17-ARPC-06

Assessment of In-Situ Versus Surface Methods of Gas Migration Testing

I. Proposal Summary (Executive Summary)

Answers Sought

Better quantification of the current methane emission rates from pneumatic devices, including the reduction and associated CO2e after retrofit, is key to determining the available opportunity for reducing methane emissions in upstream oil and gas operations. Pneumatic device (pump and instrument) retrofits are one key means of achieving a 45% methane reduction by 2025. Field measurements obtained, without backpressure effects, will help establish the uncertainty associated with other measurement emission rates published to date. These include measurements from devices such as Hi Flow samplers, thermal mass flow meters, and positive displacement meters. That scope could be expanded for comparison of other measurement techniques such as ultrasound if merited and the budget allows.

Method

This measurement skid delivers a pneumatic supply from a given known mass nitrogen bottle through a measurement skid that tracks the pressure decrease and temperatures changes sensed as that gas is used by the downstream pneumatic device. Having mass balance after the measurement provides certainty on the true amount of pneumatic gas used.

For bench testing, this measurement device will supply the gas to a given pneumatic device of interest with and without other measurements devices such as the Hi Flow Sampler, positive displacement meter, thermal mass meter and Coriolis flow meter. In this way, the emissions measured in a repeatable manner can be overlaid and compared to determine relative accuracy and back pressure effects.

Field measurements are achieved by loading the measurement skid onto the back of a pickup truck with the battery box and the nitrogen bottle(s) for use at an upstream oil and gas site such as a well pad. The skid can be carried by two people off the truck and located adjacent to the pneumatic device of interest for measurement. Should the nitrogen bottle pressure become too low to operate the device, the gas supply would then come from the existing onsite fuel gas supply used before the measurement device was spliced in. The existing pneumatic supply of fuel gas remains connected though the measurement, but will be isolated using a check valve when adequate nitrogen gas pressure is available. In this way, the integrity of the control loop is maintained and operation as usual at site is supported with that redundancy in place. Data collected in the panel after a given measurement duration will then be downloaded through a USB stick or direct to a laptop for further analysis, plotting and comparison in performance. This technique can be used for pre and post-retrofit measurements of the pneumatic device to quantify the gas saved with more certainty.

Purpose

Air emissions inventories are becoming an increasingly important method of monitoring and reporting on industry emissions, for the public, governments, and individual companies. Further, governments are using these emissions inventories to negotiate international treaties, establish air emissions policy measures and targets, and develop emission forecasts. As such, it is important that upstream oil and gas operators have access to a wide variety of effective emissions monitoring

technologies to report facility emissions using standardized methodologies and realistic emission factors with low uncertainty. Inaccurate and/or overly conservative emissions factors can result in an inaccurate portrayal of the emissions profile of the oil and gas industry. This in turn can lead to unnecessary or ineffective regulatory requirements.

The development of technically defensible and effective emission management policies and regulations is reliant upon good quality emissions data in order to both identify potential opportunities for emission reductions and to determine industry performance and emissions reductions in future years.
There are opportunities to address this knowledge gap by investigating potential improvements to the certainty of quantification (emission factors and measurement technologies and methodologies), monitoring, data management, and reporting of emissions from the upstream oil and gas sector.

This project will help establish better accuracy and repeatability for measurement of emissions from pneumatic devices (pumps and instruments). Gas vented from such sources forms about half the total gas vented according to the National Inventory Report 1990-2011. Improvements made in this way are one key means of achieving a 45% methane reduction by 2025. The intent is to publish our findings similar to The Prasino Group report, For Determining Bleed Rates for Pneumatic Devices in British Columbia, published on Dec 18, 2013, and to help folks make better-informed decisions.

Benefits to Industry

The certainty needed to establish better emission factors that can be applied for retrofits is provided by measuring pressure reduction with temperature compensation from a known volume, pressure, temperature and quality gas. Better quantifying the current methane emission rates from pneumatic devices, as well as the reduction and associated CO2e after retrofit, has a direct monetary impact on operations. Establishing better +/- on other measurement emission rates published to date will help de-risk the delta associated with such retrofits and will provide a better level of certainty on measurements than have been made to date and presented in published reports.

