

Project Summary, Milestones, Payment Schedule, and Quarterly Update Reports

Report Date: Q4 2023/24

(Due on the 21st of the month following the end of the Quarter. Completion of each Quarter is required for invoice processing)

Project Summary

Project Title:	Gas Migration Measurements for Inventory Accuracy and Well Abandonment
Lead Investigator:	Dave Risk
PTAC Committee Sponsor:	Technical Champions Leah Davies, Imperial Oil; Raj Varughese, AER
AUPRF Funds Awarded:	\$109,138
Other Funds Received and Sources:	\$0
Start Date:	September 1, 2022
Completion Date:	May 24, 2024

Provide a brief description of the challenges this project aims to address and how industry and others will benefit including what the anticipated impact is. (i.e., cost savings, improved environmental performance, regulatory outcomes, enhanced access to resources). (Maximum 150 words)

1. *Scope*
 - a) Develop and test rugged automatic flux chamber and data analysis tool.
 - b) Use the tool to examine feasibility of emissions-based GM Cut and Cap threshold
 - c) Decrease GM uncertainty in the national methane inventory
2. *Reference to knowledge gap analysis*
We are improving methods to quantify Gas Migration (GM) methane emission rate. Rate measurement of GM is important for two reasons: 1) Better field quantification

approaches are needed if AER's zero-tolerance rule on GM at well abandonment is to be revised, 2) The GM methane inventory for Canada is estimated from a small study done 30 years ago and may be inconsistent with today's leak rates. Current GM under-quantification creates reputational risk for producers, and hidden liability.

3. *Benefits to industry – costs savings, quantified reduction in environmental impacts and/or smart policies/regulations.*

- a) Cost savings – GM remediation is expensive, and for each well deemed better suited to Cut and Cap without leak remediation, industry will save over \$100,000.
- b) Quantification improvements – Significantly improve understanding of environmental liabilities by building better inventories and maps of GM incidence and severity.
- c) Greenhouse emission reductions – small benefit from avoiding needless emissions from well re-entry and interventions when GM leakage rates are very low.
- d) Training – 2 highly qualified graduate students, who will each intern with an industry service company.

Total Project: List of milestones/quarterly payments schedule.

Milestone		Quarterly	Quarter	Claim #
		Claimed	* actual invoice	
1	Automatic flux chamber tested for use (Methodology/Topic 1)	24,009	*Q3	1
		20,324	*Q4	2
3	Report and finalized specifications and uncertainties for flux chamber	12,906	*Q1	3
2	Field Cut and Cap Campaign 1 at ~25 sites and Inventory Campaign 1 at 50 sites (Methodologies/Topics 2 and 3)	13,311	*Q2	4
4	Field Cut and Cap Campaign 2 at ~50 sites (Methodology/Topic 2)			
	Proper amount for Claim 2			
	Over payment from Claim 2			
5	Inventory Campaign 2 at >100 sites (Methodology/Topic 3)	19,584	*Q3	5
6	Report on Cut and Cap emissions threshold feasibility	19,667	*Q4	6
7	Report on GM Inventory and emission factors			
8	Final project report		May-24	
	Total Project Spending	109,802		
	Total Project Award	109,139		

Current Quarter Report: Q3 2023/24

Exception Highlight for this Quarter:

1. There are no exceptions in this quarter.
<i>(any exceptions to the original project scope, timelines, payment schedule OR early significant findings) – this can be left blank if no changes are needed, and do not include exceptions already reported</i>

Update on scope, key questions, gap analysis and work performed this quarter (include any requests for assistance to PTAC or the committees)

During this quarter, our project has focused on (1) analyzing oil and gas well soil methane emissions data for wells in Alberta, (2) obtain and analyze data on the carbon footprint of well plugging, (3) write summary reports.

1. Report on the feasibility of a cut and cap emissions threshold.
2. Report providing new estimates of oil and gas well soil methane emissions to inform Canada's greenhouse gas inventory.
3. Final project report that will be written in a manuscript format and submitted to a scientific journal.

Key Questions:

Our research continues to address the following key questions:

1. Emission magnitude: What are the methane emission rates associated with gas migration from oil and gas wells?
2. How do emission rates compare with the carbon cost of leakage repair?
3. How do emissions vary by well attributes and how should Canada's greenhouse gas inventory account for methane emissions from soil surrounding oil and gas wells.

Gap Analysis:

In the current quarter, we have made substantial progress in addressing our research questions.

