Pine Cliff Energy Ltd.

Pilot alt-FEMP Program
(formerly executed by Certus Oil and Gas Inc.)
2024 Performance Report

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Submitted by:

Justin Kraft
HSE Manager, Pine Cliff

Connor Deering
Emissions Analyst, Arolytics

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Executive Summary

Pine Cliff Energy Ltd. (Pine Cliff) is a conventional upstream oil and gas producer with operations in Alberta and Saskatchewan. In December 2023 Pine Cliff completed the corporate acquisition of Certus Oil & Gas Inc. (Certus). After which, Pine Cliff and Certus were amalgamated effective January 1, 2024. The acquisition resulted in acquiring a portion of the facilities within the Certus alternative fugitive emissions management program (alt-FEMP) pilot. The acquired Certus pilot alt-FEMP was approved by the Alberta Energy Regulator (AER) in 2023 and covered two full compliance years from May 2023 to December 2024 and Pine Cliff continued the program for the facilities that they acquired.

For methane detection in 2023, this alt-FEMP utilized Montrose Environmental Group (Montrose) optical gas imaging cameras (OGI) along with two different site-level emission-screening technologies: Bridger Photonics, Inc.'s (Bridger) aerial-based technology and Montrose's truck-based continuous emission monitoring sensor. In 2024, the alt-FEMP was amended to have Vertex Resource Group Ltd. (Vertex) use a truck-based screening technology and carry out the follow-up OGI surveys. See Section 9 for more information on the amendments made to the alt-FEMP in 2024.

With the Pilot alt-FEMP Program screenings and surveys completed, Pine Cliff will continue to use the data collected to track progress towards methane reduction targets and inform areas of improvement. This report satisfies requirements for the AER and AMEP performance reporting. Also, this report summarizes data collected during the alt-FEMP screenings, follow-up OGI surveys and Control Region OGI surveys. The schedule of the program was as followed:

Quarter-Year	Site Level Screening	OGI Surveys	Status
Q2 2023	Aerial-based, site-level screening by Bridger of alt-FEMP facilities.	Followed by Montrose OGI at the top 20% of all screened LSDs ranked by total emission rate for fugitive emission localization and repair.	Completed
Q3 2023	Truck-based, site-level screening by Montrose of alt-FEMP facilities	Followed by Montrose OGI at any sites with detections for fugitive emission localization and repair.	Completed
Q3 2024	Truck-based, site-level screening by Vertex of alt-FEMP facilities	Followed by Vertex OGI follow-up surveys at the top 20% of all screened LSDs ranked by total emission rate for fugitive emission localization and repair.	Completed
Q4 2024	Truck-based, site-level screening by Vertex of alt-FEMP facilities	Followed by Vertex OGI follow-up surveys at the top 20% of all screened LSDs ranked by total emission rate for fugitive emission localization and repair.	Completed

1. Screening Data

Table 1 summarizes various statistics regarding the screening campaigns across the alt-FEMP. Please note emissions detected during the screenings can be a combination of fugitive, vented and sporadic operations-related emissions. The detailed screening data is provided in an Excel attachment with this report, and the tables summarizing each site's total and individual emissions detected during each screening are provided in Appendix B and C, respectively.

Table 1. Combined summary of screening data for 2023 and 2024.

Parameter	**2023**	**2024**
Number of sites screened	144	163
Number of screened sites with detections	67	142
Number of detections during screenings	209	163
Percentage of screened sites with detections (%)	46.5%	87%
Average emissions per screened site with a detection (m^3/day)	45.6	39.2
Total emission rate identified (m^3/day)	3053.1	6387.8
Number of sites followed-up on	70	34
Percentage of sites followed-up on vs. screened (%)	48.6%	21%
Number of follow-up sites with no screening detections	1	0
Number of follow-up emissions with emission source not detected by the screening technology	0	0
Average time between detection and follow-up to site (days)	46.1	35
Percentage of follow-up sites that are recurring (%)	76.2%	8%

Number of emissions from the screenings that were followed-up on	206	46
Number of emissions from the screenings that were followed-up and identified as fugitive emissions	64	27
Total emission rate of fugitives identified and fixed for the calendar year (m^3/day)	258.4	47

2. Follow-up Data

Table 2 summarizes statistics regarding the OGI follow-up surveys of the alt-FEMP region conducted after a screening campaign. The raw detailed follow-up data is provided in an Excel attachment with this report.

OGI has the capability to localize emissions to a source-level. Also, the OGI operator can normally determine the emission type. Table 3 shows the emission source equipment types for all identified fugitive emissions including the number and volume of emissions for each equipment type.

Table 2. Summary of OGI follow-up data.

