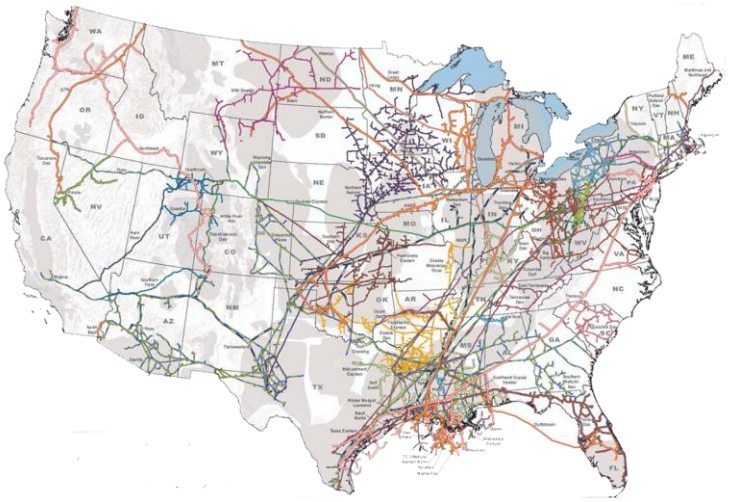
November 13, 2015

Via email
Ms. Carey Bylin
Natural Gas STAR Program
Global Methane Initiative (Oil & Gas)
U.S. EPA
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Comments of the Interstate Natural Gas Association of America (INGAA) on the Natural Gas Star Methane Challenge Program: Proposed Framework

Dear Ms. Bylin:

The Interstate Natural Gas Association of America (INGAA) is a trade organization that advocates regulatory and legislative positions of importance to the natural gas pipeline industry in North America. INGAA is comprised of 25 members, representing the vast majority of the interstate natural gas transmission pipeline companies in the U.S. and comparable companies in Canada. INGAA's members, which operate approximately 200,000 miles of pipelines, provide an indispensable link between natural gas producers and natural gas consumers in the residential, commercial, industrial and electric power sectors. INGAA's members are committed to providing safe, efficient and reliable transportation services to their diverse customers and to maintaining a high level of customer service.

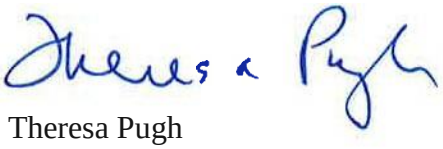


INGAA and its member companies have a long history of working collaboratively with a variety of stakeholders on greenhouse gas (GHG) issues, including methane issues. INGAA appreciates the opportunity to comment on the Environmental Protection Agency's (EPA) Natural Gas

STAR Methane Challenge (Methane Challenge), a voluntary program designed to "reduce emissions and realize significant voluntary reductions in a quick, flexible, cost-effective way."[1] INGAA may supplement its comments at a later date should EPA issue additional technical documents, papers or Memorandum of Understanding (MOU) for Methane Challenge Participants**.**

Thank you for your consideration of these comments.

Sincerely,



Theresa Pugh
VP, Environment, Health & Construction Policy

[1] EPA's announcement of Methane Challenge on Natural Gas STAR website http://www.epa.gov/gasstar/methanechallenge/

I. EXECUTIVE SUMMARY

INGAA supports EPA's decision to propose a voluntary methane emission reduction program, rather than a prescriptive regulatory program, with the stated goal of achieving significant emission reductions in a cost-effective manner. INGAA also supports EPA's decision to offer three emissions reduction options, rather than prescribing uniform program criteria. Providing multiple options will enable each company to select the emissions reduction approach that best suits its business units.

- Program should be truly voluntary.
- Flexibility is critical.
- Program should focus on the largest sources of methane.
- Reducing Methane emissions from blowdowns events is unrealistic.

INGAA's decision to comment does not necessarily mean that its individual member companies will choose to participate in the Methane Challenge. While INGAA's comments highlight areas that may affect the willingness of member companies to participate in the program, that ultimate decision is entirely at the discretion of the individual operators of natural gas transmission pipelines.

INGAA supports voluntary measures to reduce methane emissions from Transmission and Storage (T&S) compressor stations and pipeline operations. INGAA developed and has proposed Directed Inspection and Maintenance (DI&M) guidelines for EPA's inclusion as a Best Management Practice (BMP) under the Methane Challenge program. Implementation of these DI&M guidelines has the potential to achieve significant emission reductions from existing T&S compressor stations that would not be achieved under existing regulatory programs (or the recently proposed OOOOa New Source Performance Standards). Including INGAA's DI&M as an approved BMP will encourage companies to participate in the voluntary Methane Challenge program.

INGAA urges EPA to accept the DI&M approach advocated by INGAA as a BMP for leak monitoring and repair. **INGAA's DI&M has the potential to address over 80 percent of leak emissions from natural gas transmission and storage compressor stations**.[2,3] (See Figures 1 and 2 on page 5 for illustration of the 80 percent). DI&M also can help to identify "super emitters"[4] that offer the best opportunity for cost-effective methane emissions reductions. Modification of the Methane Challenge to incorporate DI&M as a BMP would encourage gas pipeline participation.

[2] EPA Natural Gas STAR, Lessons Learned, "Directed Inspection and Maintenance at Compressor Stations," EPA430-B-03-008 (October 2003); http://www.epa.gov/gasstar/documents/ll_dimcompstat.pdf

[3] Picard, D., 2005. In Proceedings: Modern Technologies Of Detection And Elimination Of Methane Leakages From Natural Gas Systems. Akademgorodok, Russia (2005).

[4] Recent literature has referred to these sources as "super emitters," "gross emitters," or "long tail" emissions, with the latter term based on the appearance of a cumulative distribution plot of emissions.

INGAA believes its DI&M meets the criteria for a BMP, and it recognizes that individual pipeline companies may choose to propose to EPA other arrangements governing the frequency of inspection and the criteria for repair.

EPA was not completely clear in the call for comments as to whether it would seek a Leak Detection and Repair (LDAR) program or might accept the interstate pipeline's DI&M as a BMP[5]. Should EPA expect use of a LDAR program in the Methane Challenge (as it proposed in the OOOOa or New Source Performance Standard) it would discourage program participation. Companies have two primary concerns about a traditional LDAR program:

1. Unnecessary costs associated with the frequency of monitoring and
2. The lack of operator flexibility to prioritize fixing leaks based on magnitude and risk.

LDAR works on the principal of robotically repairing leaks no matter how small or expensive rather than targeting repairs at the most common and serious leaks for maximum effect. By contrast, the DI&M approach focuses on finding and fixing 80 percent of the methane leaks from the T&S sector. It is common sense for EPA to use this DI&M approach as a BMP, especially since this is a program designed for existing sources.

Several INGAA member companies have participated actively in EPA's current Natural Gas STAR program and understand that flexibility is essential to a successful voluntary program that achieves meaningful reductions. Similarly, flexibility is critical for EPA's voluntary program to make significant methane reductions. Flexibility will afford operators the ability to focus resources on significant emission reduction opportunities in a cost-effective manner rather than following generically prescribed criteria. Accordingly, INGAA provides specific comments intended to enhance the incentives and avoid disincentives for companies to participate in the Methane Challenge program.

INGAA believes the most important aspect of a federal voluntary program is that the program remains truly *voluntary*. If EPA wants to ensure, as stated in the Proposed Framework that its Methane Challenge encourages "ambitious commitments" and "innovative approaches,"[6] then volunteering companies must be confident that they will not be penalized if they inadvertently underperform or fail to meet specific milestones or reduction goals. Further, volunteering companies must have assurances from EPA that their voluntary commitment to meet certain emission reduction targets does not create mandatory permit requirements once the voluntary program terminates.

Further, it is important to recognize that pipelines must, at times, emit methane through pipeline blowdowns to maintain and improve the safety of pipeline facilities. Specifically, in certain instances a pipeline operator must reduce the pressure within a pipeline and remove the gas in order to perform inspections and maintenance. In other instances, a pipeline operator must blow down gas to prevent a pipeline incident and ensure safety. Therefore, INGAA requests that EPA eliminate the presumption added on October 19 that program participants commit to reduce pipeline blowdowns by 50 percent and instead allow companies to decrease blowdown emissions

[5] Footnote 17, page 17 of EPA Methane Challenge found at http://www3.epa.gov/gasstar/documents/methane_challenge_proposal_072315.pdf

[6] Proposed Framework at 5.

to the extent reasonably practicable, taking safety and other factors into consideration, without giving a percentage goal.

INGAA strongly encourages EPA to allow the companies to design their program participation with sufficient flexibility consistent with the Natural Gas STAR program. The details on flexibility are further addressed beginning on page 14. In particular, INGAA observes that some companies have other oil and gas sector segments in their businesses and may want to create different approaches for their different business segments that might go beyond the T&S sector.

II. DETAILED COMMENTS

A. Adopting INGAA's DI&M As a BMP Option Would Advance EPA's Goal of Reducing Emissions From the Largest Sources

A relatively small number of leak sources account for the vast majority of methane emissions in the T&S sector. The vast majority of the methane emissions are from reciprocating and centrifugal compressors and from tanks. EDF's February 2015 collaborative study with the Colorado State University (CSU) documents that a small number of leaks, termed, "super emitters" account for a large percentage of emissions from leaks.[7] These leaks have also been called either "gross emitters" or "long tail emitters." The CSU study concludes that, "…the highest emitting 10% of sites (including two super emitters) contributed 50% of the aggregate methane emissions, while the lowest emitting 50% of sites contributed less than 10% of the aggregate emissions."

INGAA members are committed through its DI&M to identify and reduce emissions from the largest emission sources. INGAA's DI&M is preferable to a conventional LDAR program as described by EPA in the proposed OOOOa rule because it targets the largest T&S emission sources. INGAA's DI&M focuses on compressor station equipment most likely to be the sources of the T&S sector's largest leaks. This approach allows pipeline companies to dedicate available resources to address the largest leaks. DI&M provides the ability to achieve reductions similar to leak detection programs while managing costs. EPA has said that they learned many things in response to its 2014 call for comments to its Methane White Papers and that it would be unnecessary to require program participants to include every methane source.

Figures 1 and 2 illustrate the Pipeline Research Council International's (PRCI) analysis of leak emissions using EPA's Subpart W data and supplemental data submitted by INGAA and PRCI. This analysis demonstrates that INGAA's DI&M will address 80 percent or more of the methane leak emissions at compressor stations.

Figure 1 (on page 5) shows leak emissions from the T&S sector by source category for 2011 reporting. Figure 2 shows the same information for 2012 reporting. The five categories of pipeline emissions include reciprocating compressors, centrifugal compressors, storage tank

[7] Subramanian, R., et al., *"Methane Emissions from Natural Gas Compressor Stations in the Transmission and Storage Sector: Measurements and Comparisons with the EPA Greenhouse Gas Reporting Program Protocol"*, Environ. Sci. Technol., 49, 3252-3261, DOI: 10.1021/es5060258 (2015); http://pubs.acs.org/doi/pdf/10.1021/es5060258

(dump valve leakage), leaks in compressor units, and leaks in non-compressor units. For the four categories other than tanks, the total emissions are comprised of emissions from multiple sources, including:

1. Reciprocating compressors (typically released to atmosphere through elevated vents):
    a) Rod packing;
    b) Isolation valve; and
    c) Blowdown valve.
2. Centrifugal compressors (typically released to atmosphere through elevated vents):
    a) Wet seal degassing vent (this is more a vent source than a leak source, but is grouped with centrifugal compressor leak emissions for tracking purposes);
    b) Isolation valve; and
    c) Blowdown valve.
3. Compressor or non-compressor unit leaks generally are accessible at or near ground level for surveying. The total emissions estimate is based on emissions from the following five component types:
    a) Connectors;
    b) Valves;
    c) Open ended lines (OELs);
    d) Pressure relief valves (PRVs); and
    e) Meters.

The figures show each of the categories (i.e., the primary bullet in this list), as well as the emissions from the specific leak sources associated with each category (i.e., the sub-bullets in this list). The percentage of total leaks for each source or category is shown in the figures. Where total emissions for the five component types are a small overall contributor to leak emissions, the percentage for the total is shown rather than emissions by component types.

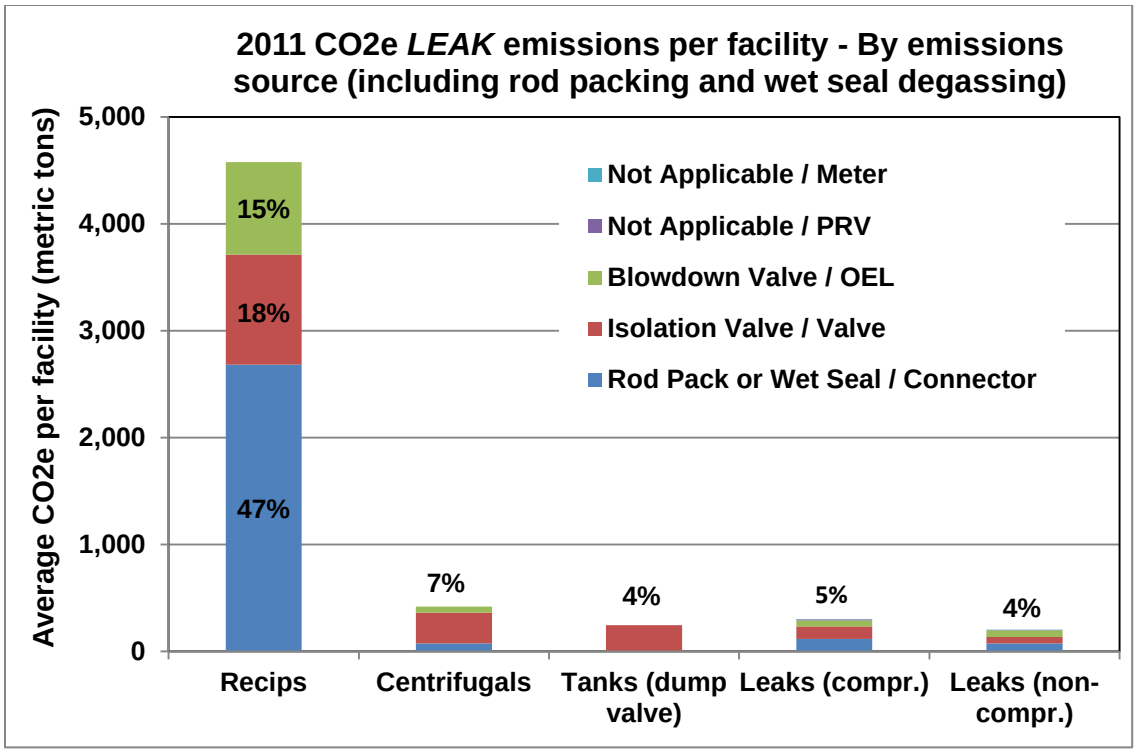


Figure 1. Leak emissions by category and emissions source for Subpart W reported emissions compiled for PRCI project – 2011.

