumulative emissions (y-axis) – order measured data from high to low and sum
 - » Example chart analysis: in 2011 for isolation valves, ~440 measurements, with ~20% of leaks (~90) accounting for over 85% of emissions

Recip Compressor CH4 Emissions:
2011 Cumulative Emissions by Leak Source

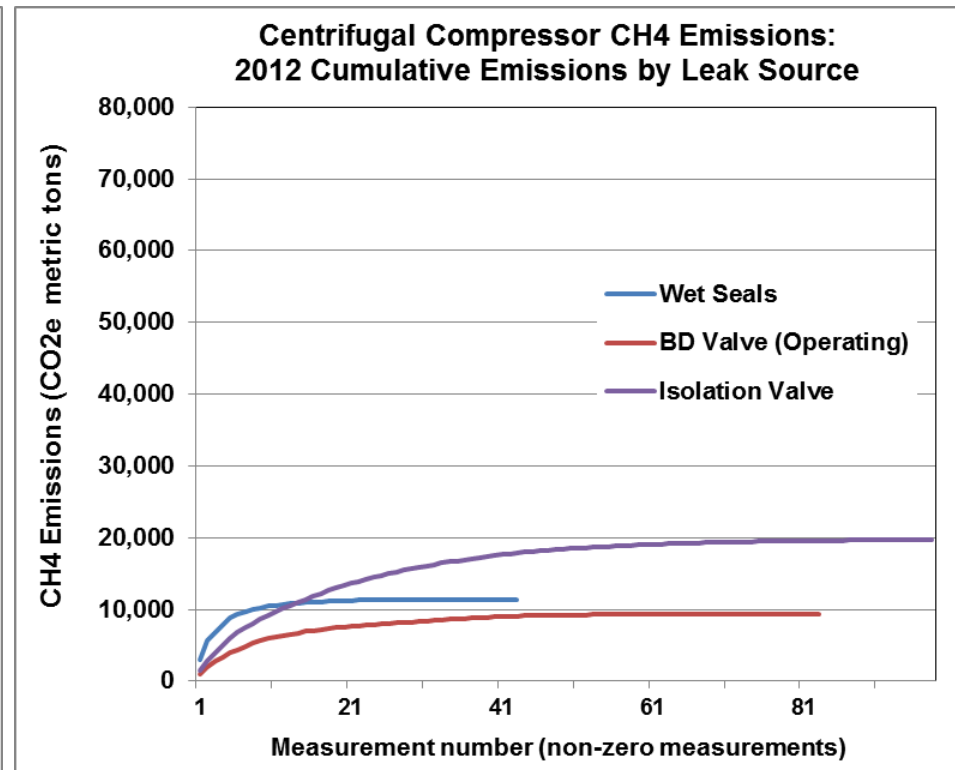
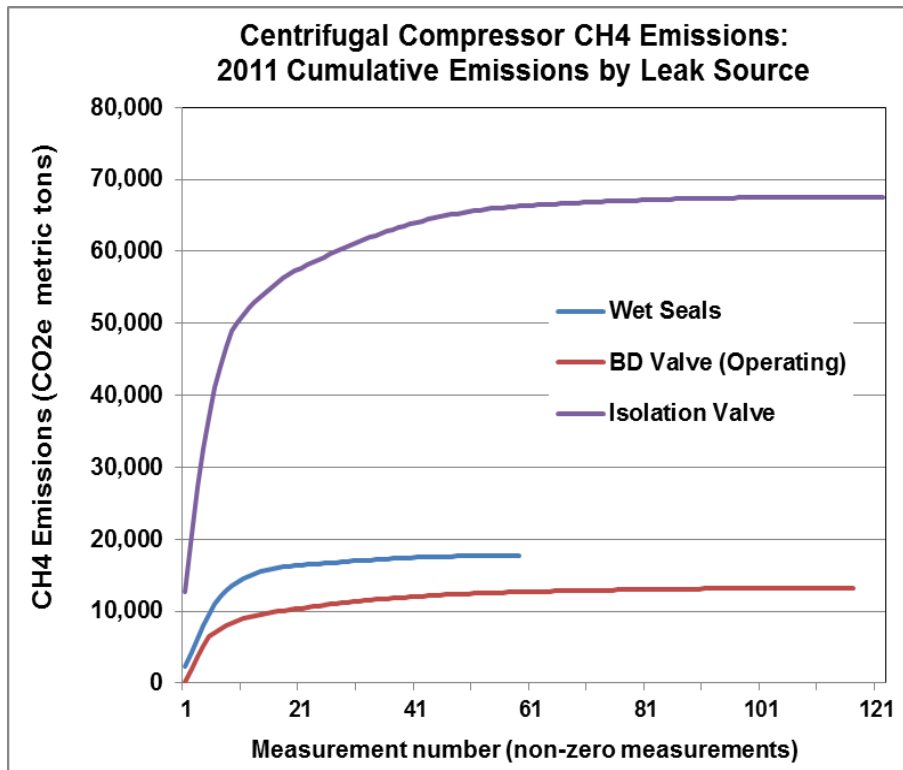