Year		2023	2024
Number of sites followed-up on for the year		70	34
Percentage of screened sites followed-up on (%)		48.6%	21%
Percentage of sites with screening detections followed-up on (%)		100%	23%
Percentage of follow-up sites with OGI detections		98.6%	65%
Number of follow-up surveys where no emissions were found		1	12
Average time between detection and follow-up to site (days)		46.1	35
Percentage of follow-up sites that are recurring (for the calendar year – following-up on a site more than once)		76.2%	19%
Identified emission source types per follow-up per screening campaign (vent, fugitive, methane slip, other)		Fugitives and Vents	Fugitives and Vents
Number of detections by emission source type (n)	**Fugitives**	58	31
	Vents	217	47
	Total	275	78
Volume of detections by emission source type (m^3/day)	**Fugitives**	278.0	90
	Vents	1,301.1	146
	Total	1579.1	236

Average emissions per follow-up site (m^3/day)	22.6	6.6
Identified emission source equipment types per follow-up per screening campaign (e.g., tank, compressor seal)	10	6
Number of recurring leaks observed (if the leak occurred more than once per year)	3	2

Table 3. Number and volume (m^3/d) of emission detections by equipment type.

Identified emission source equipment types	2023		2024	
	Number of detections by equipment type	Volume of detections by equipment type (m^3/d)	Number of detections by equipment type	Volume of detections by equipment type (m^3/d)
controlled tank				
dehydrator	17	81.3	8	16
flare stack	5	68.5	1	13.7
header				
heater				
meter				
other	11	64.2	19	62.4
pig sender/receiver				
pipeline - aboveground				
pipeline - buried				
pneumatic instrument	2	3.8		
pneumatic pump				
reciprocating compressor	33	293.8		
screw compressor	12	59.3		
separator	160	671.6	31	63.7
surface casing vent				
sweetening process				
treater				
uncontrolled tank	25	292.4	7	68.4
vent stack				
wellhead	10	44.4	12	11.8
Total	**275**	**1579.3**	**78**	**236**

3. Emissions Summary

3.1 Screening Summary

Figure 1 shows the distribution for site-total methane emission rates detected during screening campaigns in 2023 and 2024, capturing all types of methane emissions (fugitives, vents, methane slip and others). The graph allows one to discern how many site-total emission measurements reported emission rates within a certain range (e.g. emissions with rates between 0 and 100 m^3/day where individual emissions on a single site from one screening are summed).

Figure 2 shows the distribution for individual emission rates detected during the 2023 and 2024 screening campaigns. Screening technologies are generally unable to determine the type of methane emission measured (fugitives, vents, methane slip and others). The graph allows one to discern how many individual emission measurements had an emission rate within a certain range (e.g., emissions with rates between 0 and 100 m^3/day).