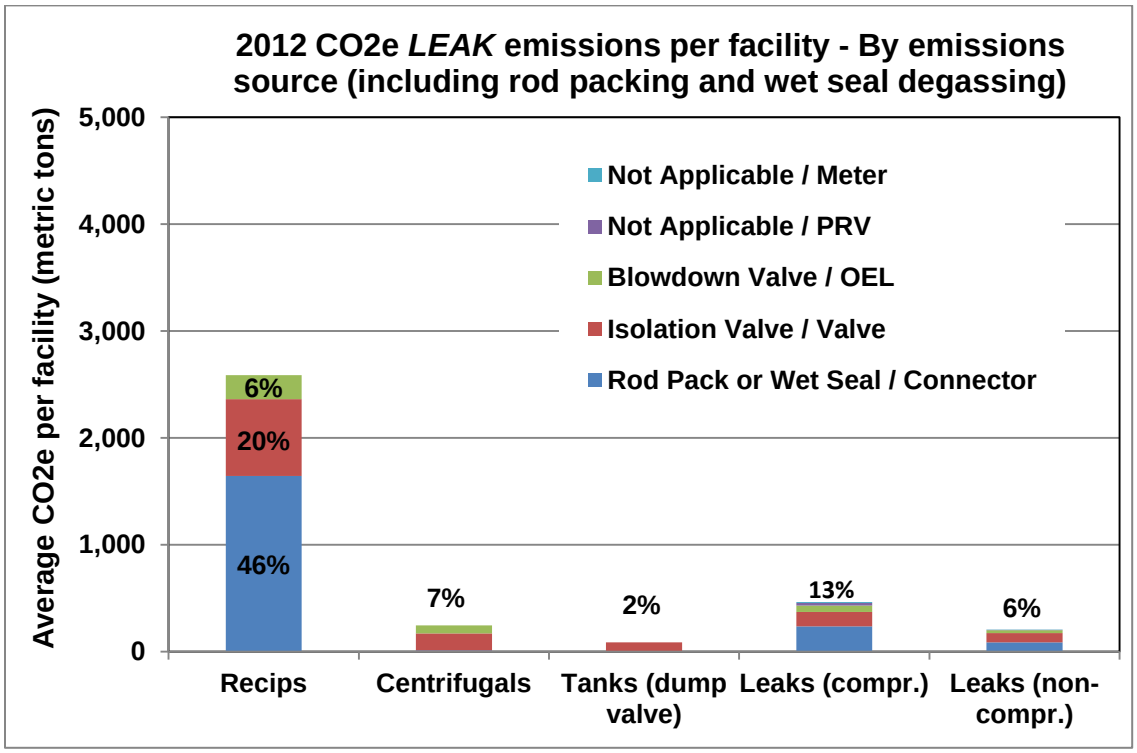


Figure 2. Leak emissions by category and emissions source for Subpart W reported emissions compiled for PRCI project – 2012.

The first three leak categories – reciprocating compressors, centrifugal compressors, and storage tank dump valves – are included in INGAA's DI&M. and the latter two are not included. In addition, the three categories included in INGAA's DI&M require surveying a limited number of potential leak sources – e.g., a reciprocating compressor (see items 1(a), 1(b) and 1(c) in the list above) will include rod packing leakage, two isolation valves (suction and discharge side of the compressor) and a blowdown valve. Thus, a limited number of vent lines need to be surveyed to identify leakage for the three sources in INGAA's DI&M. In contrast, the other potential leak sources (see five component types in items 3(a) through 3(e) in the list above) are comprised of *hundreds or thousands* of components throughout the compressor station that would require surveying.[8]

For 2011, reciprocating compressors, centrifugal compressors, and storage tank dump valves comprise 91 percent of the total leak emissions from the T&S sector. The three sources emitted 5,240 metric tons CO_2 equivalent emissions on average for all facilities in the PRCI dataset. The two leak categories not included in INGAA's DI&M (other equipment leaks in compressor or non-compressor units) comprise only 9 percent of the total T&S sector emissions and resulted in less than 500 metric tons of emission.

For 2012, total leak emissions are lower, which is likely due to repair of some of the larger leaks discovered in 2011 (e.g., reciprocating compressor leak emissions). Reciprocating compressors, centrifugal compressors, and storage tank dump valves comprise 81 percent of the total leak emissions from the T&S sector. The three sources emitted 2,915 metric tons CO_2 equivalent on average for all facilities in the PRCI dataset. The two leak categories not included in INGAA's DI&M (other equipment leaks in compressor or non-compressor units) comprise 19% of the total emissions, or approximately 665 metric tons.

INGAA's White Paper titled, "Directed Inspection and Maintenance for Reducing Leak Emissions from Natural Gas Transmission and Storage Compressor Stations: Greenhouse Gas Reporting Program Data Supporting a Focused Leak Mitigation Program" is submitted as an attachment to these comments (see Appendix) and provides supporting data to INGAA's conclusions regarding sources of T&S sector emissions. The White Paper (WP) demonstrates in greater detail that on a volume basis, the vast majority of emissions from natural gas transmission and storage operations are attributable to a relatively small percentage of leaks. As page 14 shows, the vast majority of the emissions (80 percent) are from a small number of leaks (20 percent or fewer). These "cumulative distribution" plots show the cumulative emissions associated with adding the emissions from each measured leak for reciprocating compressors (WP, Figure 4), centrifugal compressors (WP, Figure 5) and storage tanks (WP, Figure 6). As examples:

- There were approximately 950 "non-zero" measurements of reciprocating compressor rod packing leakage in 2011. About 10 percent of the leaks (by count) were responsible for 65 percent of the leak emissions; 22 percent of the leaks (by count) were responsible for 80 percent of the leak emissions.
- There were approximately 425 "non-zero" measurements of reciprocating compressor isolation valve leakage in 2011. About 15 percent of the leaks (by count) were responsible

[8] EPA's OOOOa model compressor station includes over 3,800 components. Table 5-11 from EPA's Background Technical Support Document indicates that model storage station has over 7,900 total components.

for 80 percent of the leak emissions; 27 percent of the leaks (by count) were responsible for 90 percent of the leak emissions.

- There were 122 "non-zero" measurements of centrifugal compressor isolation valve leakage in 2011. About 12 percent of the leaks (by count) were responsible for 80 percent of the leak emissions; 20 percent of the leaks (by count) were responsible for 90 percent of the leak emissions.

These assertions by INGAA are validated by EPA's Subpart W data. Although the entire EPA dataset includes additional facilities (and associated leak measurements) that are not included in the PRCI project data collected from its members, INGAA contends that EPA's review of the entire data set will result in similar conclusions.

For context on potential reductions, in EPA's Technical Support Document (TSD) for the recently proposed revisions to the oil [9] and gas NSPS, Subpart OOOOa, EPA references information from a Colorado rulemaking that estimates an LDAR program would achieve 40 percent to 60 percent reduction for an annual or quarterly survey frequency, respectively. The figures and discussion above show that over 80 percent of leak emissions are covered by focusing on the sources in the Subpart W program with a higher potential for large leaks – reciprocating compressors, centrifugal compressors, and storage tanks (leaking dump valve). For these categories, the White Paper figures discussed above show that a large percentage of the emissions are from 10 percent to 20 percent of the leaks. Thus, DI&M provides the opportunity for similar reductions as LDAR reductions as estimated from EPA's Subpart OOOO TSD.

DI&M capitalizes on the opportunity to achieve cost-effective and efficient emissions reductions with procedures that focus on repairing the largest leaks on a timely basis. The White Paper provides additional technical support and description of the figures and data discussed in these comments based on data and analysis from the PRCI project. The data from measurements conducted for the Subpart W program demonstrates that T&S leak programs, focusing on the emission sources in INGAA's DI&M can achieve significant reductions while focusing on a subset of potential leak sources and larger leaks from these sources. This approach supports allowing the T&S sector to use DI&M as a BMP to effectively address gross emitters.

EPA acknowledged DI&M as an established method for reducing the vast majority of compressor station leak emissions in an EPA STAR "lessons learned" document.[10] Consequently, there is a sound basis for recognizing DI&M as a BMP in the Methane Challenge.

As shown in the tables on page 5, INGAA's DI&M will address the same sources of methane emissions from natural gas compressors as the BMPs proposed by EPA in its Methane Challenge. DI&M leak surveys will focus on elevated vents associated with reciprocating compressors, centrifugal compressors, and storage tanks. For other equipment leaks not covered by DI&M, leak emissions are much smaller. Nonetheless, those leaks are still addressed through

[9] EPA Docket Document Number EPA-HQ-OAR-2010-0505-5120. "Oil and Natural Gas Sector: Standards for Crude Oil and Natural Gas Facilities, Background Technical Support Document for the Proposed New Source Performance Standards, 40 CFR Part 60, subpart OOOOa." (August 2015)

[10] EPA Natural Gas STAR, Lessons Learned, "Directed Inspection and Maintenance at Compressor Stations," EPA430-B-03-008 (October 2003); http://www.epa.gov/gasstar/documents/ll_dimcompstat.pdf

Pipeline and Hazardous Materials Safety Administration (PHMSA) requirements, and facility approaches such as safety walk-throughs that use "audio-visual-olfactory" (AVO) approaches to identify and address leaks. Often, these leaks can be repaired easily (e.g., tighten a connector or valve bonnet) and are addressed through standard compressor station operations and management programs. These practices are a likely reason that the "other equipment leaks" are a relatively small contributor to total T&S leak emissions.

EPA BMP	**INGAA DI&M Guidelines as BMP**	**How DI&M Addresses Emissions**
Centrifugal Compressor – Wet Seal Degassing Vent	Centrifugal Compressor – Wet *or Dry* Seals	DI&M addresses centrifugal compressors with wet seals or dry seals. Need for mitigation depends on emissions rather than pre-determination that degassing vent is problematic.
Reciprocating Compressor – Rod Packing	Reciprocating Compressor – Rod Packing	DI&M may supplement prescribed maintenance interval with approaches such as condition-based maintenance.
Equipment Leaks	Equipment Leaks	DI&M covers many easy to repair leaks (e.g., AVO approach) and surveys focused on sources with potential for large leaks – e.g., compressor isolation valves and blowdown valves; scrubber dump valves.

The remaining leaks, resulting in significantly fewer emissions among a significantly larger source of emissions, are much less cost-effective or efficient to repair. Moreover, methane emissions would likely increase from pre-repair levels due to the fact that the pipeline would need to blowdown gas from the pipeline in order to conduct such repairs.

INGAA's key points are detailed in the following responses to EPA's specific questions set out in the Methane Challenge proposed framework (July 23 and October 19, 2015).

B. INGAA's Responses to EPA's July 23, 2015 Questions

EPA Question 1: Please indicate whether your company has specific interest in one of the commitment options presented, included the possibility or likelihood of your company marking that commitment.
INGAA response: INGAA believes that some member companies are likely to participate in the Methane Challenge; however, INGAA defers to its members companies to respond on an individual basis. INGAA believes that the program's disincentives must be addressed in order for participation to be broadly considered.

EPA Question 2: In addition to recognition through the Program, what are the key incentives for companies to participate in this Program? Should EPA offer some partners extra recognition, such as awards?
INGAA Response: INGAA believes EPA should incentivize participation by making the

program and BMP commitments flexible, and by ensuring reasonable reporting. INGAA believes the ability to participate in decision-making and to craft industry-lead voluntary guidelines rather than a prescriptive program is a key incentive to participation.

Specifically, INGAA requests that: (1) EPA should continue to allow participants to choose whether they wish to have one company within their corporate family or a number of affiliated companies participate in the Methane Challenge. (2) EPA should continue to provide participants the opportunity to select among the three proposed methane reduction opportunities (i.e., BMPs, ONE Future or EPA's third option of Emissions Reduction through the use of a common baseline). (3) EPA specifically lists DI&M as an approved BMP; (4) EPA should provide participants with some flexibility in their repair schedules based upon season, operating conditions and worker safety concerns. (5) EPA provide assurances that it will not penalize volunteering companies for failing to meet interim emissions reduction targets as long as overall reductions commitments in the MOUs are met. (6) EPA specifically assures companies that it will not modify or ask the states to modify Title V or other air permits prospectively to mandate emission reductions that had been voluntary commitments. (7) While INGAA realizes that EPA wants the reporting program to be transparent and to assure the public that methane reductions are verifiable and documented, INGAA also wants EPA to avoid any risks of disclosure of Confidential Business Information (CBI). Companies may need to work with EPA to ensure that they are not disclosing any CBI information on their own processes and related to non-T&S business units (such as in the upstream or gathering sectors).