1. Lack of Comprehensive Soil Methane Emission Data by Well Status: Prior research may have not differentiated methane emissions based on the operational status of wells (active, inactive).
2. Variability in Soil Methane Emissions: There is limited understanding of how soil methane emissions vary by well parameters, such as produced fluid type and the presence of hydrogen sulfide.
3. Development of Emission Factors: There's a need for specific emission factors for soil methane emissions from oil and gas wells to improve the accuracy of greenhouse gas inventories.
4. Integration of Surface Casing Vent Flow Measurements: The inclusion of surface casing vent flow measurements in our analysis helps address the gap in understanding the contribution of these emissions to overall methane release.
5. Determination of Methane Emission Origins: There is a gap in the ability to infer the origin of methane emissions near oil and gas wells, whether from gas migration or other sources.
6. Carbon Footprint of Well Plugging: Information on the carbon footprint associated with well plugging activities is scarce. Our project's goal to obtain and analyze data on this aspect addresses this gap.

Work Performed:

We analyzed 1241 measurements of methane emissions collected from soils surrounding 60 oil and gas wells in Alberta and British Columbia. We studied the variability of soil methane emissions by well status, produced fluid and presence of hydrogen sulfide to understand well parameters affecting soil methane emissions. We used these results to develop emission factors to inform Canada's greenhouse gas inventory on oil and gas well soil methane emissions. Additionally, we included surface casing vent measurements from 41 of the wells where we measured soil emissions and conducted 1088 measurements of soil ethane emissions. We used the surface casing vent flow and soil ethane emissions data in conjunction with soil methane emissions to infer if the origin of the emitted methane is gas migration. Additionally, we are in the

process of obtaining data on the carbon footprint of well plugging and will analyze this data in conjunction to our measurements. In terms of summary reports, we are writing a comprehensive report that encompasses all the conducted analysis and the project findings.

Schedule B

Project Schedule, Milestones, Deliverables, and Budget

B1 Project Schedule/Milestones/Deliverables/Budget Table

Revised & reduced budget based on exclusive PTRC project funding

Source	Gas Migration Budget	Year 1	Year 2	
		June '22 - Mar '23	April '23 - May '25	
AUPRF	1 MSc students, 19500 per yr @ 100%	19,500	19,500	
	Field Campaigns and Travel	19,858	19,858	
	Hardware to build two prototype flux chambers	20,500	0	
	AUPRF (before Administrative Overhead)	59,858	39,358	
	OH @ 10% (PTAC limit)	5,986	3,936	
			AUPRF FUNDING	109,138

18,500	Year 1	Sep-22 Sign Agreement with PTAC
		Oct-22 Automatic flux chamber tested for use (Methodology/Topic 1)
15,000		Oct-22 Field Cut and Cap Campaign 1 at ~25 sites and Inventory Campaign 1 at 50 sites (Methodologies/Topics 2 and 3)
20,311	Year 2	Apr-23 Report and finalized specifications and uncertainties for flux chamber
15,000		May-23 Field Cut and Cap Campaign 2 at ~50 sites (Methodology/Topic 2)
18,500		Sep-23 Inventory Campaign 2 at >100 sites (Methodology/Topic 3)
8,375		Jan-24 Report on Cut and Cap emissions threshold feasibility
13,453		Mar-24 Report on GM Inventory and emission factors
		May-24 Final project report
109,138	TOTAL	

C2.1 Quarterly Reports

As per the attached form

C2.2 Project Quarterly Reports Submission Deadlines

Project Quarterly Reports	Submission Deadlines (on or before)
Quarter 1 (April 1 – June 30)	July 21, 2022
Quarter 2 (July 1 – September 30)	October 21, 2022
Quarter 3 (October 1 – December 31)	January 21, 2023
Quarter 4 (January 1 – March 31)	April 21, 2023
Quarter 1 (April 1 – June 30)	July 21, 2023
Quarter 2 (July 1 – September 30)	October 21, 2023
Quarter 3 (October 1 – December 31)	January 21, 2024
Quarter 4 (January 1 – March 31)	April 21, 2024
Final Report Due:	May 24, 2024

Budget Summary Update: Comparing original budget to actuals

			Claim 1	Claim 2			Claim 3	Claim 4	Claim 5	Claim 6		
	Total Project Original Budget (all years)	Budget	Q3	Q4	Actual YTD Expenditures 2022-23 year	Budget	Q5	Q6	Q7	Q8	Actual YTD Expenditures 2023-24 year	YTD Variance
		FY 2022-23	Expenditures this fiscal year	Expenditures this fiscal year		FY 2023-24	Expenditures this fiscal year	Expenditures this fiscal year	Expenditures this fiscal year	Expenditures this fiscal year		%
AUPRF Funds Received	\$109,138	\$33,500				\$83,845						
Other Funds Received (and Sources)	\$0	\$0				\$0						
Total Revenue	\$109,138	\$33,500				\$83,845						
Project Expenses			\$24,009	\$20,324	\$44,333		\$12,906	\$13,311	\$19,584	\$19,667	\$65,469	
Total Expenditures	\$109,138											
Excess (or- Deficiency) of Revenue over Expenditures					(\$10,833)						100.6%	

Of the project funding has been spent

Variance analysis (includes changes to invoicing schedule)