More certainty on pneumatic emissions will be key to quantifying reductions. Quantifying dynamic and static emissions will provide better insight into the full picture of the how much pneumatic gas is consumed. Quantifying the dynamic contribution will also draw attention to the additional volume that can be saved if a no-bleed control loop is used instead of a low-bleed control loop. Going no-bleed reduces OpEx and will be key for consideration in regulations written around this type of activity. A published report that better quantifies emission rates and the error associated with other measurement techniques will help producers make informed decisions and have better certainty on the ROI associated with pneumatic device retrofits or replacements. Retrofitting and replacing the pneumatic devices would result in over 4 megatonnes of CO2e reduction in Alberta annually.

Identified policy issues and knowledge gaps addressed

Industries involved in the production, processing, and storage of oil and gas resources in Canada are gaining insight how to reduce their methane emissions. Regulatory actions are also being deliberated at provincial, national, and international levels. Methane emissions abatement options are highly source and process specific in nature, making it difficult to offer generic solutions for the affected industry. In order to address methane emissions more urgently, the oil and gas sector requires better and more innovative solutions as it continues to explore options and take action to reduce methane emissions in a technically achievable and economically sustainable manner.

Few current measurement techniques focus on measuring the amount of gas vented from, not supplied to, a pneumatic device. This proposed measurement technique measures the amount of

upstream gas supplied to the pneumatic device. Measuring the upstream pneumatic supply will not cause device performance nor emission affecting backpressure effects, which are a source of error in the published data sets.

Current regulations are focused on emissions specific to a low bleed steady state threshold of six standard cubic feet per hour (scfh). The total consumption of a given control loop can be optimized including more than just steady state consumption. There are few details on just how to do the latter because the consumption in a pneumatic control loop attributed to the final control element, is difficult to segment from the instrument. Furthermore, the pneumatic device's contribution to the total emission in the dynamic state is not well understood. Trending the consumption will provide opportunity to assess how much is attributable to each from the total consumption of gas operating that pneumatic control loop or pump. Giving consideration for the dynamics in a control loop will provide reference for determining the error associated with a given emission factor. Policy can include that broader scope of focus if the associated consumption is better understood for the control loop and the means of doing so is reasonable and achievable.

Stakeholder benefiting the most

Producers will benefit the most per the benefits to industry above. Regulators will also see value through better quantification of outcome focused GHG reductions achieved in this way. It is much easier to be proud of reductions achieved if there is more certainty on just how much that is.

Research Team

It is our intent to work closely with GreenPath Energy for field measurements. We see that it will be valuable to collaborate with them to carry out this study and effectively apply our knowledge with their field experience doing previous field measurements. I will also be, and have been, supported by a group of Spartans that include Cam Dowler, project managers, instrument technicians and technical specialists.

In Appendix B, additional detail is provided for Mike and Josh with supporting detail for Jamie Callendar as peer reviewer. My CV is also included there.

The field results will be communicated at a methane focused event at PTAC. I would certainly appreciate the opportunity to be part of the Air Forum in 2017 to present the learnings. I would be happy to engage at other venues covering this topic as merited.

Peer reviewers of the final report are Greg Brown from Spartan, Mike D'Antoni and Jamie Callendar.

II. Project Timeline/Budget Timeline

All timelines proposed in the Gantt chart included in Appendix A will be reviewed and adjusted prior to commencing formally to ensure the objectives are reasonable and achievable per contract.

Three key milestones are identified with January 15, 2017 a start date for using the measurement skid, July 21, 2017 the completion date for the draft report of findings and August 20, 2017 the date the Final Report is published.

III. Budget

2017 AUPRF Fuding Request: $35,000 (See additional Detail in Appendix C)
Funding Source: PTAC TEREE Requested/Secured/In-Kind: $5,000