INGAA believes that the greatest incentives to participation in the program would result from EPA's elimination of a presumption that T&S companies can reduce compressor station blowdowns by 50 percent or greater as covered in EPA's October 19, 2015 Supplementary Technical Information Document. (See INGAA's response to EPA's Supplemental Document Question 8 on page 19)

Expecting companies to reduce blowdown events and the resulting volume of methane by 50 percent is unrealistic. Blowdown events at compressor stations are not frequent but are undertaken as a public safety protection measure to purge natural gas (methane) from its pipelines in order to address a repair. The best example for blowdown necessity is that, like water pipelines in a residence, the water pipeline must have its water contents drained before a pipeline repair can be made by a plumber. In some pipelines there may be no opportunity to redeploy the natural gas to another line or to recompress quickly enough to undertake the pipeline repair. In some new compressor stations there may be opportunities to reduce the natural gas in a pipeline through either moving the natural gas to another pipeline, recompression or by use of some portable devices. However, there are many locations where an arbitrary expectation of methane reductions of 50 percent from blowdowns would simply not be feasible or achievable without risking public safety.

Another major disincentive is in including any presumption that T&S pipeline companies should place methane reduction measures ahead of public and worker safety in excavation activities. INGAA notes that Common Ground Alliance (CGA)[11] is committed to saving lives and preventing damage to underground infrastructure by promoting effective damage prevention

[11] http://commongroundalliance.com/about-us#sthash.ApSPzaxb.dpuf

practices. While INGAA may encourage companies to reduce methane through a variety of activities, excavation actions are inherently dangerous and those safety concerns trump any goal of reducing methane. It is also outside the scope of normal business for INGAA member companies to require their construction contractor company employees engaged in excavation activities to reduce methane while undertaking their primary mission. Further, documenting this action by a construction company and linking this back to the pipeline company is onerous and a distraction for the construction company. INGAA finds EPA's description about excavation a bit unclear as to whether EPA intended to include the T&S sector. EPA should make it clear that excavation does not apply to the T&S sector. INGAA offers no comments addressing excavation for other sectors.

EPA should clarify that company-provided data and information marked as Confidential Business Information ("CBI") will enjoy a presumption by the agency that the information is CBI and, therefore, be protected from production under the Freedom of Information Act. Further, EPA should clarify the interaction between the Methane Challenge and potential future regulations so that a company that makes early voluntary investments in emissions abatement is not penalized by early action if in fact any future regulatory program requires different types of investments or does not provide credit for earlier company reductions.[12] By doing so, EPA can convert what is currently a *disincentive* to participation into a positive incentive.

Accordingly, INGAA urges EPA to commit in the Methane Challenge that any subsequent regulation of methane emissions from existing sources will set the baseline at the start of the Methane Challenge program and will provide full credit for any emissions reductions achieved under the Methane Challenge program. Such a non-binding statement of policy about the content of a future proposed rule is consistent with EPA's legal obligations for rulemaking under the Clean Air Act.

INGAA also suggests that EPA provide a process for companies to take credit for methane reduction under the Methane Challenge in the future for actions not yet identified or approved by EPA under the current BMPs. These might include, but are not limited to, the use of new technologies that might be commercially demonstrated or more cost effective in future years that are not currently available or affordable.

EPA Question 3: EPA is proposing to launch the Program with charter partners by the end of 2015, but will welcome new partners on an ongoing basis. Please comment on the likelihood of your company committing to join this Program as a charter partner, or at a future date.

INGAA Response: INGAA defers to its members companies to respond on an individual basis. Nonetheless, INGAA notes that given the timing of EPA's supplemental documents that detail its proposed program and the announcement of the Memorandum of Understanding and Implementation Plan only days before the deadline for comments make it very challenging for INGAA to comment fully. Further companies might find it difficult to make a commitment to the

[12] INGAA does not advocate future mandatory regulations under Section 111(d) of the Clean Air Act for reducing methane emissions from existing sources, because a well-crafted voluntary program, with sufficient flexibility, will achieve the same goal more efficiently. This is consistent with EPA's statements that they have no plans to propose a separate rulemaking under Section 111 (d) of the Clean Air Act.

Methane Challenge by 4Q 2015 given that the last two documents were only announced on November 9. EPA should consider allowing companies to enter the Methane Challenge after 2015, or to expand the program to other corporate business units, after the initial deadline rather than require a one-time sign-up deadline.

EPA Question 4: For the BMP option, how can EPA encourage companies to make commitments for sources for which they have not made significant progress in implementing mitigation options? In other words, how can companies be encouraged to participate beyond the sources for which they have already made significant progress?
INGAA Response: INGAA believes that it is unrealistic to expect participating companies to expand their commitment to additional business units or pipelines or additional emission sources (e.g., adopt additional BMPs) until they have had several years' experience with the Methane Challenge. EPA should provide participating companies an opportunity to gain experience operating under the framework of the Methane Challenge before expecting parties to commit to additional reductions prior to 2022 or the five year compliance period.

INGAA believes that "source" could mean a facility or additional emission sources within the facility. For example a participant could elect to implement the pneumatic BMP but not other BMPs for any other "sources" at that company.

The BMP option provides companies the ability to pick the BMP, or multiple BMPs, that work best for a particular company. INGAA supports EPA's proposal to allow submission of additional BMPs at a future date whether from INGAA, another industry association, or through individual companies. This allows companies to submit new innovative measurement, monitoring or emission reduction technologies for inclusion in the Methane Challenge program as those technologies or practices are developed.

EPA Question 5: **Please provide comments on the sources and corresponding BMPs that are provided in Appendix 2, including any recommended additions, deletions, or revisions.**
INGAA Response: As explained at the beginning of the comments, INGAA recommends that DI&M be included as a BMP. As already explained, INGAA's DI&M Guidelines would focus on key equipment that address 80 percent or more of methane leak emissions at compressor stations based on 2011 and 2012 data from Subpart W surveys. In addition, the vast majority of emissions from the focused list of sources in the INGAA Guidelines are attributable to approximately 10 to 20 percent of leaks from these key sources. See tables provided in IES Paper Appendix A.

INGAA appreciates EPA's consideration of DI&M as a BMP for the T&S sector as referenced in footnote 17 of the Methane Challenge. INGAA strongly recommends including DI&M, based on the INGAA DI&M Guidelines provided to EPA and discussed in recent meetings.

These findings are documented in a white paper that INGAA is providing as an appendix to these comments. Based on a review of EPA GHG reporting program (GHGRP) data, as well as supplemental data collected in a project undertaken by Pipeline Research Council International, the white paper concludes that the sources included in the INGAA DI&M Guidelines would

address 80 percent or more of methane leak emissions at compressor stations. See table on page 30.

Other examples in the literature confirm the general trend that a relatively small percentage of leaks are responsible for the vast majority of leak emissions. A 2014 paper[13] that compiled and analyzed a number of technical papers from the last 20 years provides several examples. The collaborative EDF-Colorado State University shows similar findings. INGAA's White Paper[14] further demonstrates that a relatively small percentage of leaks account for the vast majority of emissions from natural gas transmission and storage operations.

INGAA's DI&M capitalizes on this opportunity to achieve cost effective and efficient emissions reductions with procedures that focus on repairing the largest leaks on a timely basis.

EPA acknowledged DI&M as an established method for reducing the vast majority of compressor station leak emissions in its EPA STAR "Lessons Learned" document[15]. Consequently, there is a sound basis for recognizing DI&M as a BMP in the Methane Challenge. EPA referenced INGAA's DI&M approach as BMP on page 17[16] by stating "EPA has received, and is considering, a proposal to structure BMP coverage of natural gas transmission and storage compressor stations as a Directed Inspection and Maintenance Program". INGAA seeks EPA's adoption of this BMP for those companies that wish to use it in their participation.

DI&M is preferable to conventional leak detection and repair (LDAR) programs with an approach that focuses on compressor station equipment more likely to be the source of a large leak, and prioritizes repairing those larger leaks. DI&M provides the ability to achieve similar reductions while better managing costs. The discussion above (see Figures 1 and 2 and related discussion) shows that significant reductions can be realized through DI&M. The costs savings are obvious. As discussed above, DI&M includes lower survey costs because the survey portion of the program is limited to select equipment with a higher potential for larger leaks. Repair costs are also lower because conventional LDAR requires repair of *all* leaks while DI&M focuses on larger leaks. While existing programs (e.g., PHMSA requirements, AVO walk-throughs for safety) will find many of the smaller leaks, LDAR would still trigger additional leak repairs for very minor leaks, thus resulting in higher costs. Increased emissions could also result if station piping blowdowns are required to accomplish the repair.

Figures 1 and 2 demonstrate through Subpart W data and pipeline company data for both 2011 and 2012 that more than 80 percent of the leak emission which come from three source categories-reciprocating compressors, centrifugal compressors and tanks.

As shown in Figures 1 and 2 (pages 5 and 6) and discussed in the related text as well as the attached White Paper, data from a PRCI project to collect and analyze members' data from

[13] Brandt, A.R., et al., *"Methane Leaks from North American Natural Gas Systems"*, Science, 343, 733-735 (2014).
[14] Subramanian, R., et al., *"Methane Emissions from Natural Gas Compressor Stations in the Transmission and Storage Sector: Measurements and Comparisons with the EPA Greenhouse Gas Reporting Program Protocol"*, Environ. Sci. Technol., 49, 3252-3261, DOI: 10.1021/es5060258 (2015); http://pubs.acs.org/doi/pdf/10.1021/es5060258
[15] http://www3.epa.gov/gasstar/documents/ll_rodpack.pdf
[16] http://www3.epa.gov/gasstar/documents/methane_challenge_proposal_072315.pdf

Subpart W of the GHGRP shows that for the leak emissions sources, more than 80 percent (2012 data) to 90 percent (2011 data) of leak emissions are associated with three source categories – reciprocating compressors, centrifugal compressors and tanks. These sources would be addressed by the DI&M guidelines because these sources include components (e.g., isolation valves, rod packing, dump valves) with the greatest potential of being a large emission source. The DI&M guidelines address these sources through surveys that focus on a limited number of components with the greatest potential for large leaks. The leaks from other components require surveying hundreds or thousands of additional components throughout a facility, and the total emissions from those hundreds of potential leak sources comprise about 9 percent (2011 data) to 19 percent (2012 data) of total leak emissions. Requiring hundreds or perhaps a thousand of additional component surveys across a facility is not cost effective.

INGAA and PRCI members that submitted GHGRP data provided the PRCI project with Subpart W data along with related supplemental data on equipment, operations, and measurement methods. It includes well over half of the sources that reported to EPA. The emissions reported under EPA's Subpart W of the GHGRP provides a good basis for assessing the potential effectiveness of DI&M as a BMP because it includes far more facilities than included in other studies that assess leak emissions, and the DI&M guidelines focus on sources that require direct measurement under Subpart W (compressors, storage tanks).

In addition, Figures 1 and 2 (on page 5) and discussion above clearly demonstrates that reciprocating compressors are the largest sources of T&S methane emissions, and collectively with the other two source types measured in Subpart W (centrifugal compressors and storage tanks) 80 percent or more of emissions are addressed. Consequently, DI&M offers a BMP for addressing more than 80 percent of the methane leak emissions from compressor stations based on 2011 and 2012 PRCI data.[17]

The conclusion that a relatively small number of leaks account for the vast majority of methane emissions from reciprocating and centrifugal compressors and tanks is supported by the data in the White Paper. Thus, the GHGRP data reinforces the foundation for INGAA's development of DI&M as an alternative to LDAR: the vast majority if emissions (80 percent or more) are from a small number of leaks (e.g., 20 percent or fewer). The White Paper supports this conclusion with cumulative distribution plots of individual sources for reciprocating compressors and centrifugal compressors, and with plots of measurements from tanks. The GHGRP data confirms the premise for DI&M as an efficient strategy for reducing T&S sector methane emissions.

<u>EPA Should Provide Participating Companies the Flexibility to Define the Scope of BMP Implementation within Their Operations</u>

The current proposal requires a company-wide commitment to implement the BMP(s) selected by the reporting entity. In the proposal, EPA sought to find a balance between covering significant portion of the operations and widespread implementation of best practices. INGAA is

[17] The PRCI project is also compiling data for 2013, but the analysis of Subpart W and supplemental data is not complete.

concerned that a BMP might not achieve cost-effective emissions reductions if it must be implemented across the entire company. INGAA recommends that participating companies have the flexibility to define the scope of implementation of the BMP within its operations. For example, a BMP might be appropriate for implementation at only 75 percent of an operation because implementation at the remaining 25 percent of the operation might not achieve meaningful reductions. In such a case, a company should have the flexibility to replace the BMP with an alternative BMP that achieves comparable or better emission reductions. The CSU paper from the EDF-industry study discusses relative emission results in this manner – i.e., 10 percent of the facilities are responsible for more than 50 percent of methane emissions, and 50 percent of the lowest emitting facilities are responsible for less than 10 percent of emissions. This also would provide the opportunity to achieve cost-effective emission reductions as new leak identification or mitigation technologies are developed and incorporated within a participating company's implementation plan. As new technology is developed, opportunities may also be provided to achieve effective reductions at fewer sites. For example, figures above and in the White Paper show that reciprocating compressors are an important source. Advances that focus on reducing those emissions could support implementing a BMP for facilities with reciprocating compressors and not facilities that exclude those compressors.