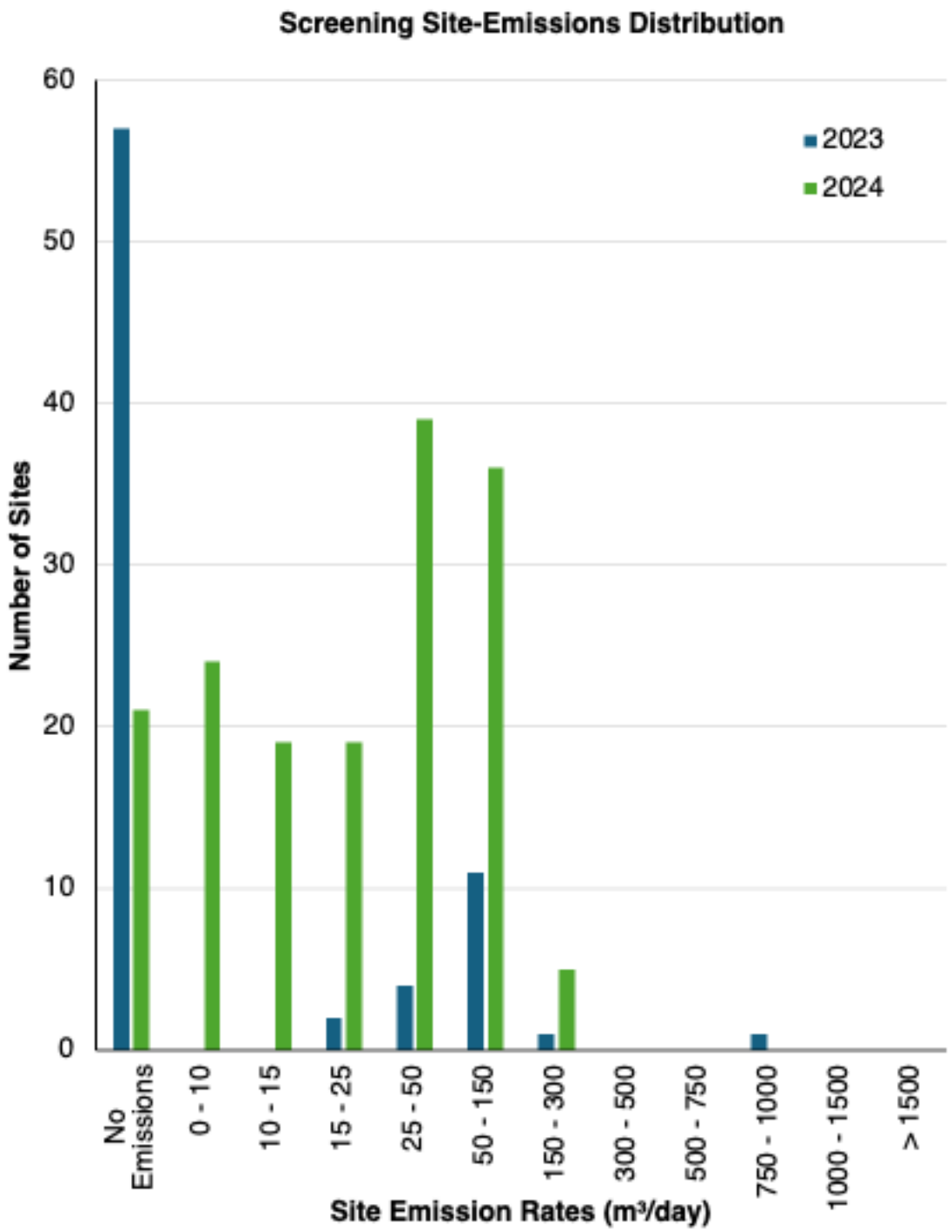

Figure 1: Distribution of site-total emission rates measured during screening campaigns.

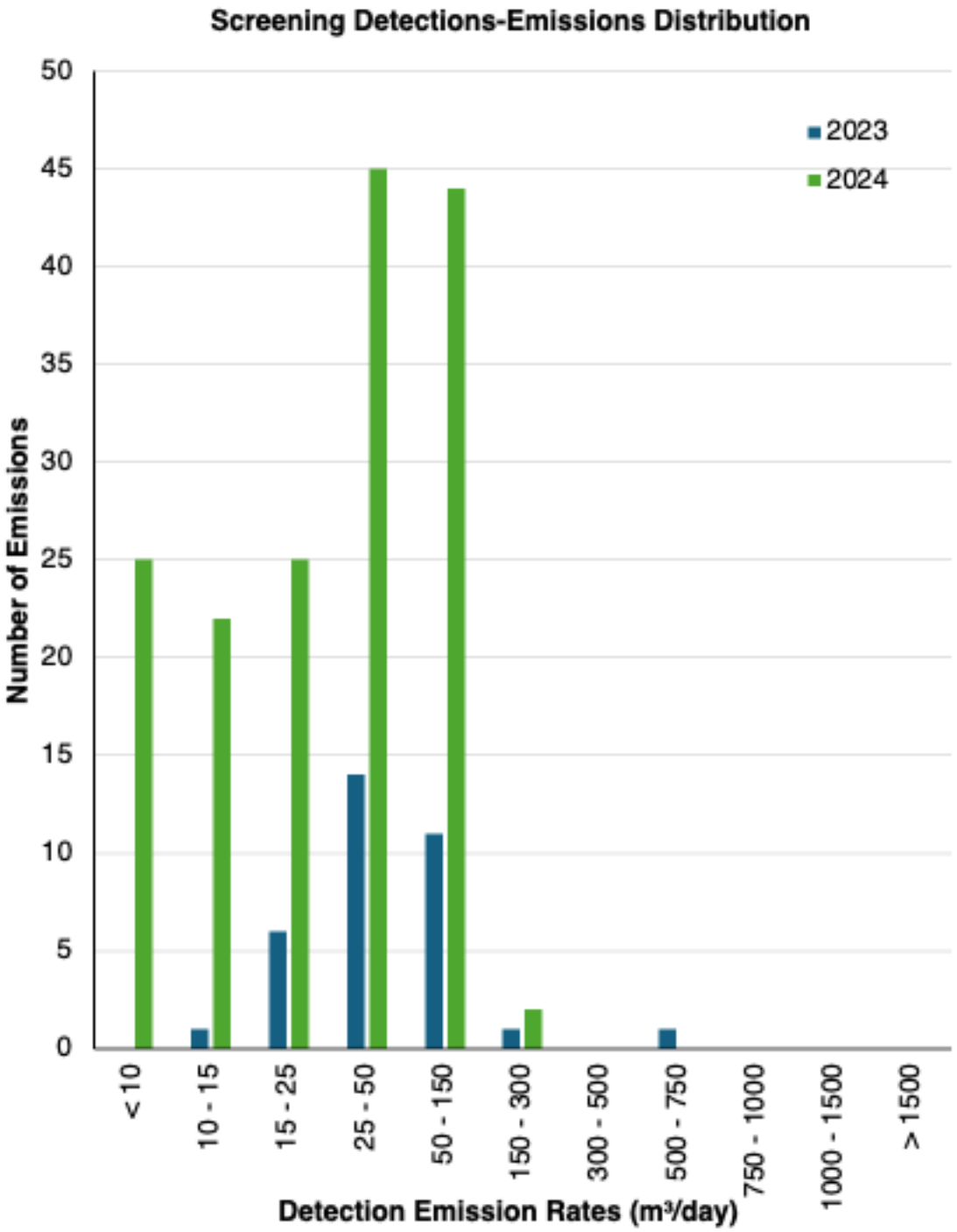

Figure 2: Distribution of individual emissions, by rate, measured during screening campaigns.

In general, screening technologies cannot discern fugitive emissions from other emission types, thus a graph depicting the emissions distribution specifically for fugitives detected during screenings could not be generated.

