CANADA EMISSIONS REDUCTION INNOVATION NETWORK (CERIN) PUBLIC REPORT

1. PROJECT INFORMATION:

Project Title:	Methods for Estimating Emissions from Tanks
Emissions Reduction Scope/Description:	Deploy relevant measurement and monitoring techniques for methane vents from uncontrolled hydrocarbons storage tanks, to understand the magnitude of tank emissions, and recommend alternative methods, techniques, and technologies to estimate tank emissions
Applicant (Organization):	Modern West Advisory Inc
Project Completion Date:	March 31st 2023

2. EXECUTIVE SUMMARY:

The magnitude of tank vent rates, the temporal nature of tank vents, the root cause of tank venting, the difference between actual vent rates and reported vent rates, and the viability of emerging technologies to detect and quantify tank vent rates, are not widely understood or known. This study answered many of these questions.

There are approximately 12,000 production tanks in operation in Alberta. 88% are at oil batteries.

Oil Single-well batteries *without* separators were found to vent persistently at 50 m3/day to 500 m3/day.

Batteries with separators, oil or gas, single or multi well, will typically vent intermittently, averaging less than 50 m3/day. These site may vent persistently at higher rates, indicative of mechanical issues at the separator, design issues with the separator, or upstream well issues.

Aerial surveillance is an effective method to identify persistent and intermittent tank vents. Follow-ups with temporary meters (Calscan's Hawk 9000), OGI quantification (Vertex's tank vent methodology), and/or Kuva's continuous OGI camera will confirm the magnitude and temporal nature of the tank vents.

3. KEY WORDS

Methane

Oil and Gas

Tanks

Detection

Quantification

4. APPLICANT INFORMATION:

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5. LEAD CONTRIBUTING PARTNER INFORMATION:

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6. PROJECT PARTNERS

Calscan Solutions Inc

Vertex Resource Group

Kuva

Natural Resources Canada | Ressources Naturelles Canada

Canada

ALBERTA INNOVATES

PTAC PETROLEUM TECHNOLOGY ALLIANCE CANADA

A. INTRODUCTION

The magnitude of tank vent rates, the temporal nature of tank vents, the root cause of tank venting, the difference between actual vent rates and reported vent rates, and the viability of emerging technologies to detect and quantify tank vent rates, are not widely understood or known.

Jointly funded by CanERIC, CRIN, and PTAC AUPRF, **Methods for Estimating Emissions from Tanks** answered many of these questions.

Key Objectives included:

1. Deploy relevant measurement and monitoring techniques for methane vents from uncontrolled fixed-roof liquid storage tanks in Alberta.
2. Understand the magnitude of tank emissions and the reasons for variability in emission rates.
3. Recommend alternate methods, techniques, and technologies to estimate tank emissions.

B. METHODOLOGY

Four (4) detection and quantification technologies were deployed:

- Calscan's Hawk 9000 Data Logger and gas turbine meter. Portable, battery operated, intrinsically safe, ideal for temporary direct measurement of tank vents.
- Vertex's use of FLIR's QFx320 Optical Gas Imagining (OGI) camera to identify emission sources, and a FLIR-Providence Photonics QL320 QOGI system to quantify emissions.
- Bridger Photonics' Gas Mapping LiDAR (GML), an aerial screening technology deployed commercially in Canada since 2020, which can survey 100 sites or more in a day, detecting and locating methane releases within 2 metres of source.
- Kuva Canada's newly commercial GCI362 continuous OGI camera with a passive shortwave infrared sensor. Self contained, cloud connected, and autonomous, the camera is installed on relocatable 30 ft towers.

Field work began in September 2021. Three (3) separate and distinct field campaigns were launched across central Alberta, focusing on oil storage tanks at conventional oil and gas batteries in Alberta, noting that gas plants, oil sands facilities, and heavy oil facilities are out of scope. Learnings from each campaign informed both the schedule and the scope of subsequent campaigns.

The following is a brief description of each campaign:

Campaign 1: Fall 2021, Sundre area, 500 sites screened with Bridger, 8 sites direct measurements with Calscan/Vertex, and 10 sites with Kuva's continuous OGI Camera.

Campaign 2: Spring 2022, central Alberta, 12 Oil Single-well Batteries without Separators, all direct measurement with Calscan/Vertex

Campaign 3: Fall 2022, west of Sylvan Lake, 209 sites screened by Bridger, 3 sites with direct measurement, and 1 Kuva deployment.

C. PROJECT RESULTS AND KEY LEARNINGS

The estimated inventory of production tanks at conventional oil and gas batteries in Alberta is approximately 12,000.

Temporal characteristics of tank vents can be described as:

- Persistent, constant,
- Persistent, fluctuating,
- Persistent, fluctuating, and cyclic,
- Intermittent.

Oil Single-well Batteries without Separators will vent persistently at 50 to 500 m3/day.

Batteries with Separators, either Oil or Gas, Single or Multiwell, will vent intermittently with an average vent rate typically between 5 m3/day and 50 m3/day.

Batteries with Separators, either Oil or Gas, Single or Multiwell, can indeed vent persistently at rates up to or exceeding 500 m3/day, but this is indicative of mechanical issues at the separator, design issues with the separator, or upstream well issues.

Area-based Aerial Detection and Quantification Surveys are a valuable and effective way of establishing a methane inventory of persistent and intermittent releases by facility type and process block, including tanks.

Area-based Aerial Detection and Quantification Surveys can also support valuable research studies while establishing a methane inventory for the area. Include local wind measurements to determine impact on quantification accuracy. Integrate with other detection technologies. Semi-annual or annual surveys will identify any trends in methane emissions.

Calscan's Hawk 9000 Data Logger and Turbine Meter has proven to be a reliable and accurate vent gas meter. It is battery operated and intrinsically safe, making it ideal for studies of this kind.

Vertex Ltd developed confidence in quantifying persistent and intermittent tank vents using FLIR's GFx320 OGI camera and FLIR/Providence QL320 quantification tablet. Quantification improves with visible line of site to the vent, and extended survey times.

Kuva's Continuous OGI Camera's unique benefits include continuous non-contact emission detection and quantification from multiple sources. Limitations include daylight operation only. Winter operation may be limited due to low or insufficient solar illumination.

Bridger's Gas Mapping LiDAR (GML) is an effective aerial technology for quickly screening for intermittent and persistent releases from tanks.

D. PROJECT AND TECHNOLOGY KEY PERFORMANCE INDICATORS

Organization:	Current Study	Commercial Deployment Projection
Project cash and in-kind cost ($)	$445,000	
Technology Readiness Level (Start / End):	n/a	
GHG Emissions Reduction (kt CH4/yr):	n/a	
Estimated GHG abatement cost ($/kt CH4)	n/a	
Jobs created or maintained:		

E. RECOMMENDATIONS AND NEXT STEPS

Oil Single-well Batteries without Separators should be investigated further to confirm persistent tank vents and to identify vent reduction opportunities.

Recommend additional Area-based Aerial Detection and Quantification surveys across Alberta to establish methane inventories of persistent and intermittent release by facility type and equipment, including tanks. Incorporate local wind measurement to improve quantification. Integrate with other detection technologies. Repeat area surveys annually to identify emission trends.

Recommend further field work to refine and document Vertex's methodology using FLIR's OGI/QOGI for tank vents.

Recommend PTAC AUPRF host a workshop with subject matter experts to identify root causes of persistent tank venting due to mechanical issues at the separator, design issues with the separator, or upstream well issues, and to identify monitoring, mitigation, and reporting best practices.