Since the emissions and emission reductions will be reported to EPA, this approach would ensures transparency and continued progress in achieving methane emission reductions.
An example is that routing gas from rod packing vents to re-use is only viable at stations where other equipment is running and available to use the recovered gas. Further, pipeline blowdown recovery is another BMP that cannot be implemented for all maintenance activities due to customer scheduling demands, cost, and safety limitations. Companies should have the flexibility of not implementing the BMP at 100 percent of their facilities and/or to choose an alternative BMP that achieves meaningful emission reductions.

<u>While Blowdowns Can Be Minimized at 50 Percent Reduction of Blowdowns Is Not Achievable in All Cases</u>

Pipeline companies must have the ability to blowdown pipeline segments for public safety, and pipeline integrity purposes. PHMSA regulations[18] and initiatives to improve pipeline safety make it necessary for pipeline operators to blow down natural gas from a pipeline to either reduce the pressure within a pipeline or to evacuate the pipeline segment completely to perform inspections, maintenance and, in limited instances, to ensure safety in the event of an incident. INGAA supports minimizing pipeline segment blowdowns as a BMP. INGAA, however, is concerned that the BMP, as proposed, would apply to all pipeline segment blowdowns, except in emergencies. INGAA recommends that EPA redefine the BMP to "minimize pipeline segment blowdowns for maintenance activities."

<u>INGAA Believes That Pipeline Companies Must Be Able To Blowdown Pipeline Segments for Public Safety and Pipeline Integrity Purposes</u>

In addition, it is neither practical nor economic to install portable flares at all compressor stations to combust the residual gas once the operating pressure has been reduced using existing or

[18] 49 C.F.R. Sections 101, 102 and 103.

temporary compression. INGAA believes that reducing the operating pressure to the extent feasible using existing or temporary compression should be adequate for this BMP.

EPA Question 6: Please comment on the proposed definitions on the companies or entities that will make BMP commitments, per Appendix 3.
INGAA Response: INGAA agrees that reporting by an individual inter- or intra-state transmission pipeline system company is reasonable. However, for companies with some combination of production, gathering, processing, transmission, storage, and distribution operations, a more comprehensive, corporate-wide approach should remain an option. Reporting by the individual inter- or intra-state transmission pipeline system company is consistent with the current GHGRP reporting structure. INGAA believes that each company should determine the scope of the reduction measure and Methane Challenge participation level including whether a single pipeline, business unit or entire corporation participates.
INGAA also encourages EPA to provide the opportunity for companies to participate at the parent company level by combining multiple industry segments under the same parent company. This would provide the same flexibility as the One Future option.

EPA Question 7: Is a 5-year time limit to achieve BMP commitments appropriate? If not, please provide alternate proposals. Would a shorter time limit encourage greater reductions earlier?
INGAA Response: INGAA believes that the five-year period proposed by EPA for implementing BMPs or other program commitments (e.g., ONE Future intensity reductions, etc.) is reasonable. INGAA does not believe it is reasonable to expect achievement of the commitments in less than five years. It is important to recognize that companies likely will not be able to implement their commitments fully on day one, or even in year one. For example, pipeline companies likely will need time to train staff, hire third party contractors (to implement LDAR or DI&M program, to develop internal processes for pipeline pumpdowns and other recovery activities, to identify, to establish new maintenance schedules for rod packing replacements, etc.). Certain reduction measures might require one time replacements of equipment (e.g., pneumatic devices) while others might involve longer-term commitments (e.g., equipment component monitoring and repair programs, minimization of pipeline segment blowdowns, etc.). Memoranda of Understanding (MOUs) should reflect individual company milestones and final action dates. While many reduction measures can take place within the five years proposed by EPA, INGAA recommends that EPA not limit the Methane Challenge to a five year compliance period when a company may have reasons why it cannot complete the reductions within five years INGAA recommends that participating companies have a similar option addressing technical feasibly under the BMP option, where a progress update can be provided within 5 years but that complete implementation of the BMP be achieved within 10 years (i.e., by 2025).

EPA Question 8: Should EPA offer the Emissions Reduction (ER) approach? If so, please provide specific recommendations for ways that EPA could address the implementation challenges outlined in this document. What is the minimum target company-specific reduction level that should be set for participation in this option? Would your company use this option if it were offered?

INGAA Response: INGAA supports EPA offering the ER approach as a means to encourage greater participation. EPA should maintain flexibility for each company to define the reduction goals that make sense for that individual company or entity. INGAA does not prefer ER over the other two options but believes it gives more choices to potential program participants.

EPA Question 9: To what extent is differentiating the voluntary actions from regulatory actions important to stakeholders? What are the potential mechanisms through which the program could distinguish actions driven by state or federal regulation from those undertaken voluntarily or that go beyond regulatory requirements?
INGAA Response: INGAA believes the most important aspect of a federal voluntary program is that the program is truly *voluntary and flexible*. As stated in response to question 2, companies must have some ability to craft the best approach for participation. If EPA wants to ensure, as stated in the [Proposed Framework] that it Methane Challenge encourages "ambitious commitments" and "innovative approaches,"[19] then volunteering companies must have specific assurances that they will not face penalties under the program. To this end, INGAA urges EPA to clearly indicate that, in the event that there are discrepancies about a company's performance under the Methane Challenge or if a company wants to end its participation; such actions will not be enforceable or punishable in any way under the Clean Air Act.

INGAA also urges EPA to make clear that Methane Challenge commitments have no place in Title V permits, and that the Agency will neither issue nor approve a Title V permit (or any other regulatory permit) that requires inclusion of Methane Challenge commitments.

In addition to emphasizing that participating companies' commitments should not be included in Title V or other regulatory permits, EPA should clarify that the Agency will only use Methane Challenge data supplied by participating companies to assess performance under that program. We urge EPA to make clear that it will not use Methane Challenge data (including DI&M or other data) for purposes of evaluating compliance with *other* programs or regulations.

EPA Question 10: EPA plans to leverage existing reported data from GHGRP (Subpart W) and supplemental data from companies to EPA. Would e-GGRT system be appropriate mechanism to collect the voluntary supplemental data?
INGAA Response:
The Methane Challenge reporting system will need to interface with the current GHGRP reporting system (e-GGRT) and coordinate with reporting under the existing Natural Gas STAR program. INGAA believes it is important to keep the data separate and maintain different sets of data for the voluntary program and the GHGRP. INGAA members are concerned that too many supplemental reporting requirements beyond the current GHGRP could deter participation in the Methane Challenge Program. The e-GGRT system may be an appropriate mechanism for reporting under the Methane Challenge Program, but voluntary data should be reported separately from the mandatory data and clearly labeled. INGAA believes that in order to maximize participation, the reporting system must be easy to use and confidential data must remain confidential. The reporting requirements should not be overly burdensome or companies may be deterred from participating in the program.

[19] Proposed Framework at 5.

INGAA respectfully requests an opportunity to review and further comment on the reporting structure once it has been developed and proposed by EPA.

EPA Question 11: Would companies be willing and able to make commitments related to emissions sources where EPA has proposed, but not finalized, new GHGRP Subpart W requirements?
INGAA Response: INGAA companies will need to evaluate a more detailed proposal from EPA regarding supplemental data requirements under the Methane Challenge program, both for emission sources similar to those reported under the GHGRP, as well as for new emission sources, such as pipeline emissions and the gathering and boosting segment, which are not yet a part of the GHGRP.

EPA Question 12: EPA seeks feedback on potential mechanisms for encouraging continued, active participation in Program once a company's initial goals have been achieved.
INGAA Response: INGAA believes that the best encouragement for continued and active participation is for EPA to recognize accomplishments in the MOUs with individual companies. INGAA defers to individual company participants for feedback on other mechanisms for encouraging active participation.

As new technologies are developed and commercially deployed, EPA should encourage the implementation of new BMPs, if these technologies are commercially demonstrated, widely deployed and cost-effective.

EPA released its model MOU and Implementation Plan documents less than a week from the deadline for the Methane Challenge Comments with a separate deadline of November 20, 2015. INGAA will not be able to provide comments back on those two documents as soon as November 20th because INGAA and many member companies will be attending a four day EPA meeting on methane in Pittsburgh, PA. INGAA believes it is regrettable that EPA did not issue all documents relevant to Methane Challenge in July and provide at least 60 days for comments on all documents and materials. In fact, INGAA requested a minimum of 30 days for filing comments after all Methane Challenge documents were publicly available. INGAA retains the right to file additional comments after Nov. 20, 2015 to address any additional concerns with those documents.

As already stated in response to questions 2 and 9, INGAA believes that companies should have the ability to participate in the decision-making and to craft industry-lead approaches that allow for flexibility. Voluntary programs are preferred over prescriptive regulatory requirements.

EPA Question 13: EPA is proposing to call this new voluntary effort the "Natural Gas STAR Methane Challenge Program", and welcomes comments and suggestions on this name.
INGAA Response: INGAA believes the name is suitable.

C. INGAA's Responses to EPA's October 19, 2015 Questions

EPA Question 1: Are potential partners interested in reporting measured methane emissions for any sources that currently don't include measurement in the quantification options? Please comment on this and, if so, provide information on recommended measurement protocols for sources of interest.
INGAA Response: Because the Methane Challenge program is a voluntary program intended specifically to achieve real and quantifiable methane reductions while minimizing the reporting burden on the partner companies, the additional measurement or data elements beyond those specified under the GHGRP or in the Methane Challenge Technical Support documents would only add more reporting burden to participating companies without providing any information that would be considered relevant for demonstrating methane reductions.

EPA Question 2: Should intermittent pneumatic controllers be included in the Pneumatic Controllers source? EPA seeks recommendations on whether and how to include intermittent controllers.
INGAA Response: Intermittent pneumatic controllers should not be included as a source. Intermittent pneumatic controllers are used to assure safe operation of critical valves and other compressor station components that must operate in emergency situations. Intermittent pneumatic controllers operated by natural gas pressure provide greater reliability and safety than alternative energy driven devices. Companies should be allowed to include reductions from the replacement of intermittent pneumatic controllers if these controllers are replaced utilizing the existing BMP.

EPA Question 3: For Tanks, EPA seeks comment on whether additional elements collected under GHGRP should be considered for tracking purposes for the Methane Challenge Program.
INGAA Response: With the exception of the data elements already listed on the table provided on Pages 7 and 8 of the Methane Challenge Supplementary Technical document, INGAA does not see the need to require the reporting of any additional data elements collected under the GHGRP for the applicable facilities. Because the Methane Challenge program is a voluntary program intended specifically to achieve real and quantifiable methane reductions while minimizing the reporting burden on the partner companies, the additional data elements specified under the GHGRP would only add more reporting burden to the companies without providing any information that would be considered relevant for demonstrating methane reductions.

EPA Question 4: What types of situations require operators to vent to the atmosphere instead of capturing emissions during liquids unloading? How could this information best be captured in the reported data?
INGAA Response: The liquids unloading provisions do not pertain to the T&S sector.

EPA Question 5: For liquids unloading, are there additional supplemental data elements or quantification methods needed to demonstrate that operators are minimizing emissions during liquids unloading?
INGAA Response: The liquids unloading provisions do not pertain to the T&S sector.

EPA Question 6: EPA seeks feedback on methodologies for calculating and tracking centrifugal compressor seal oil degassing and reciprocating compressor rod packing methane emissions for the following operational situations:

a. **Compressors that route seal oil degassing/rod packing vents to manifolded vents that include sources other than seal oil degassing (e.g., blowdown vents) or seal oil degassing/rod packing emissions from multiple centrifugal compressors.**
b. **Compressors that route seal oil degassing/rod packing vents to flare, a thermal oxidizer, or vapor recovery for beneficial use other than as fuel.**

INGAA Response: INGAA's members represent the vast majority of the natural gas pipeline operators in the U.S. Installation and operation of vapor recovery systems, thermal oxidizers or flares for seal oil degassing and rod packing vents is not a common practice within the natural gas transmission and storage. This technology may be applied in limited situations (e.g., Alaska operations), but it is not a typical industry practice. Rather, this technology is not yet deemed to be a proven technology for the transmission and storage sector.

EPA Question 7: EPA seeks feedback on methodologies for calculating methane emission reductions for centrifugal compressors that convert from wet seals to dry seals.
INGAA Response: INGAA supports the option to include methane reductions when converting to dry seals during centrifugal compressor upgrade or routine maintenance. INGAA recommends use of the Subpart W wet and dry seal emission factors for calculating the associated emission reductions. Wet seal emission factors are available in current Subpart W reporting methodologies. Companies would simply report the number of wet seal to dry seal conversions covered under the program and the associated methane emission reductions. INGAA also recommends that EPA leave flexibility for a "before" and "after" measurement should a T& S company want to use a different reduction factor.

