geoconvention
Calgary • Canada • May 15-17 2023

Identification and characterization of large emitter surface casing vent flows in Alberta

Negar Nazari, Adam Hayman
Carbon Management Canada

Introduction

Methane emissions through surface casing annuli, referred to as surface casing vent flows (SCVFs), contribute to approximately 20% of Alberta's upstream oil and gas methane emissions (Clearstone, 2019). SCVFs must be reported to Alberta Energy Regulator (AER) within 30 days of detection (AER, 2022). According to the AER, SCVFs are considered serious when flow rates are ≥ 300 m^3 and are required to be repaired within 90 days (AER, 2022). In this work, any SCVF with a flow rate ≥ 300 m^3 is defined as a large emitter. Analysis of the AER vent flow and gas migration dataset retrieved on November 22, 2022, showed that 4% of the wells identified with SCVFs are large emitters. This accounts for 80% of total volumetric flow rates reported in Alberta. Therefore, to reduce emissions from SCVFs, it is crucial to identify and characterize wells with the potential for higher emissions. A thorough understanding of the root causes and conditions that leads to SCVFs can improve the monitoring, detection, and mitigation of these fugitive emissions and their potential risks.

Observations and Results

This study is investigating spatiotemporal variations of large emitter SCVF leaks in Alberta by applying descriptive and inferential statistical approaches. This study differs from previous works by the authors by focusing only on identifying and characterizing large emitters. Analyzing the spatial distribution of these leaks revealed that lognormal distribution parameters of large emitters vary significantly from region to region. Thus, we subdivided SCVF leaks into four geographic regions based on spatial density of leaks and regional geology: Northwest Plains, West-Central Plains, East-Central Plains, and Southern Plains (Figure 1a). Preliminary analysis revealed that each region's leak duration is similar at approximately 900 days except for East-Central Plains, where the leak duration reaches 1400 days. Here we define the leak duration as the interval between when the leak is reported to the AER and when the leak is repaired. Analysis of the four regions has also revealed that the statistics of wellbore status vary significantly from region to region. For example, in West-Central and Southern Alberta, most wells with SCVF leaks are active wells, whereas, in East-Central abandoned wells are the dominant source of SCVF leaks (Figure 1b). Therefore, the higher leak duration in the East is correlated with the higher number of abandoned wells. In addition, the number of wells identified as large emitters reached a maximum in 2003 in the Southern plains, while in the other three regions, the maximum occurred in 1996 (Figure 1c). This can be attributed to regulatory changes in 1996. However, it requires a further in-depth root cause analysis using statistical inference methods. This work is presented as ongoing research on characterizing SCVFs in Alberta to better understand underlying causes of leaking methane through subsurface.

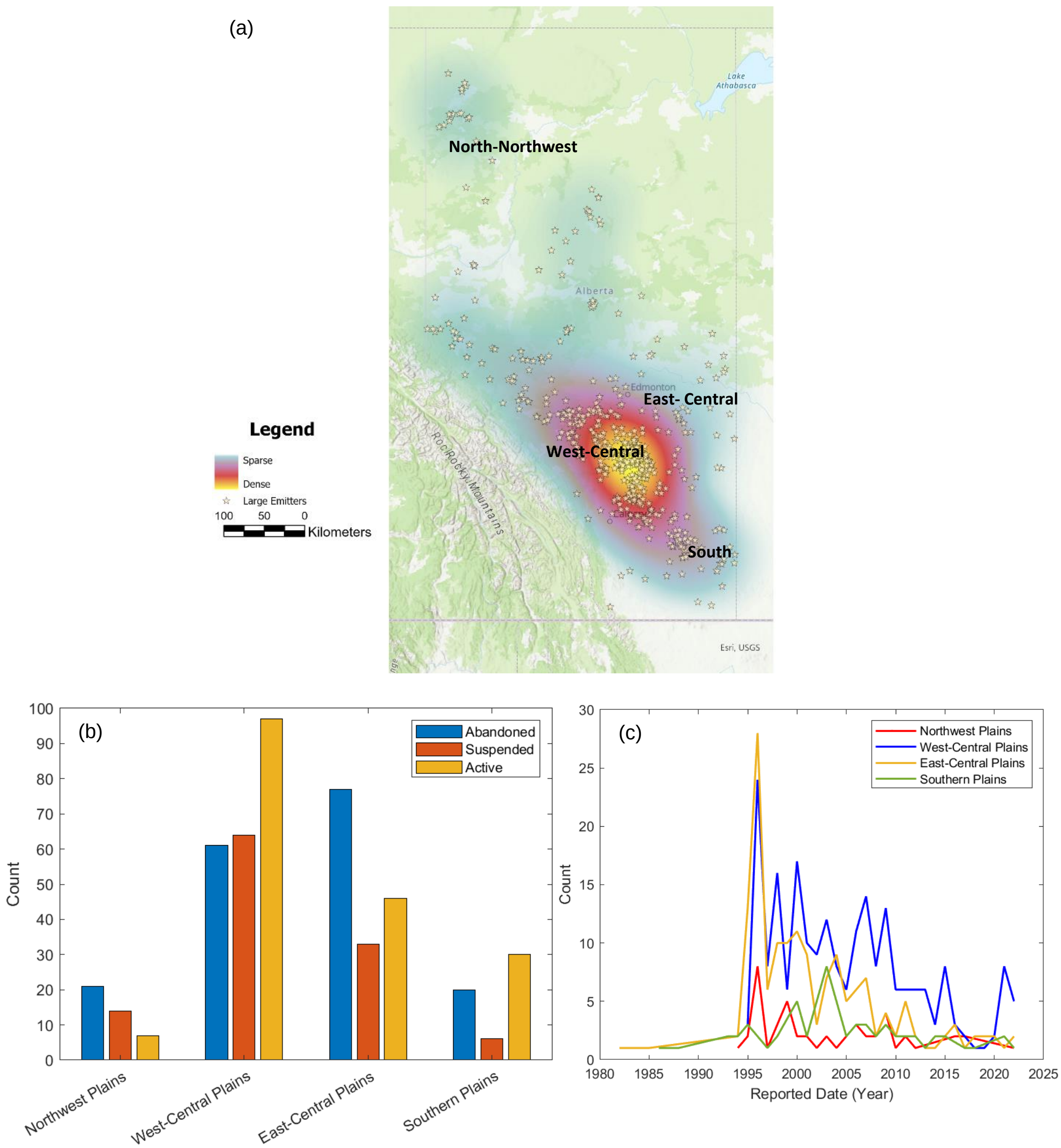

Figure 1. (a) A spatial heatmap of large emission (flow rates ≥ 300 m^3) SCVFs distribution in Alberta. (b) Subdivision of wellbore status for wells with large emission SCVFs. (c) Subdivision of annual reported large emission SCVFs.

Acknowledgements

We would like to thank Carbon Management Canada for providing the opportunity to work on this project. We would also like to express our gratitude towards Alberta Energy Regulator for accessing vent flow and gas migration data.

References

Alberta Energy Regulator. (2022). Directive 087: Well Integrity Management. Retrieved January 1, 2023, from https://static.aer.ca/prd/documents/directives/directive-087.pdf

Clearstone Engineering Ltd. 2018 Alberta upstream oil & gas methane emissions inventory and methodology. (2019). Retrieved January 19, 2023, from https://www.aer.ca/documents/ab-uog-emissions-inventory-methodology.pdf