3.2 OGI Survey Summary

Figure 3 shows the emission rate distribution for site-total emissions detected during OGI survey campaigns of the alt-FEMP region, aggregating all methane emissions measured during that OGI campaign. The graph allows one to discern how many site-total emission measurements, by OGI, reported an emission rate within a certain range.

Figure 4 below shows the emission rate distribution for individual emissions detected during OGI survey campaigns. The graph allows one to discern how many individual OGI measurements had an emission rate within a certain range.

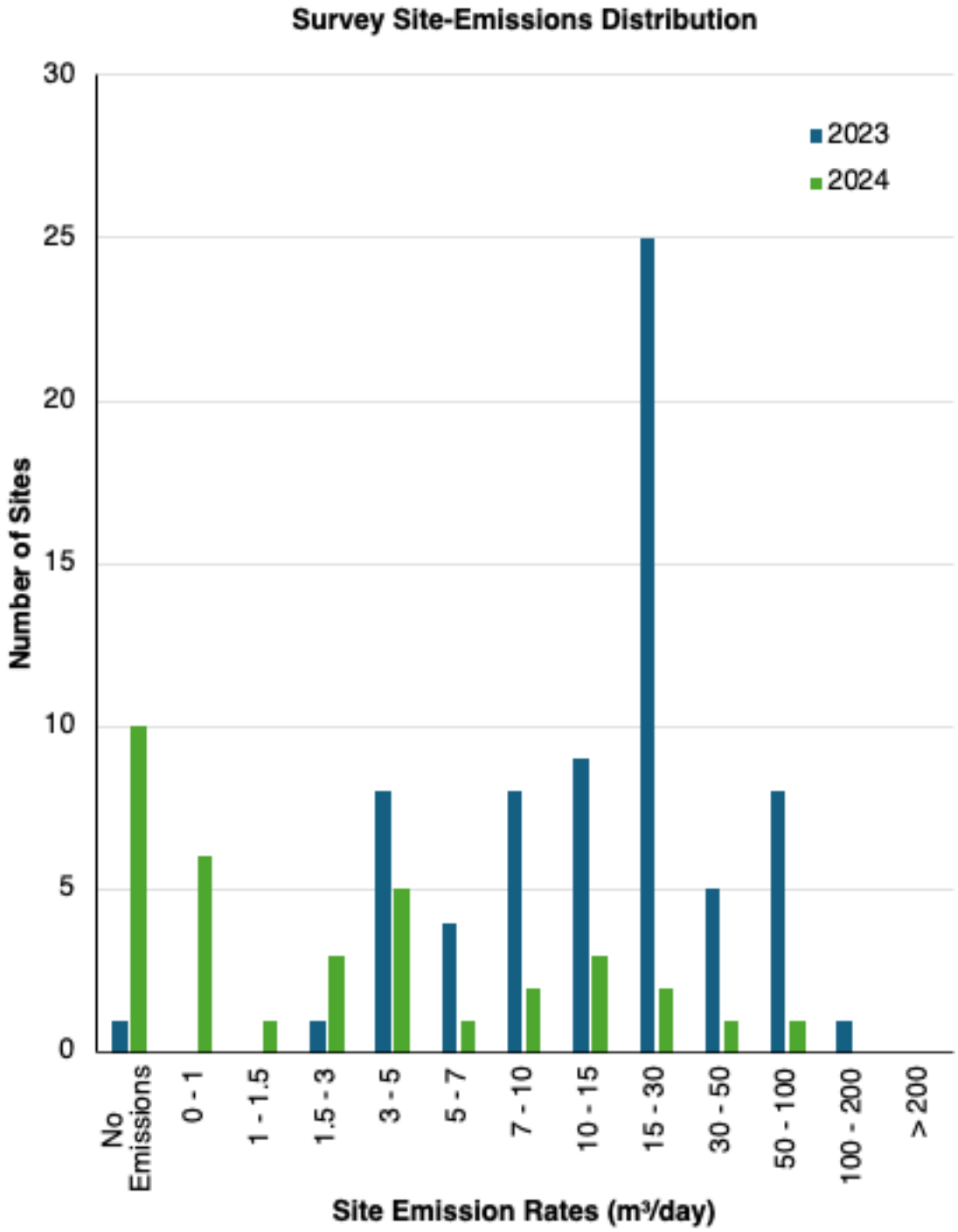

Figure 3: Distribution of site-total emission rates measured during OGI survey campaigns (e.g. follow-up and independent campaigns) of the alt-FEMP region.