EPA Question 8: For transmission and distribution blowdowns, EPA requests feedback on the proposal of 50% as the minimum reduction percentage commitment, and whether the minimum commitment should be adjusted to serve as an appropriate stretch goal for partner companies. Is the proposed methodology for calculating potential emissions from this source appropriate? The proposed methodology assumes full evacuation of the pipeline to atmospheric pressure; are there circumstances in which companies don't lower pipeline pressure all the way to atmospheric levels, such that using this basis for calculating potential emissions could overstate potential emissions?
INGAA Response: INGAA supports voluntary measures to reduce methane emissions from pipeline blowdowns. Pipeline segment blowdowns are required to perform maintenance, testing, pipe replacements and for safe pipeline operations. Specific Pipeline and Hazardous Materials Safety Administration (PHMSA) regulations[20] require pipeline blowdowns for class location changes (that is, population increases in the vicinity of the pipeline above specified thresholds) and hydrostatic testing (testing pipe using water under high pressures) and for other pipeline safety purposes. The ability to reduce the pipeline pressure to minimize blowdown emissions is limited by the pipeline configuration (single pipeline or multiple pipelines adjacent to each other), available compression (either existing pipeline compression or temporary rental compression), timeframes required to draw down the pressure, impacts to customers, weather and multiple other factors. EPA must be cognizant of the fact that pipeline operators frequently cannot always control the timing and need for blowdowns in emergency situations to maintain pipeline integrity and assure safety. Pipeline operators must evaluate and address all of these

[20] 49 C.F.R. Parts 191, 192 and 193

factors in determining whether a pipeline can be drawn down or must be blown down. Even when a pipeline is drawn down, some residual gas remains in the pipeline that must ultimately be blown down. Therefore, the ability for any pipeline operator to achieve a specific minimum blowdown reduction goal will vary. Therefore, establishment of a specific minimum percentage reduction threshold could deter companies from participating in the Methane Challenge program. Rather, the 50 % reduction should be an overall program goal, but not a specific BMP or company requirement for participation.

Emission reductions can be calculated based on pipeline operating pressures, temperatures and other engineering factors. For pipelines that are drawn down but have a residual gas volume that is subsequently vented to atmosphere, the emission reduction calculation is the difference from the volume of gas at operating pressure minus the residual volume vented to atmosphere. For example, a pipeline may have an operating pressure of 1000 psi and is drawn down using compression to 300 psi. The emission reduction could be calculated assuming a 700 psi reduction volume using the same engineering calculation methodology.

As stated above, PHMSA regulations require pipeline blowdowns for pipeline integrity and public safety purposes. For example, one INGAA member company currently has to blowdown an average 8 to 10 segments per year under PHMSA's regulations for class location changes. *See* 49 C.F.R. § 192.611. Collectively, upgrading 10 segments of pipeline per year would result in approximately 200 million cubic feet (91,300 metric tons of CO_2e) of methane emissions.

INGAA member companies operate approximately 90 % of the nation's transmission lines, so nationwide the amount of methane released due to unnecessarily upgrading pipelines is significant. Instead, if PHMSA would adopt limitedly revised regulations allowing for integrity management in lieu of pipeline replacement, these tons of methane could be preserved each year. Revisions to provide an alternative to pipe replacement under the PHMSA class location rules to reduce pipeline blowdown should be promoted in lieu of a an extensive NSPS regulatory program imposed by EPA. Because such blowdowns are not required for safety, but instead are driven by existing regulations (as described above), the Obama Administration should adopt limited revisions under PHMSA's regulatory program to reduce the frequency of those blowdowns and still attain its goal of reducing methane emissions. Implementation of pipeline integrity management practices to reduce unnecessary blowdowns results in a win-win for pipeline safety and the environment.

EPA has called for comments on the supplemental document that included an expectation that for participants in Methane Challenge to reduce blowdowns by 50%. Most importantly, INGAA believes the greatest incentive to participate in the program would result in EPA's elimination of a presumption that T&S companies can reduce blowdowns by 50% of greater. Expecting companies to reduce blowdown events and the resulting volume of methane by 50% is unrealistic. Blowdown activities are undertaken as a part of a company's safety management program or required maintenance activities. The intent of a blowdown is to purge the methane from the pipeline, similar to water in a residential water pipeline, and that pipeline must have the water removed before a pipeline repair can be made by a plumber.

In some natural gas pipeline system there may not be an opportunity to transfer the natural gas (methane) from one pipeline to a secondary pipeline which could elevate the need for a blowdown. Blowdowns along the pipeline are infrequent because of the improvement in pipeline repair techniques. In comparison, compressor station blowdowns occur on a more regular basis for maintenance activities. Companies are currently working on best management practices to mitigate the amount of methane released during these maintenance activities. There are many locations where an arbitrary expectation of methane reductions of 50% from blowdowns would simply not be feasible or achievable without risking public safety.

EPA Question 9: For distribution mains, EPA requests feedback on the proposed percentage replacement rates, which include a new proposed category for companies with an inventory of >3000 miles of cast iron and unprotected steel mains.
INGAA Response: These provisions do not pertain to the T& S sector.

EPA Question 10: EPA seeks feedback on the proposal to use the plastic pipe EF for "Distribution Mains – Cast Iron or Unprotected Steel with Plastic Liners or Inserts" and "Distribution Services – Cast Iron or Unprotected Steel with Plastic Liners or Inserts."
INGAA Response: These provisions do not pertain to the T&S sector.

EPA Question 11: For distribution mains and services, should "vintage" plastic pipe or "Century" plastic pipe be included with cast iron and unprotected steel in this category (Aldyl A and LDIW Aldyl A Polyethylene gas piping manufactured from 1965 through 1972 and plastic piping extruded by Century Utility Products Inc. from Union Carbide Corporation's DHDA 2077 manufactured between 1970 and 1973 respectively)? In particular, EPA seeks input on whether companies have sufficient available activity data (e.g., known inventories of vintage plastic pipe and annual information on plastic pipeline material) such that they can commit to and track replacement levels, and if so how emissions of this type of pipe should be quantified (e.g., are material- or age-specific emissions factors available?).
INGAA Response: These provisions do not pertain to the T&S sector.

EPA Question 12: For cast iron services, EPA seeks comment on how to quantify methane emissions, and requests quantification methodology suggestions, including any available data.
INGAA Response: These provisions do not pertain to the T&S sector.

EPA Question 13: For distribution mains, EPA seeks feedback on whether to include as a mitigation option use of internal or external joint sealants for cast iron pipes greater than 20" in diameter. In particular, EPA seeks feedback about the ability to implement other mitigation options for these pipes (e.g., slip-lining), which reinforce the joints as well as the pipeline. EPA requests commenters to provide relevant supporting data with their response, if available.
INGAA Response: These provisions do not pertain to the T&S sector.

EPA Question 14: For excavation damages, EPA seeks comment on whether to limit the scope of this source to pipe operating at 15 psi or greater, or whether it should cover excavation damages on all pipe.
INGAA Response: See response to Question 8.

EPA Question 15: Because many excavation damages are technically out of the control of companies, EPA is proposing company-specific goal setting to participate in the Program. We request feedback on this approach, in particular whether companies would be able to set emission reduction targets versus other targets (e.g., reducing number of damages, reducing average shut-in time for all damages, other qualitative targets).
INGAA Response: See response to Question 8. Since excavation damages are outside the control of pipeline operators, it would be impossible to set company goals and emission reduction targets. Pipeline operators must implement immediate corrective actions to address excavation damage and emergency situations in accordance with PHMSA regulatory requirements and to assure public safety.

EPA Question 16: EPA requests feedback on how to quantify methane emissions/gas releases from excavation damages. Is there publically available data on recommended calculation methods for quantifying emissions from this source? Are there any circumstances under which it would be appropriate to use an emission factor (e.g., GRI/EPA or Lamb et al.)?
INGAA Response: Refer to comments in Question 8. Since excavation damages are outside the control of pipeline operators, it would be impossible to set company goals and emission reduction targets.

EPA Question 17: The Natural Gas STAR Program Annual Reporting Forms specify Sunset Dates (the length of time a technology or practice can continue to accrue emission reductions after implemented) for mitigation options (http://www3.epa.gov/gasstar/tools/program-forms.html) Should the Methane Challenge Program create a similar structure to establish Sunset Dates for designated mitigation options?
INGAA Response: INGAA does not support a Sunset Date. Emission reductions should be available throughout the length of the Methane Challenge commitment period.

EPA Question 18: The Methane Challenge Program seeks to stimulate new action to reduce methane emissions while also recognizing past actions undertaken by partners. For some sources, such historic action will be clear through proposed reporting (e.g., facilities that have converted high-bleed pneumatic controllers will show a low number of high-bleeds relative to low-bleed and zero emitting controllers). For other sources, such as cast iron pipe, a low level or nonexistent cast iron could reflect a historic replacement program or the fact that the facility never had such pipe. For practice-based programs, such as that proposed for excavation damages, companies may already have taken steps to reduce damages such that they cannot expect to achieve significantly lower levels. Should the Methane Challenge Program create a mechanism to specifically recognize historic action for certain sources? If so, how could the Program recognize such previous action (for

example, by allowing these companies to join the Program and collecting and posting relevant details on previous action prior to joining the Program)?
INGAA Response: If a company desires to submit historic reductions, the company should report them under the existing Natural Gas STAR program. EPA should provide a mechanism for member companies to report historic emissions reductions from a BMP. Companies can use the same data elements to report past emissions reductions, which can be identified as occurring prior to the start of the Methane Challenge commitment.

III. Conclusion

Addressing methane through a voluntary program is preferred over a regulatory system under section 111(d) of the Clean Air Act (or as those measures proposed in "OOOOa"). A properly structured voluntary program will encourage the gas transmission industry to identify the greatest sources of methane emissions (the "super emitters") and reduce methane emissions more efficiently and cost-effectively.

INGAA supports having all of the three options offered to prospective Methane Challenge program participants yet strongly encourages EPA to add INGAA's DI&M to its BMP option. Allowing companies to select from several BMPs, ONE Future, or the Emissions Reduction option will increase the likelihood of voluntary program participation. **INGAA recommends its DI&M as a Best Management Practice (BMP) to identify and respond to 80 percent of the T&S sector's methane leaks in a responsible manner.**

INGAA does not believe it is currently feasible to achieve a reduction 50 percent of the methane from blowdown events given the design of many pipelines that cannot avoid blowdowns. INGAA believes that excavation measures should not apply to the T&S sector because it is not appropriate to interfere with the core mission of excavation work and public safety protection.

INGAA respectfully requests an opportunity to further comment on the additional implementation or MOU documents released by the EPA on November 11, 2015.

INGAA contact
Theresa Pugh
VP, Environment, Health & Construction Policy
tpugh@ingaa.org
202/216-5955

Directed Inspection and Maintenance for Reducing Leak Emissions from Natural Gas Transmission and Storage Compressor Stations: Greenhouse Gas Reporting Program Data Supporting a Focused Leak Mitigation Program

Prepared for:

Interstate Natural Gas Association of America (INGAA)
40 F Street, N.W., Suite 450
Washington, D.C. 20001

Prepared by:
Innovative Environmental Solution, Inc.
Cary, IL

September 2015

INTRODUCTION AND BACKGROUND

It has been shown that a relatively small percentage of leaks contribute the vast majority of leak emissions for natural gas operations. For example, 95% of methane emissions from equipment leaks are from 20% of the leaks at natural gas transmission compressor stations.[21] Directed Inspection and Maintenance (DI&M) is a leak mitigation practice that leverages this characteristic of compressor station leaks through procedures that focus repairs on larger leaks while limiting resources expended on inconsequential leaks. This White Paper provides background and technical support for implementing DI&M, as described in the INGAA DI&M Guidelines, to mitigate natural gas transmission compressor station equipment leaks.

The INGAA DI&M Guidelines provide the structure, program elements, and procedures for a company-specific DI&M program. The Guidelines focus on key leak sources within a facility that have a higher probability of being large leaks – referred to as "gross emitters" in recent EPA documents. The focused list of sources is based on previous studies, company experience, and available information, including data from the EPA Greenhouse Gas Reporting Program (GHGRP). The key leak sources are discussed further below, and GHGRP data collected for an industry research project are analyzed to demonstrate that the INGAA DI&M Guidelines focus on the appropriate leak sources.

INGAA members operate compressor stations that are required to report GHG emissions under the GHGRP. An ongoing project is being conducted by the Pipeline Research Council International (PRCI) to collect data submitted to EPA through its electronic greenhouse gas reporting tool (e-GGRT). The PRCI project is also collecting supplemental data that provides additional information on associated facility and equipment operations, and on vent measurements. Data from the PRCI project was analyzed to document that the sources included in the INGAA DI&M Guidelines represent the vast majority of equipment leak emissions from natural gas transmission compressor stations. Data and associated analysis is presented in this document.

INGAA GHG GUIDELINES – EQUIPMENT LEAK SOURCES AND RELATIONSHIP TO SUBPART W LEAK SOURCES

Leak sources included in the INGAA DI&M Guidelines are similar to emissions sources that require measurement in Subpart W of the GHGRP. The primary interest is compressor related leak sources, and the INGAA DI&M Guidelines go beyond the requirements of Subpart W by including leak sources and operating modes that are not included in GHGRP reporting. The sources included in the INGAA DI&M Guidelines are shown in Table 1.

[21] "Directed Inspection and Maintenance at Compressor Stations." U.S. EPA Natural Gas STAR, Lessons Learned (see http://epa.gov/gasstar/documents/ll_dimcompstat.pdf), EPA430-B-03-008 (October 2003).

Table 1. Affected Equipment / Component List for DI&M Program.