Recip Compressor CH4 Emissions:
2012 Cumulative Emissions by Leak Source



Relevance of Larger Leaks: Centrifugal Compressors

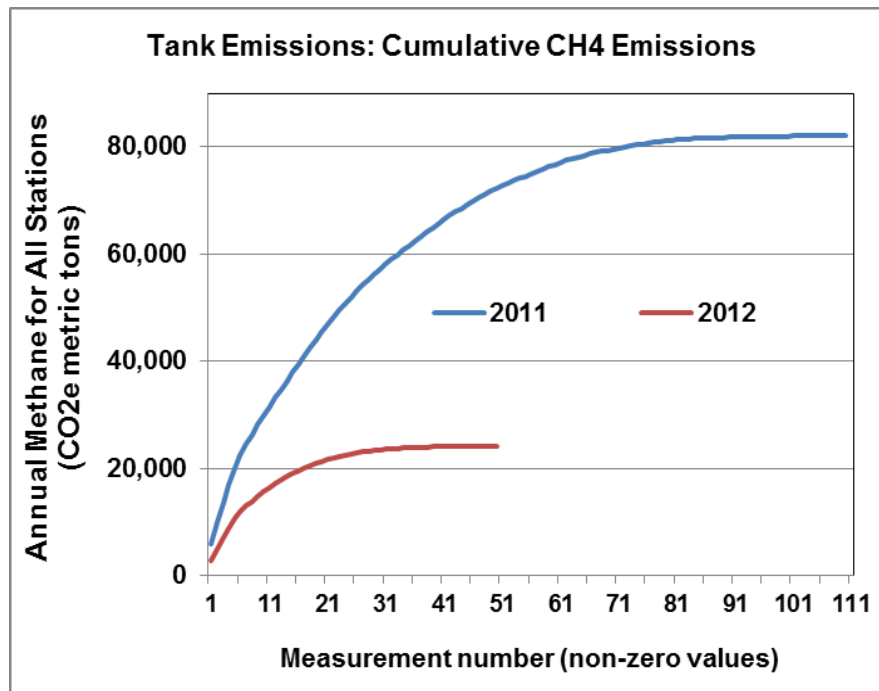
- Leakage from wet seal degassing vent, unit isolation valves, blowdown valves for 2011 and 2012
 - » In 2011, isolation valve leakage much larger than others; 2012 decrease



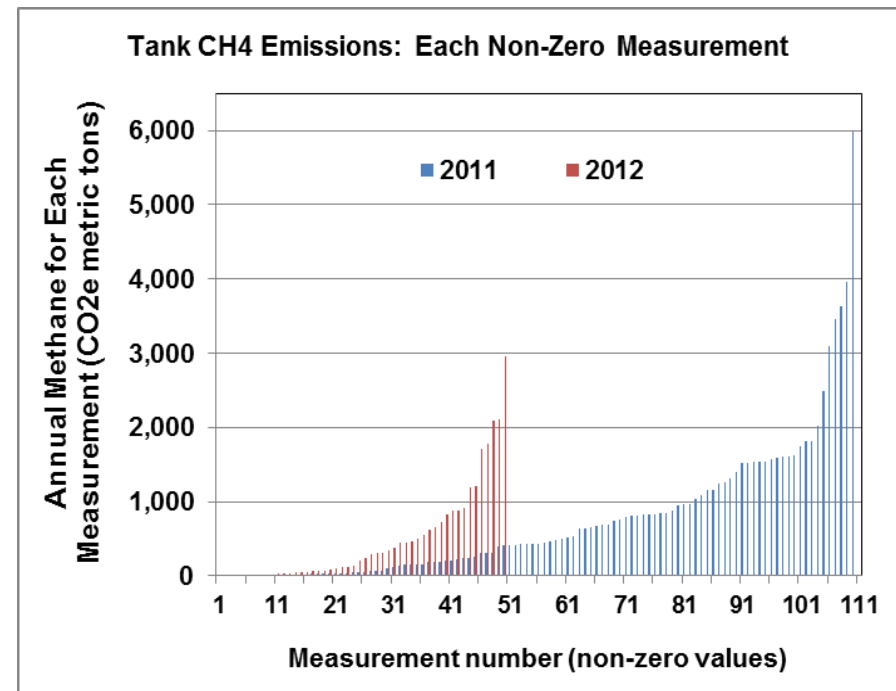
Storage Tanks (Dump Valve Leaks): Measurement Results

- **Condensate tank – leaking dump valve**
 - » If valve not adequately seated, large leak rate can occur
 - » Over 100 non-zero measurements in 2011; ~50 in 2012