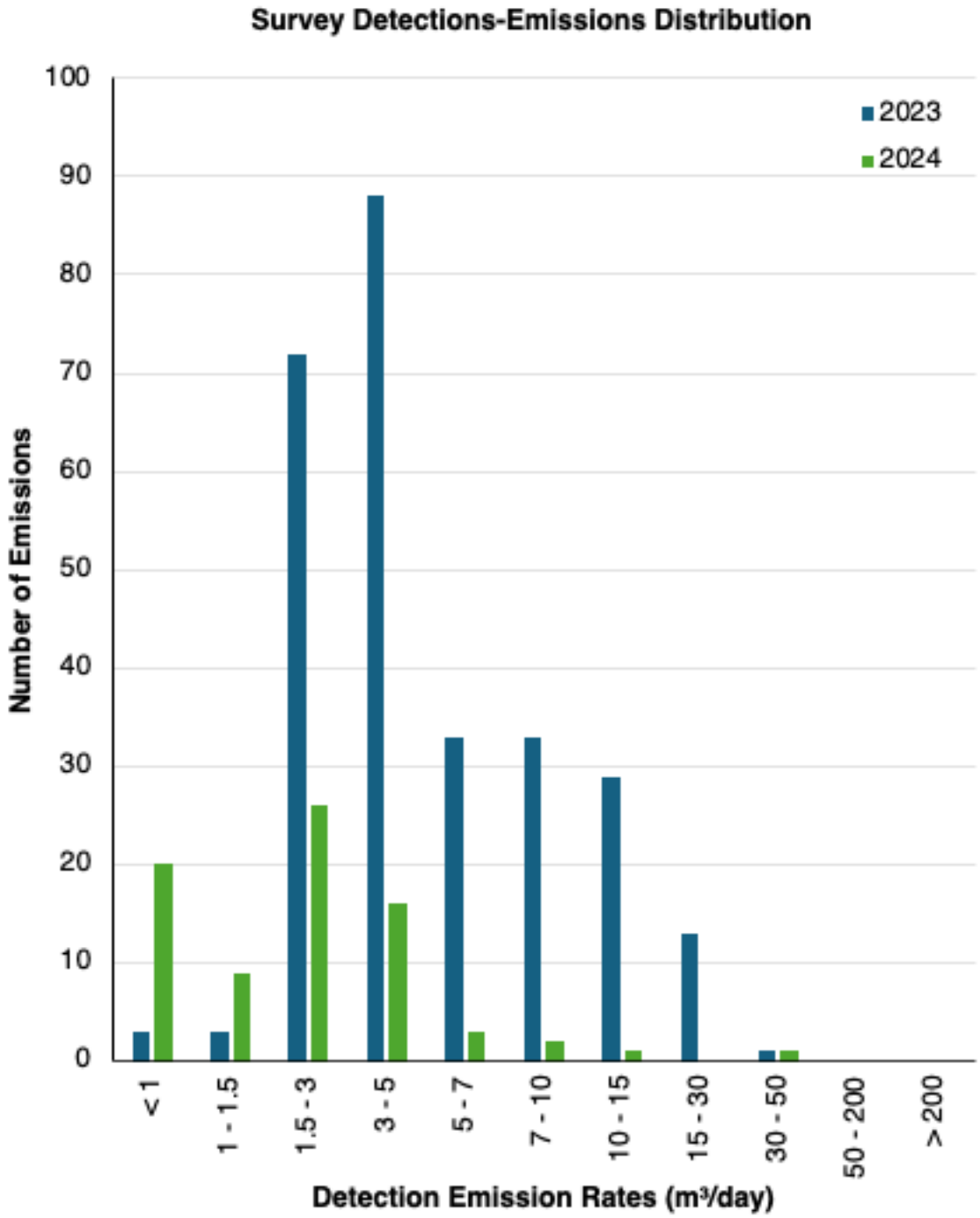

Figure 4: Distribution of individual emissions, by rate, measured during OGI survey campaigns (e.g. follow-up and independent campaigns) of the alt-FEMP region.

Figure 5 below shows the emission rate distribution for individual fugitive emissions detected during OGI survey campaigns. The graph allows one to discern how many individual fugitive emission measurements reported an emission rate within a certain range.