<table>
<tr><td>• Reciprocating compressor blowdown valve leakage through blowdown vent in any mode as found:
1. Leakage during “Operating” mode
2. Leakage during “Standby Pressurized” mode</td><td rowspan="2">• Reciprocating rod packing leakage[A] in any mode as found:
1. Reciprocating rod packing emissions during “Operating” mode
2. Reciprocating rod packing emissions during “Standby Pressurized” mode</td></tr>
<tr><td>• Reciprocating compressor unit isolation valves (suction and discharge) leakage through the associated vent during “Not Operating, Depressurized” mode</td></tr>
<tr><td rowspan="2">• Centrifugal compressor blowdown valve leakage through the blowdown vent in any mode as found:
1. Leakage during “Operating” mode
2. Leakage during “Standby Pressurized” mode</td><td>• Centrifugal compressor unit isolation valves (suction and discharge) leakage through the associated vent during “Not Operating, Depressurized” mode.</td></tr>
<tr><td>• Centrifugal compressor wet or dry seal leakage through associated vent(s) in any mode as found (see modes listed above for rod packing).</td></tr>
<tr><td colspan="2">• Storage tank vents to atmosphere from scrubber dump valve leakage.</td></tr>
</table>

[A] Reciprocating compressor rod packing is designed to leak, even when new.[22] Repair decisions and timing that considers condition-based maintenance for rod packing will be defined in the DI&M Plan.

The primary focus is on compressor emissions from large valves and other known leak sources, such as reciprocating compressor rod packing and centrifugal compressor wet seal degassing vents. The list of sources includes combinations of the emission source and the compressor mode that are not included in GHGRP reporting, including: reciprocating compressor rod packing leakage in standby-pressurized mode; centrifugal compressor dry seals; and centrifugal compressor sources in standby-pressurized mode. As discussed below, GHGRP data indicates storage tank emissions from scrubber dump valve leakage is not a significant source, but because this is a source of interest included in Subpart W, storage tanks are included in the INGAA DI&M Guidelines.

The equipment leak sources *excluded* from the INGAA Guidelines are components such as connectors, valves, and open ended lines associated with yard piping or compressor house gas lines. As discussed in the next section, evaluation of detailed data from the PRCI project demonstrates that these emissions are generally a small portion of overall leak emissions.

[22] EPA Natural Gas STAR Lessons Learned document, “Reducing Methane Emissions From Compressor Rod Packing Systems.” October 2006. http://www.epa.gov/gasstar/documents/ll_rodpack.pdf

PRCI GHG DATA COMPILATION PROJECT

Compressors stations that exceed the GHGRP annual emissions reporting threshold of 25,000 CO_2 equivalent (CO_2e) metric tons are subject to reporting under Subpart C (combustion emissions) and Subpart W (leaks, venting, blowdowns). Subpart W requires annual leak measurements for compressor-related sources and storage tanks. In addition, a leak survey that counts leaks by component types is required for other facility equipment. Since significant new data is being collected, PRCI is conducting an ongoing project to gather data from its members, and compile and analyze the data. This includes Subpart W data submitted to EPA and supplemental data on equipment, operations, and measurement methods. The project is analyzing the data to assess development of improved emission factors for compressors. The data can also be analyzed to provide technical support for ongoing dialogue related to GHG emission estimates and emission reduction opportunities.

The first year of Subpart W reporting was 2011, and data elements reported to EPA were broadened in January 2015. Since reporting was more limited in the initial three reporting years, the PRCI project supplemented the e-GGRT data with additional information. In addition to e-GGRT data, companies provided supplemental data on facility equipment, operations, and methods used for vent measurement. This supplemental data is needed to better understand the reported emissions and to support analysis such as emission factor development.

The PRCI data was collected from members and the dataset does not include all companies or facilities that report to EPA. However, the majority of facilities are included in the PRCI dataset: 70% of all EPA facilities are included for 2011 and over 60% are included for 2012. As discussed in the following section, the emission trends for each Subpart W source type are similar for the PRCI dataset and the entire EPA dataset.

The PRCI GHG dataset is being analyzed to assess whether updated emission factors can be developed for reciprocating compressors and centrifugal compressors. In addition, the data is available to support technical analysis on GHG issues such as source-specific emissions, emission trends, the distribution (by size) of measured leaks, the prevalence of "large" leaks, and measurement methods performance. At this time, the PRCI dataset includes 2011 and 2012 data. Final review is being completed for 2013 data, which will be added to the PRCI dataset. Data collection and compilation for the 2014 reporting year will occur in late 2015.

DATA ANALYSIS AND DISCUSSION

The figures presented in this document are based on PRCI 2011 and 2012 data, with one exception. Figure 2 includes the entire EPA dataset downloaded from EPA's website. Figure 1 presents PRCI data for 2011 and 2012 by Subpart W emissions source. Figure 2 shows all data from EPA for 2011, 2012, and 2013. Facility counts differ from year to year. Thus, to facilitate comparison, the emissions are presented as a facility average (i.e., total emissions for each source type divided by the total number of facilities for the respective datasets). Storage facility data is more limited (i.e., fewer facilities report and fewer emission sources are included in GHGRP reporting), so the data analysis focused on the transmission segment.

Data has been collected for 2011 – 2013 reporting years; PRCI data in this document is from 2011 and 2012. These data were reported based on a methane global warming potential (GWP)

of 21, and this document does not correct the GWP to its current value (GWP = 25). The EPA website "all facility" data for 2011 – 2013 presented in Figure 2 is also based on a GWP of 21.

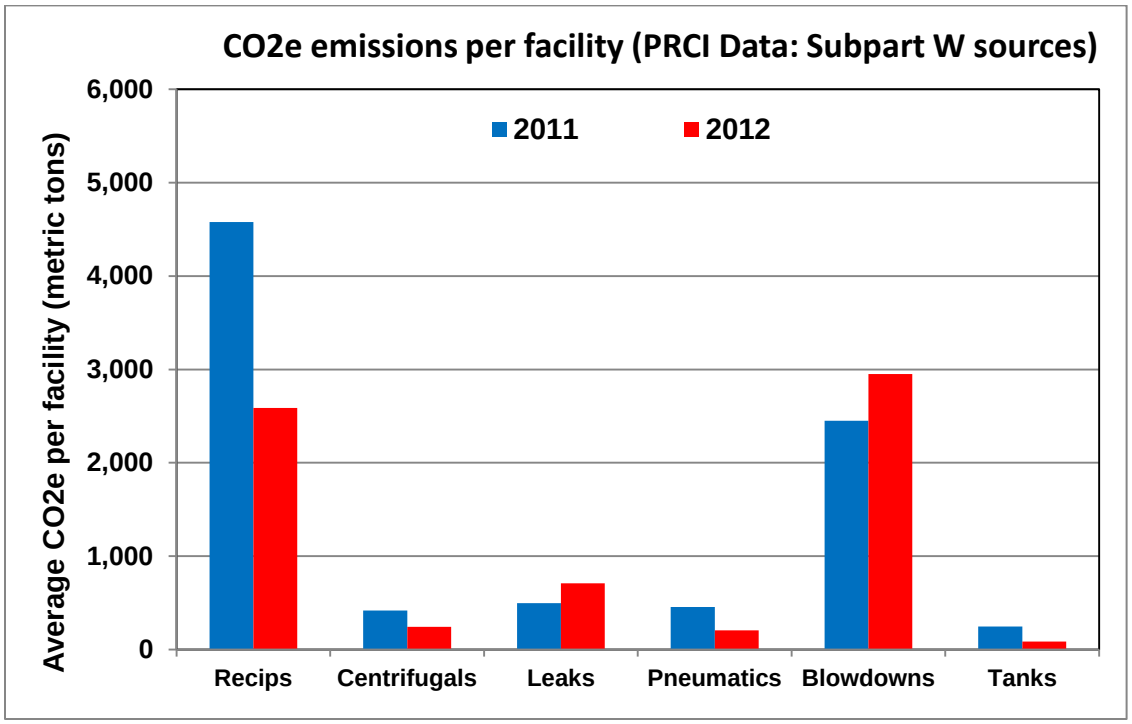


Figure 1. Emissions by Subpart W source type (PRCI data)

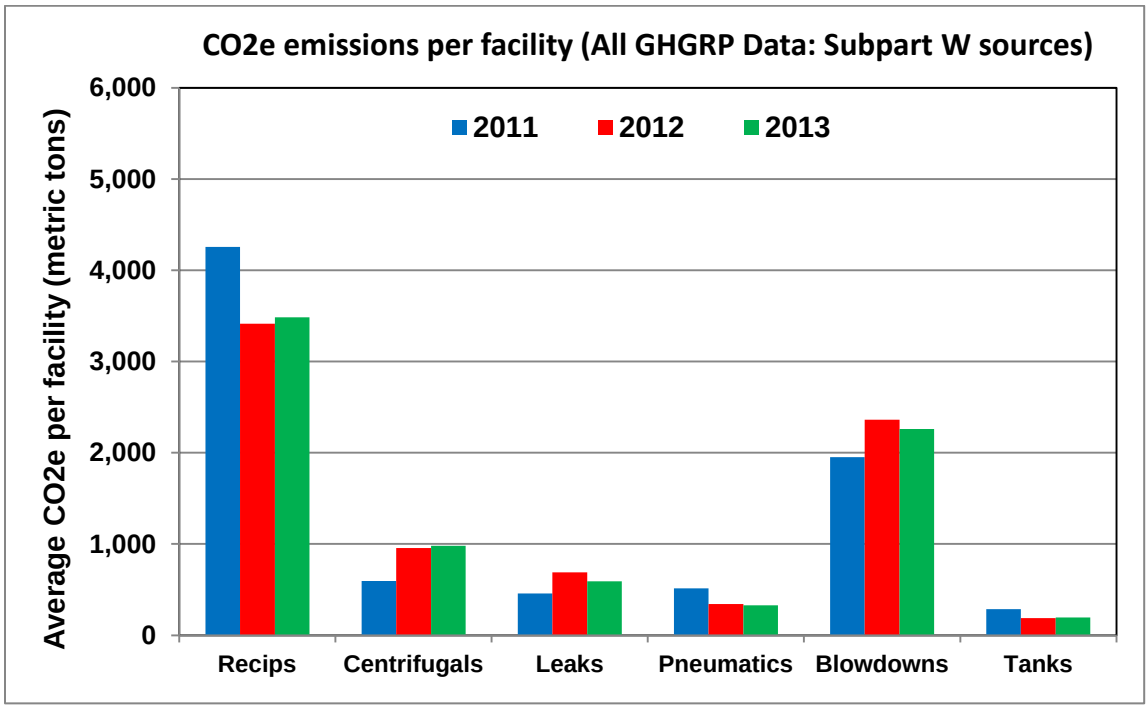


Figure 2. Emissions by Subpart W source type (All EPA data)

The two figures show similar reported emission levels and similar trends. Several observations follow:

- Reciprocating compressor emissions and blowdown emissions are more than 70% of the total emissions.
- Reciprocating compressor emissions decreased in the second year of the program. A larger decrease occurred for facilities included in the PRCI dataset compared to the entire GHGRP dataset. There are several factors that likely contribute to the decrease after the first year: 2011 allowed the use of "best available monitoring methods" (BAMM) when the program was launched; some large leaks were likely repaired following discovery in 2011; and, measurement method used may have changed.
- The 2013 data from EPA shows that emissions were similar in the second and third reporting years and generally differ from reported emissions for the first year.
- Vented emissions from pneumatic devices decreased in the second year of the program. That emission estimate is based on device count by type (high bleed, low bleed, intermittent) and emission factors. It is likely that categorization by device type improved in 2012 – e.g., in the first year of the program conservative estimates based on best available information classified devices as high bleed that were subsequently confirmed as low bleed devices.
- There is a difference between the PRCI data and "all EPA" data for centrifugal compressor emissions. The PRCI project will likely examine this data more closely to determine whether the reason for the difference can be discerned. However, the difference does not impact the discussion and conclusions that follow in the document regarding sources included in the INGAA DI&M Guidelines.

For the six Subpart W sources, four are leak-related sources where the reduction option is a leak mitigation program (e.g., LDAR, DI&M). Blowdowns are a separate category of emissions and emission reduction opportunities are generally based on the feasibility of alternative operating practices for select types of events. Pneumatic device venting is reduced by using low bleed devices or compressed air systems.

The other four source types are the candidate compressor station emission sources for leak mitigation:

- Reciprocating compressor emissions from rod packing, isolation valves, and blowdown valves.
- Centrifugal compressor emissions from isolation valves, blowdown valves, wet seal degassing vents, and dry seals. (The latter is not included in Subpart W reporting.)
- Emissions through storage tank vents from leaking condensate tank dump valves.
- Equipment leaks from equipment and components other than those listed above (i.e., "other" leak emissions).

Blowdowns are a separate category of emissions and a significant contributor to overall facility emissions. Because blowdowns are a different category than leaks and EPA has not included facility blowdown reductions in proposed mitigation programs, and compressor station methane leak mitigation is the focus of a DI&M program, blowdown emissions in Figure 1 are not included in analysis or discussion below. Pneumatic device vented emissions are also a different category than leaks, but EPA proposed programs include reducing pneumatic device emissions, so limited additional discussion on pneumatic emissions is provided below.

Pneumatic device emissions are relatively small for the transmission and storage segments. Pneumatic device emissions are included in Figure 3 to compare emissions for methane emission sources recommended as reduction opportunities in proposed EPA programs: the EPA voluntary Methane Challenge program for existing sources, and the proposed NSPS rule that regulates methane emissions from new facilities (Subpart OOOOa).

Figure 3 shows the same PRCI data as Figure 1, using a different bar chart format and excluding blowdowns. The "other" leak emissions (Subpart W leaks not from compressors or tanks) are presented in two categories consistent with Subpart W methodology, where leaks survey results track whether or not the leaking component is in compressor service (i.e., thermal cycling and vibration from compressors may affect leak size and frequency).