Cumulative emissions

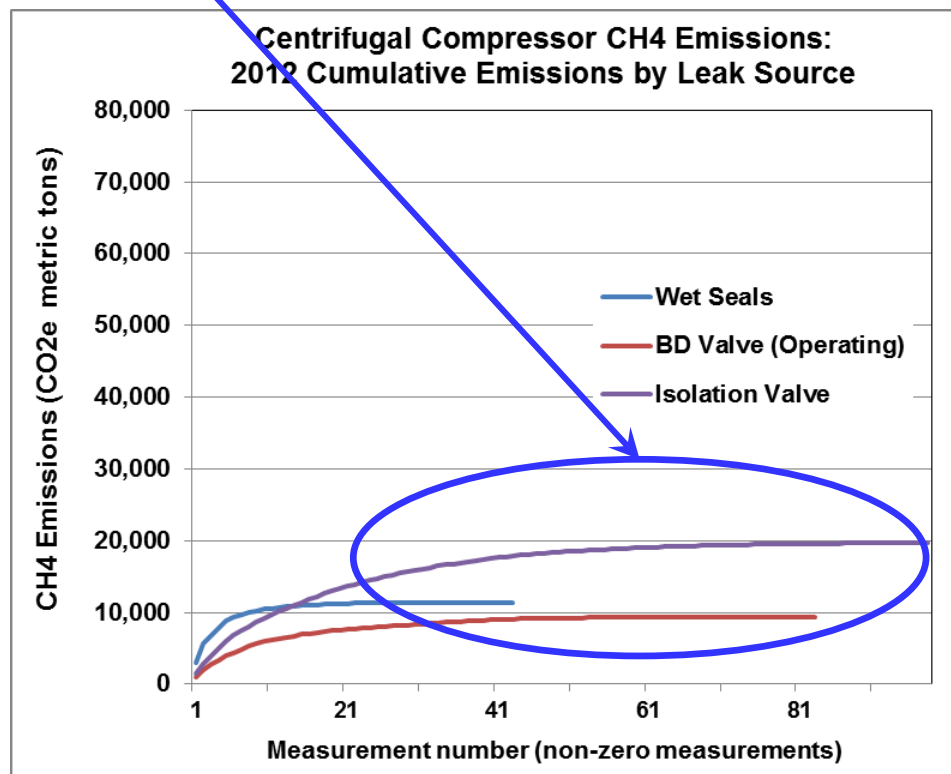
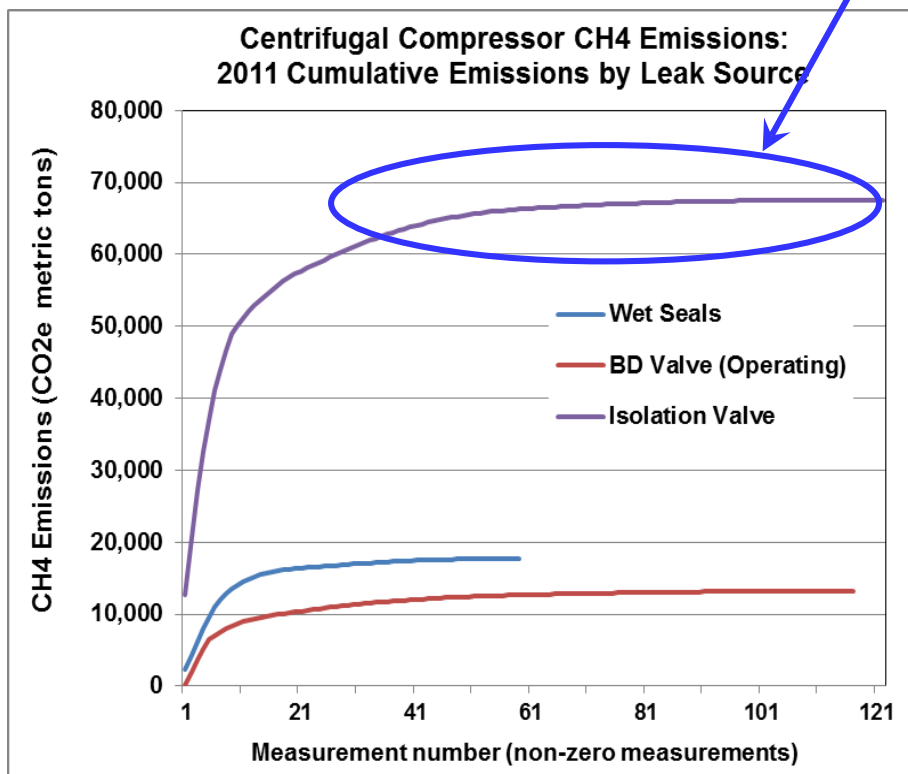


Individual Measurements



Relevance of Larger Leaks: Centrifugal Compressor Example

□ EXAMPLE... Should we be worried about these measured leaks?



Summary

- **We have new *measurement data* from Subpart W and should use it for its intended purpose – to inform policy**
- **INGAA DI&M Guidelines provide a framework for compressor station leak reduction**
 - » **Focus on categories / sources with a higher risk of a larger leak**
 - » **2011 and 2012 Subpart W data compiled by PRCI (from PRCI and INGAA members) shows that a focused survey can identify most leak emissions (>80% of total for all leaks)**
 - **And, for the focused list of sources, a small number of those leaks are responsible for the vast majority of leak emissions**

Contacts

Jim McCarthy

President

IES, Inc.

Cary, IL

847/516-3658

jamesmccarthy@comcast.net

Theresa Pugh

VP, Environment, Health & Safety

INGAA

20 F Street, NW

Suite 450

Washington, DC 20001

202/216-5955

tpugh@ingaa.org