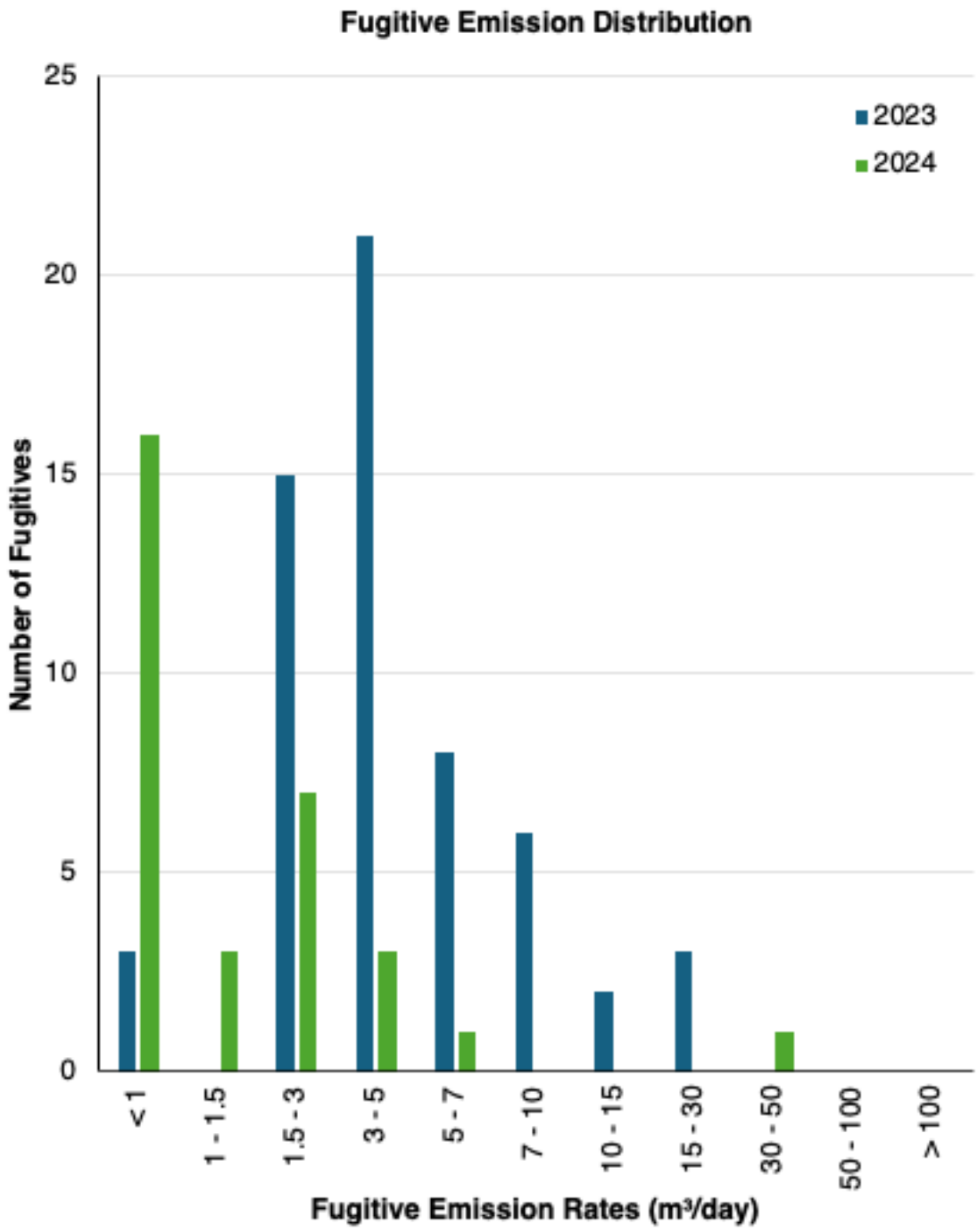

Figure 5: Distribution of fugitive emissions, by rate, measured during OGI survey campaigns (e.g. follow-up) of the alt-FEMP region.

3.3 Control vs. alt-FEMP Summary

Table 4 compares several metrics related to the sites surveyed and emissions detected via OGI surveys in the alt-FEMP vs. Control regions for 2024. The average rates in the table are calculated per site per survey (e.g. the control site was surveyed six times in the two years and the average of these six was taken).

Table 4. Comparison of the alt-FEMP and Control regions in 2024.

Item	alt-FEMP Region	Control Region
Number of Sites Surveyed	34	16
Number of Surveyed Sites with Emissions Detected	24	16
Percentage of Surveyed Sites with Emissions Detected (%)	71%	100%
Number of Emissions Detected at Surveyed Sites	78	65
Number of Surveyed Sites with Fugitive Emissions Detected	18	12
Percentage of Surveyed Sites with Fugitive Emissions Detected (%)	53%	75%
Number of Fugitive Emissions Detected	31	27
Number of Vent Emissions Detected	47	38
Total Rate of Emissions Detected (m^3/day)	236	333
Total Rate of Fugitive Emissions Detected (m^3/day)	90	99
Total Rate of Vent Emissions Detected (m^3/day)	146	234

Average Fugitive Rate per Site with Fugitive Emissions Detected (m^3/day)	12.4	20.8
Average Fugitive Rate for all Fugitive Emissions Detected (m^3/day)	3.03	5.12
Number of Fugitive Emissions Repaired	30	27
Percentage of Fugitives Repaired (%)	97%	100%
Average Time to Repair (days)	16	5

4. Emission Reduction Summary

The fugitive emission data collected during the alt-FEMP was used to generate the as-found “measured fugitive emission distribution”. This consisted of all fugitive emissions recorded during surveys of both the alt-FEMP region. Figure 6 shows a comparison of the as-found “measured fugitive emission distribution” to the “assumed fugitive emission distribution” employed in the modelling initially used to design the approved alt-FEMP. Additionally, the minimum detection limit (MDL) at 90% probability of detection (PoD) for the screening technology is displayed for reference.

A default Directive 060 FEMP program and the original Certus program were re-modelled using the as-found fugitive distribution using the AroFEMP software (Arolytics). The traditional default FEMP was predicted to have 42% less volume of methane emitted than the alt-FEMP after re-modelling. Due to the nature of data collection under an alt-FEMP, the fugitive emission distribution is comprised of less data than is desired for modelling. As well, it should also be noted that the original Certus parameters changed significantly during the program due to the acquisition and subsequent amendments to the alt-FEMP. The as-found fugitive emission distribution also shifted to smaller emissions.