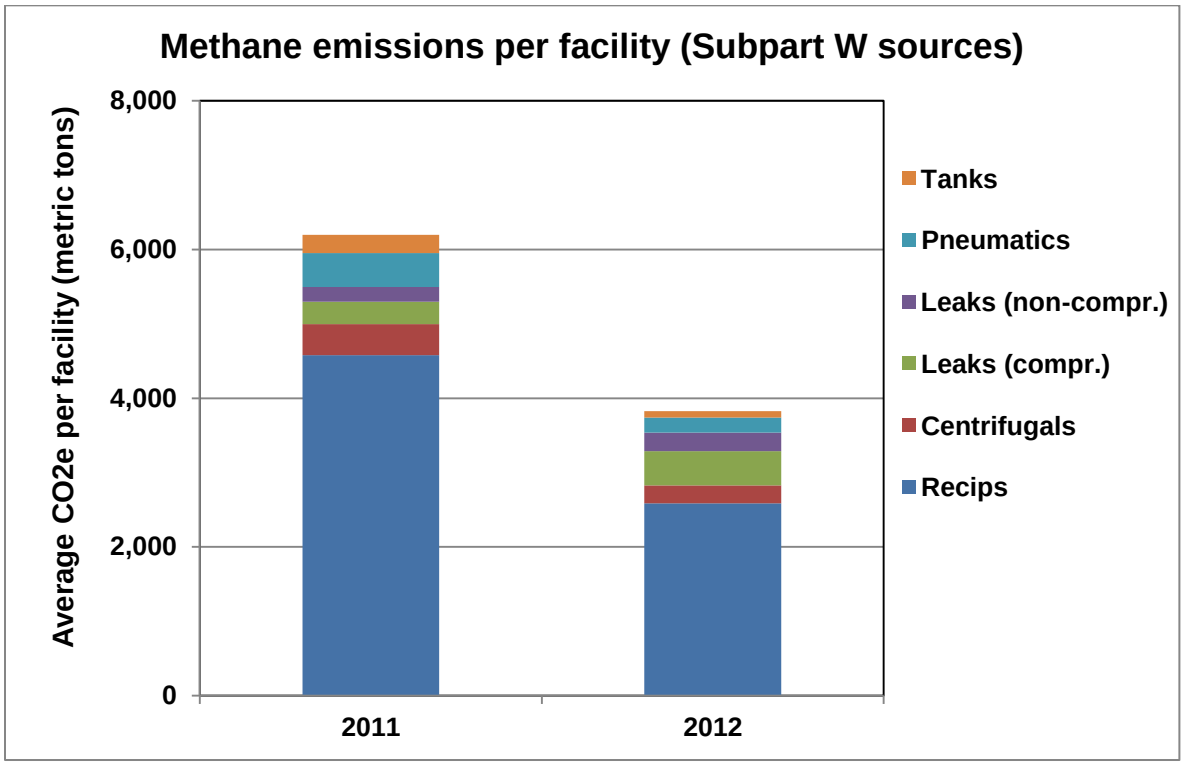


Figure 3. Subpart W emissions by source type for leaks and pneumatic venting.

Pneumatic device venting is 7% of these emissions in 2011 and 5% in 2012. For the remaining leak sources, reciprocating compressors, centrifugal compressors and tanks are included in the INGAA DI&M Guidelines. These sources comprise over 90% of the total leak emissions in 2011 and over 80% of the total in 2012. Addressing compressors and tanks requires surveying a limited number of vents, while the remaining 10 to 20% of leak emissions are associated with hundreds of components spread over the entire facility. Additional detail on leak emissions is provided in figures below.

In addition, the emission estimates from "other" leak sources excluded from the INGAA DI&M guidelines are based on a count of leaks detected in the annual survey and emission factors. The component-specific emission factors in Subpart W are based on 10 to 20 year old data, and it is

likely that emissions have decreased as leak mitigation programs have become more common. Thus, if "other" leak emission estimates based on older data over-estimate emissions, then measured Subpart W leak data from compressors and tanks would comprise a larger percentage of the leak emissions than indicated by the Subpart W data.

The PRCI leak data from the figures is also presented in Figure 4 and Figure 5, which show additional details for the 2011 and 2012 Subpart W data for leak emission sources. Additional details associated with the leak sources that comprise total compressor leak emissions is available based on the emission source-operating mode combinations measured for Subpart W. The five categories include reciprocating compressors, centrifugal compressors, storage tank (dump valve leakage), and "other leaks" for components either in compressor service or non-compressor service. EPA usually groups the "other leaks" into a single category, but the Subpart W emission estimate uses different emission factors for each component type depending on whether or not the component is in compression service. For the categories other than tanks, the total emissions are comprised of emissions from multiple sources and different compressor modes, including:

4. Reciprocating compressors (typically released to atmosphere through elevated vents):
    d) Rod packing emissions when the unit is operating;
    e) Isolation valve emissions when the unit is shutdown and de-pressurized;
    f) Blowdown valve emissions when the unit is operating or in standby-pressurized mode.
5. Centrifugal compressors (typically released to atmosphere through elevated vents):
    a) Wet seal degassing vent emissions when the unit is operating (this is more a vent source than a leak source, but is grouped with centrifugal compressor leak emissions for tracking purposes);
    b) Isolation valve emissions when the unit is shutdown and de-pressurized;;
    c) Blowdown valve emissions when the unit is operating.
6. "Other leaks" in either compressor or non-compressor service, with the total emissions estimate based on emissions from each of five component types:
    f) Connectors;
    g) Valves;
    h) Open ended lines (OELs);
    i) Pressure relief valves (PRVs);
    j) Meters.

The figures show each of the categories (i.e., the primary bullet in this list), as well as the emissions from the specific leak sources associated with each category (i.e., the sub-bullets in this list). The percentage of total leak emissions for each source or category is shown in the figures. For "other leaks," where total emissions for the five component types are a small overall contributor to leak emissions, the percentage shown is for the total rather than for each of the five component types.

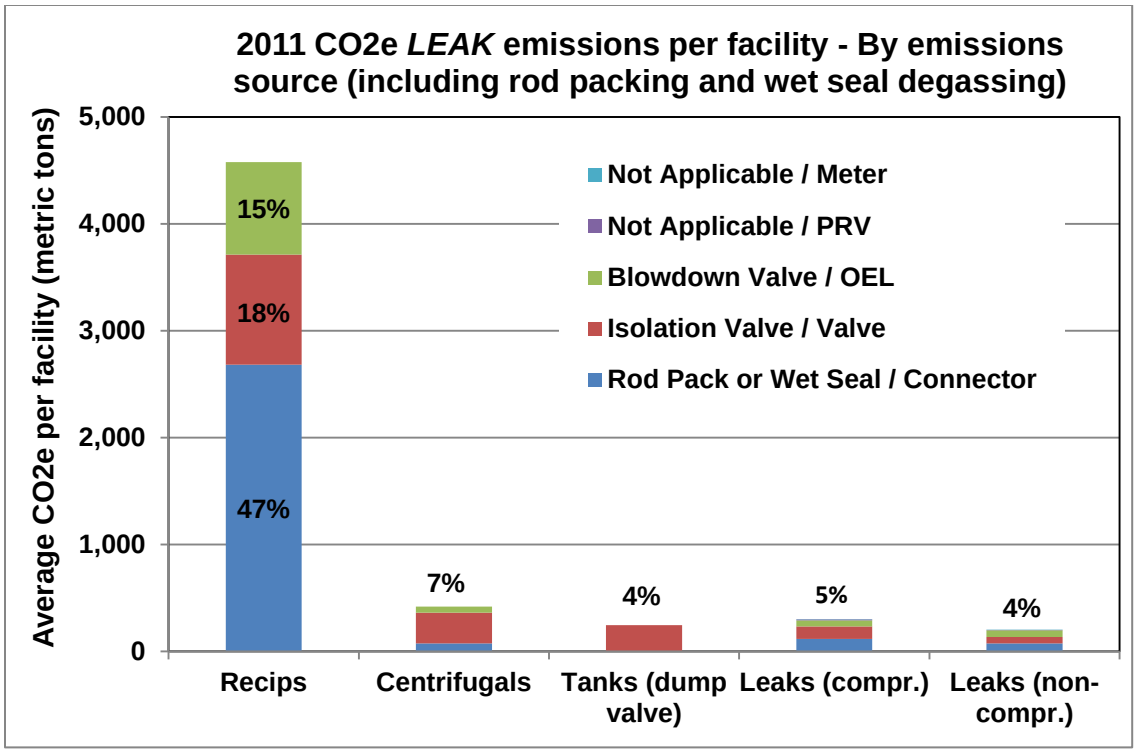


Figure 4. 2011 leak emissions by category and emissions source for Subpart W reported emissions compiled for the PRCI project.

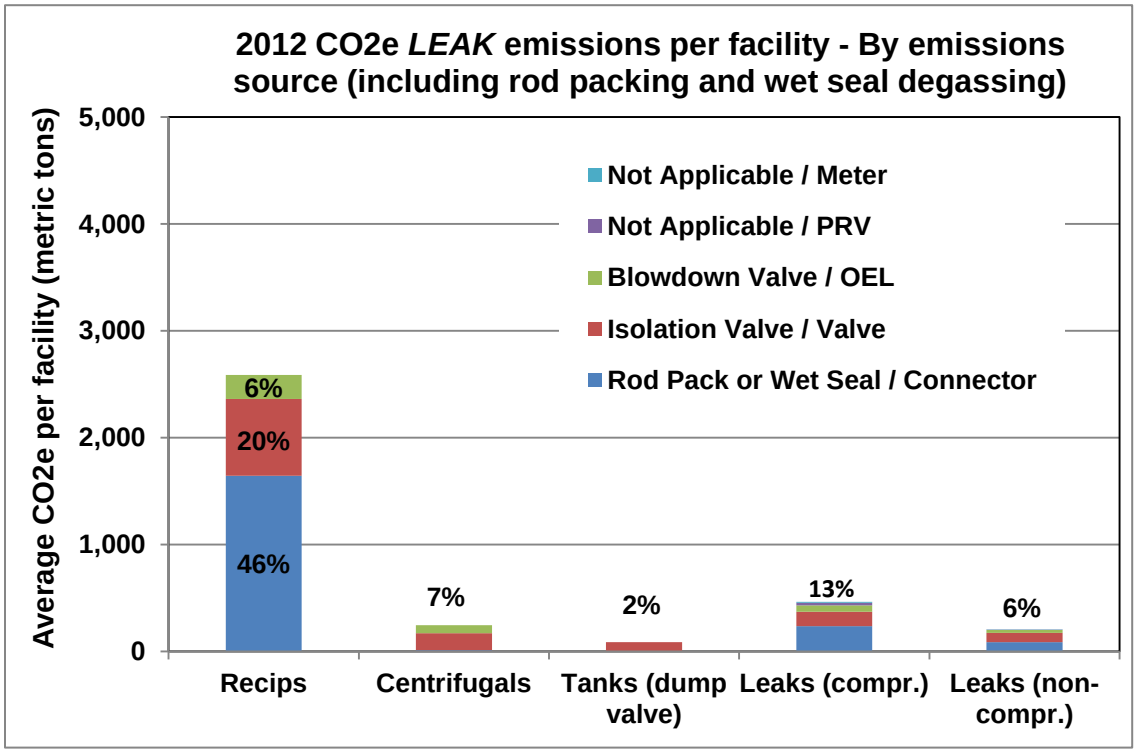


Figure 5. 2012 leak emissions by category and emissions source for Subpart W reported emissions compiled for PRCI project.

The first three leak categories – reciprocating compressors, centrifugal compressors, and storage tank dump valves – are included in the INGAA DI&M Guidelines and the latter two are not directly included in the program. Existing programs, such as walk-throughs that conduct audio-visual-olfactory (AVO) review for safety purposes will address "other leaks" within the facility, but those activities are not detailed in the INGAA DI&M Guidelines.

The number of potential leaks surveyed varies significantly for the first three categories compared to "other leaks." To reiterate, the three categories included in the INGAA DI&M Guidelines are based on sources that are measured for Subpart W and require surveying a minimal number of sources. The other leaks category requires surveying hundreds of additional components.

For example, potential leak sources for a reciprocating compressor (see items 1(a), 1(b) and 1(c) in the list above) will include rod packing leakage, two isolation valves (suction and discharge side of the compressor) and a blowdown valve. Thus, a limited number of vent lines need to be surveyed to identify leakage for the three leak categories in the INGAA DI&M Guidelines. In contrast, the other potential leak sources (see five component types in items 3(a) through 3(e) in the list above) are comprised of *hundreds* of components throughout the compressor station that would require surveying. About 80% or more of leak emissions are covered through the focused program in the INGAA DI&M Guidelines.

These two figures show the relative contribution of leak emissions by category and associated leak source for the first two years of Subpart W reporting. For 2011 (Figure 4):

- The three categories included in the INGAA DI&M Guidelines **comprise 91% of the total** leak emissions.
  - 5,240 metric tons CO_2 equivalent emissions on average for all facilities in the PRCI dataset.
- The two leak categories not included in the INGAA DI&M Guidelines – other equipment leaks in compressor service or non-compressor service – comprise 9% of the total emissions and less than 500 metric tons.

For 2012, total leak emissions are lower, which is likely due to repair of some of the larger leaks discovered in 2011 (e.g., reciprocating compressor leak emissions). From Figure 5:

- The three categories included in the INGAA DI&M Guidelines **comprise 81% of the total** leak emissions.
  - 2,915 metric tons CO_2 equivalent emissions on average for all facilities in the PRCI dataset.
- The two leak categories not included in the INGAA DI&M Guidelines – other equipment leaks in compressor service or non-compressor service – comprise 19% of the total emissions and approximately 665 metric tons.

