

EXECUTIVE SUMMARY

In 2020, regulatory changes were made to the methods of measuring and reporting associated and vent gas from cold heavy oil production with sand (CHOPS). The objective of this project is to provide recommendations on practical and cost-effective associated and vent gas measurement methods to address two key issues related to methane emissions:

- Measurement accuracy
- A perceived gap between reported venting and regional emissions measurement.

A review of past reports on CHOPS methane measurement and reporting indicates that there are three main gaps which possibly result in discrepancy between actual and reported emissions:

- Gap 1: Inaccurate measurement of casing gas venting with GOR (gas to oil ratio) methodology.
- Gap 2: Inaccurate measurement of tank venting.
- Gap 3: Absence of measurement of other methane emission sources.

This project involves two phases of field-testing, designed to evaluate the first two gaps. The key finding of the Phase 1 field-testing is that *the accuracy of measurement of casing gas venting (methane emissions) improves with direct measurement*. Phase 2 testing indicates that *methane detection and screening may be a vital component of methane measurement accuracy*. Phase 2 testing also shows that venting (methane emissions) from CHOPS tanks can be directly measured by a number of flow meters. Direct measurement can be used to develop company/site tank emission factors or to complete periodic testing. Gap 3 was not addressed in this project. To ensure that improvements to casing gas and tank venting measurements will improve overall site emission accuracy, Gap 3 emissions would also need to be investigated.

CHOPS site designs are changing as the sector transitions to new methane targets. Producers may improve methane measurement further by using multiple measurement methodologies and technologies and reconciling the results.

This project is funded by the Saskatchewan Ministry of Energy and Resources and PTAC. The project includes six tasks, as indicated:

1. Scan studies and regulations on CHOPS gas measurement and reporting (Section 2).
2. Establish a technical advisory committee.
3. Assess CHOPS gas measurement methodologies and technologies (Section 3).
4. Field-test gas measurement methodologies and technologies (Section 4).
5. Analyze and report findings (Section 5).
6. Make recommendations for CHOPS gas measurement and reporting (Section 6).

Recommendations:

Future investigations:

1. Study all CHOPS sector methane emissions; collect data with both equipment-level and aerial methodologies and technologies. If the casing and tank vents are the main sources of methane emissions in the CHOPS sector, it will make sense to improve measurement of these sources. This study will also show whether foamy oil flow leads to high tank venting at new sites. Alternatively, use data from existing producer direct measurement surveys of all methane emissions sources.
2. Evaluate accuracy improvements to vent and methane measurement from reconciling surveys with multiple methodologies and technologies including aerial surveys.
3. Evaluate periodic and continuous methane detection and screening technologies for managing methane at CHOPS sites.
4. Evaluate the option of flow meters with IoT (internet of things) technology moved from site to site to collect several hourly rate tests of vented casing gas per year, per site. This option may reduce safety risks and costs associated with frequent measurement.

The accuracy of gas and methane measurement in the CHOPS sector improves with the following:

1. Measure all CHOPS site methane emission sources. Use more accurate measurement means for sources or sites contributing more to the overall methane inventory.
2. At CHOPS sites, use direct measurement of casing venting with continuous meters or **24-hour** hourly rate testing rather than GOR testing methodology or GOR estimates. At sites where it is difficult to test hourly rate of the vented casing gas, complete hourly rate testing of the other casing streams.
3. Measure CHOPS tank venting from low emission tanks with *published, field* or *company-specific* emission factors developed from direct measurement data (diaphragm, positive displacement, or turbine meters with gas analysis) rather than the Vasquez-Beggs correlation or GIS analysis. If overall methane inventories indicate that low-emitting tanks are a very small percentage of CHOPS sector methane, then published emission factors would suffice until larger methane sources are mitigated.
4. For CHOPS tanks with moderate to high venting, use *site-specific* emission factors or periodic, direct measurement to measure tank methane emissions. Periodic testing is appropriate for sites where casing gas routinely vents via the tank.

5. Install continuous detection (inexpensive flow meters) on tank or casing vents where infrequent, high emissions are a possibility (foamy oil or gas conservation equipment failures).
6. Consider CHOPS tanks designed for easy access for direct measurement of tank venting.
7. Increase measurement accuracy of all methane emission sources (including casing gas venting) by using multiple measurement methodologies and technologies (including aerial surveys) and reconciling the results.
8. Further increase methane measurement accuracy by increasing the frequency of measurement surveys. Comparisons of emission inventories from low to high frequencies will provide indication of the relative benefit of increasing frequency.