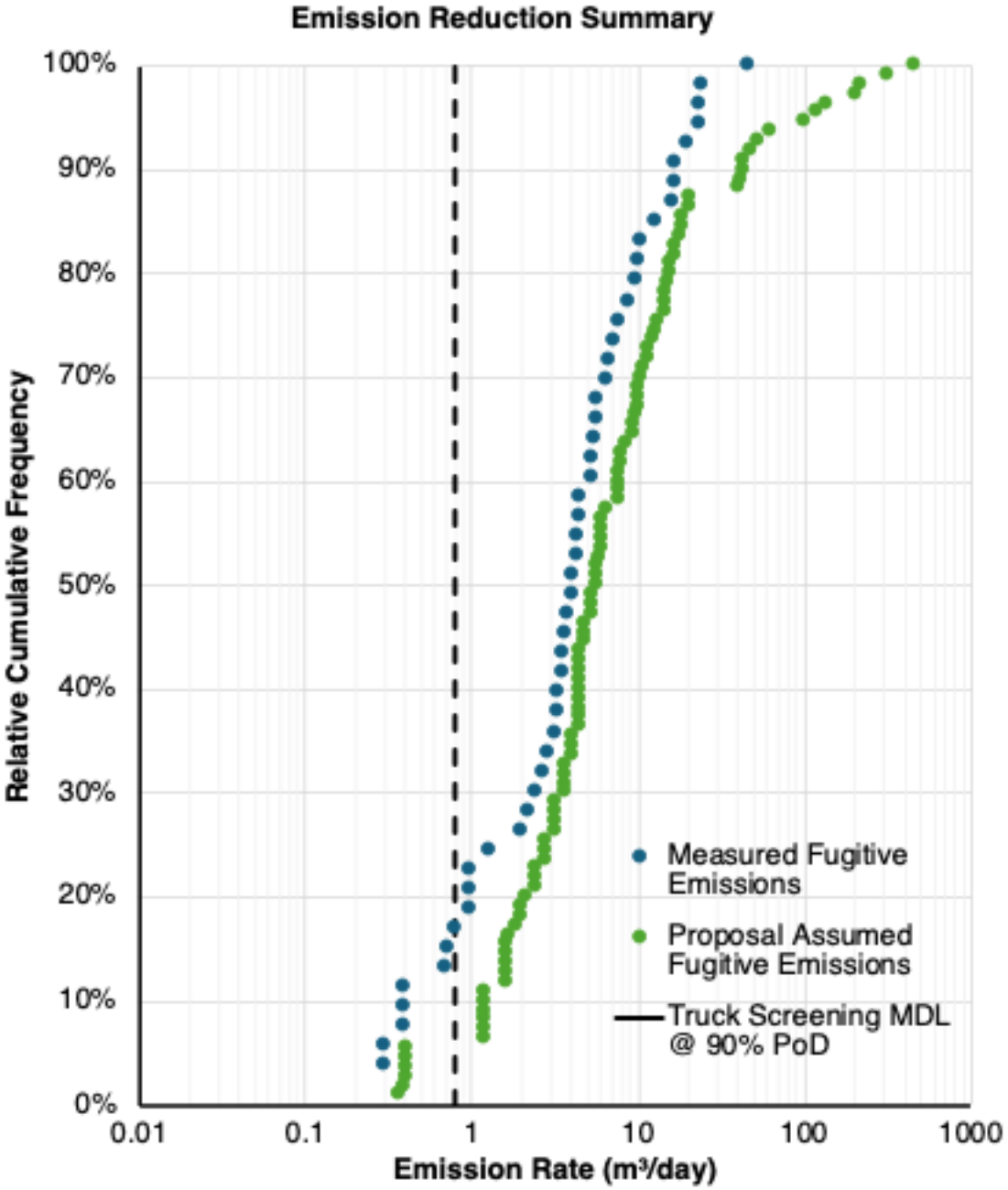

Figure 6. Comparison of relative cumulative frequencies for the "as-found" measured fugitive emissions versus the proposal-assumed fugitive emissions.

5. Technology Limitations

Bridger's detection sensitivity depends on factors including flight speed, flight altitude, measurement swath width, and wind speed. Many of these factors can be controlled by Bridger to tighten or loosen the sensitivity as required. Bridger's GML is an active, laser-based system, rather than a passive remote sensor that relies on the environment, so conditions such as cloud cover or shadows that can impair other aerial sensor technologies do not negatively impact GML. Regarding operations at northern latitudes, GML is moderately limited by snow cover and standing water. While GML will detect methane when there is snow on the ground, the detection sensitivity of the data is degraded. With standing water, Bridger's laser 'bounces' off and, as a result, no measurement is made. In several areas of Alberta, the muskeg landscape holds pockets of water in the warmer months. Based on testing and commercial projects completed in Alberta, the muskeg landscape has not negatively impacted Bridger's GML measurements. As a result of high winds rapidly dispersing emissions, Bridger limits its survey operations to ground wind speeds less than or equal to 25 mph. Bridger also implements a wind speed protocol to detect emissions at the lower end of GML's detection sensitivity. To avoid Bridger's limitations in snow, Bridger will only implement GML in snow-free months (between late Spring and early Winter). Bridger will also limit its survey operations to average ground wind speeds less than or equal to 25 mph.