Additional detail on individual measurements and the contribution of large leaks to the overall total is available for the three leak categories included in the INGAA DI&M Guidelines. Data presented in the figures below show that a DI&M program following the INGAA Guidelines

may ultimately demonstrate that an even more focused program is warranted (e.g., the relative emissions from blowdown valve leakage compared to isolation valve leakage may have implications for requirements such as survey frequency).

Figures 6 and 7 present PRCI measured emissions by source type and compressor mode – e.g., rod packing emissions in operating mode, isolation valve emissions in shutdown de-pressurized mode. Figure 6 presents a cumulative distribution of reciprocating compressor emissions for the four unique source-operating mode combinations in Subpart W. In Figures 4 and 5 above, the blowdown valve emissions for two different compressor modes are combined for the portion of the bar chart that shows "blowdown valve" emissions. The blowdown valve emissions are separated by Subpart W mode in Figure 5. Figure 7 presents the same information for the three source-compressor mode combinations for centrifugal compressors.

For the cumulative distribution plots, all of the measurement data are ranked from largest to smallest and cumulatively added. Only the "non-zero" measurements are included in these figures (i.e., the tail would be longer if additional measurements showing no leakage were included). These data show that leaking blowdown valves and centrifugal compressor degassing vents are smaller contributors to facility emissions than isolation valves and reciprocating compressor rod packing.

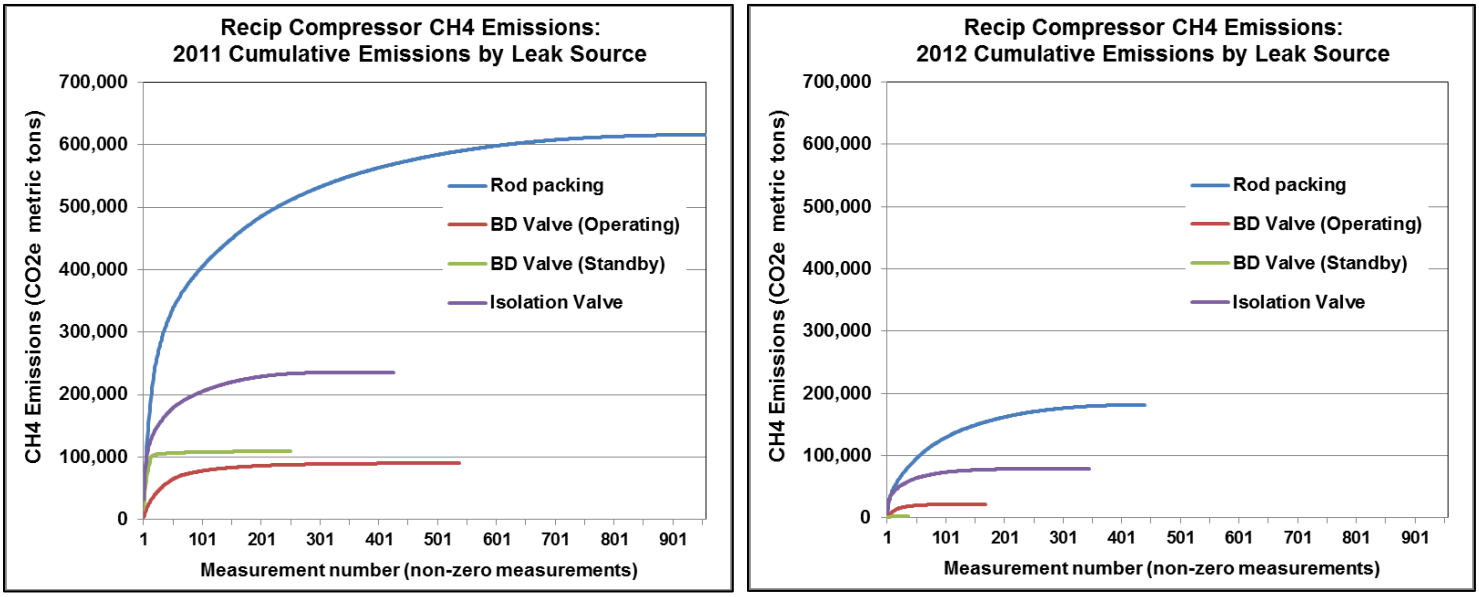


Figure 6. Reciprocating compress emissions by source – mode combination: Rod packing (operating mode), blowdown valve (operating mode or standby-pressurized mode) and isolation valve (shutdown-depressurized mode).

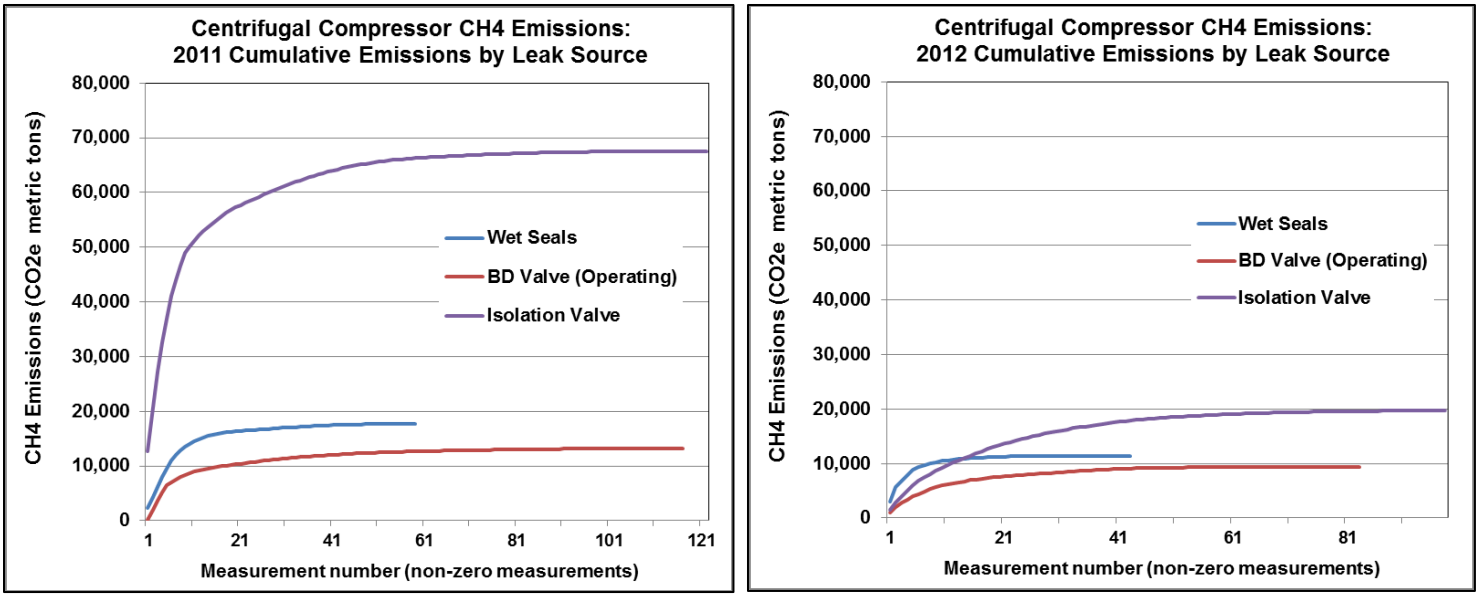


Figure 7. Centrifugal compress emissions by source – mode combination: Wet seal degassing (operating mode), blowdown valve (operating mode) and isolation valve (shutdown-depressurized mode).

For reciprocating compressors, rod packing leakage is a large contributor to total emissions. For both reciprocating and centrifugal compressors, isolation valves are an important source. In a DI&M program, repair decisions consider the leak size and the repair cost (or degree of difficulty). This approach is based on historical data that shows that a relatively small number of leaks comprise the majority of emissions. The same phenomenon is demonstrated in Figures 6 and 7. For example, in 2011 there were about 440 measurements of reciprocating compressor isolation valve emissions. The top 20% (about 90 measurements) comprise over 85% of the emissions from isolation valves. This trend is even more pronounced for the reciprocating compressor blowdown valves measured in standby mode in 2011. Several measurements (about 2% of the total) account for nearly all of the emissions from this source.

These figures, along with the storage tank figure below, show that the INGAA DI&M Guidelines include leak sources that PRCI Subpart W data shows as relatively small contributors. However, the INGAA Guidelines chose to include sources associated with Subpart W measurements, and additional sources not covered by Subpart W (e.g., rod packing in standby-pressurized mode) to provide the opportunity to develop a larger dataset and more clearly demonstrate larger leak sources. While total emissions for other leak sources are a larger percentage than some categories included in the INGAA Guidelines (e.g., Figure 5 shows that 13% of total leak emissions in 2012 are from other leaks for components in compressor service), those total emissions are from many components, while sources with smaller relative emissions included in the INGAA Guidelines (e.g., tanks are 2% in 2012) are associated with discrete sources that have a higher risk of large leaks.

A focus on the "gross emitters" is the most effective approach to reduce methane emissions. The data collected from a DI&M program, in conjunction with other ongoing data being reported for Subpart W (e.g., leak surveys for "other" leaks), will provide insight into program

performance. As the program is implemented, performance will be defined, and the need to consider program adjustments (e.g., to focus on *more or fewer* potential leak sources) will be identified.

Storage Tanks Emissions

Although a relatively small source compared to compressor leaks, EPA has expressed concern regarding leaking dump valves, and Subpart W requires measurement of the associated tank vents. Thus, storage tanks are included in the INGAA DI&M Guidelines. Figure 6 shows PRCI data results from *non-zero* measurements in 2011 (111 non-zero measurements) and 2012 (51 non-zero measurements). *Cumulative* emissions for all tank measurements are shown in the left graph. The graph on the right shows each individual measurement. These data show that total tank emissions are relatively small and decreased from 2011 to 2012. Additional observations include: a relatively small number of facilities / measurement contribute most of the emissions; there were fewer leaks in 2012 than in 2011; and, there were fewer large leaks in 2012 than in 2011.

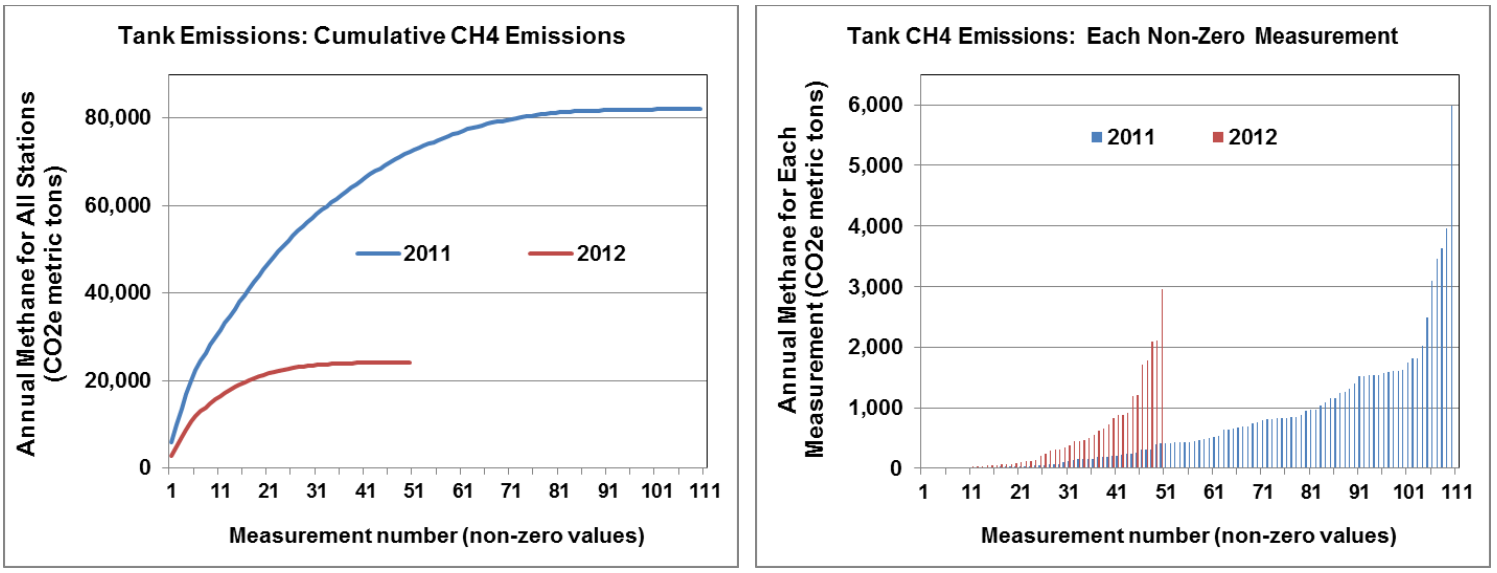


Figure 6. Storage tank emissions from leaking dump valves in 2011 and 2012. Cumulative distribution of all non-zero measurements (left graph) and leak rate for each non-zero measurement (right graph).

CONCLUSIONS

DI&M is a proven approach for reducing methane emissions from leaks at natural gas transmission and storage compressor stations. The INGAA DI&M Guidelines focus on compressor station leak sources that pose a higher risk of being a large leaker, include compressor and storage tank sources that require leak rate measurement under Subpart W, and include additional leak sources excluded from Subpart W (e.g., reciprocating compressor rod packing in standby-pressurized mode, centrifugal compressor dry seals).

Subpart W data and supplemental data from a PRCI project shows that the leak sources included in the INGAA DI&M Guidelines address more than 80% of emissions from compressor station leaks. Thus, a focused DI&M program provides an effective leak mitigation approach. Data

gathered as a DI&M program is implemented also provides the ability to assess performance, ensure that the appropriate sources are included, and consider program adjustments to address insights gained from facility leaks and reduction opportunities.