Montrose's CEMS can only reliably detect methane emissions in wind speeds of 0.8 meters per second or greater. The CEMS system is unable to quantify emissions with the truck-based sensor, and instead does a follow-up OGI survey at the site if methane levels exceed a client-specific value. There are no limitations in required operational temperatures (ranges from -40°C to +40°C). The Montrose truck's detection limit increases as the distance from the source increases.

The ExACT technology (Vertex truck screening) is not impacted by cloud cover or shadows. ExACT can only reliably measure methane emissions in wind speeds of 0.8 metres per second or greater. The vehicle must be able to get downwind of an emission source for detection to occur. There are no limitations in required operational temperatures (ranges from -40°C to +40°C). ExACT can operate in moderate rain and snow-covered conditions without limitations. Can operate up to 1500ppm of methane. Heavy tree-cover may impact the dispersion of plumes and their ability to be detected.

6. Success of the alt-FEMP

The alt-FEMP was designed to meet methane emission equivalency to a default FEMP using alternative site screening technologies combined with OGI surveys. The execution of this program has been successfully completed.

7. Nonperforming Program Elements

The acquisition of Certus alt-FEMP assets by Pine Cliff in 2023 introduced some logistical hurdles towards executing the alt-FEMP; however, as a whole, the alt-FEMP was carried out successfully in 2023. Both screening campaigns were delayed by one quarter, originally planned for Q2 and Q3 but actually deployed in Q3 and Q4. The second screening only visited 66 of the 78 sites. Despite this, more sites were followed up after this screening than the first screening (48 sites vs. 22). As a result, the follow-up to the second screening also detected more emissions (175 emissions vs. 100). The infrastructure list was confirmed with the relevant service providers prior to beginning the 2024 campaigns.

The reporting for 2023 campaigns was also delayed but through conversations with the AER, an allowance was granted to submit by July 31, 2024.

8. Additional Control Measures

Any sites that were missed during screenings were automatically added to be followed-up on by OGI survey. After the Certus acquisition, Pine Cliff added sites to the alt-FEMP for 2024 campaigns to ensure the ratio of alt-FEMP to Control sites remained similar to what was originally approved.

9. Additional Information

In Figures 1 and 2, screening data from the Montrose truck was excluded because it did not quantify a rate.

In 2024, three amendments were made to the alt-FEMP. First, an adjustment to the alt-FEMP infrastructure list was made to provide a better coverage and ratio of triannual to annual sites: a) 6 facilities from 2023 transitioned from the alt-FEMP region to the control region; and b) 11 new facilities will be added to the alt-FEMP. This brought the 2024 alt-FEMP back up to 104 facilities over 83 LSDs.

Second, sites were added to the control region as, after the acquisition, only 2 control facilities remained of the original 34. 15 facilities were added bringing the total to 17, thus making the control region 14% of the alt-FEMP in relative size. This was the original ratio proposed in the Certus application.

Finally, Pine Cliff switched service providers from Montrose Environmental Group to Vertex Resource Group in 2024. Vertex also used a truck-based screening of methane emissions within the alt-FEMP region. An added benefit of the Vertex screening process was the sensor's ability to quantify detections instead of only providing a binary "yes/no" for emission detected. The schedule of the campaigns and follow-up thresholds was not changed. The Vertex and Montrose truck technologies both used a commercially available Picarro closed-path cavity ring down spectrometer thus all technological specifications are the same including detection limits, sensitivity and use-case limitations. Moving forward, all work practices remained identical during screening campaigns. Vertex will be using the ExACT truck (Flux Lab) whose sensor is considered technically mature and is commonly used across Alberta.

10. Key Performance Indicators

- Pine Cliff Energy Ltd. was successful in implementing alternative technologies to conduct LDAR screening, where emissions were detected at 209 of the 307 screened sites.
- A default D060 program would have resulted in 99 site visits compared to the 34 that were visited with OGI under the alt-FEMP.
- In 2023 and 2024, a total of 9,440.9 m^3/day of methane was found to be emitting by screening technologies on 372 detections. Of which, 368 m^3/day was identified as fugitive emissions when followed-up with OGI.
- 97% of fugitive emissions sources were repaired under the alt-FEMP in 2024.
- A comparison of the alt-FEMP and control regions for 2024 can be found in Table 4.
- On average, leak repairs were completed 16 days after an OGI follow-up under the alt-FEMP. In the Control Region, on average, leak repairs were completed 5 days after an OGI survey.

Appendix A: Raw Detailed Data

Please refer to the attached excel file of the raw data collected during the screening and follow-up surveys titled “PineCliff-Certus 2024 femp-screening-data.xlsx”.

Appendix B: Screening Data – Site-total Emissions by Campaign

See attached “PineCliff-Certus AER-altFEMP-2024PerformanceReport-Appendix.xlsx”. Note that truck screenings are typically just given as a site-total rate and not individual detections.

Appendix C: Screening Data – Individual Emissions

See attached “PineCliff-Certus AER-altFEMP-2024PerformanceReport-Appendix.xlsx”.