Characterizing the Performance of a Mobile Methane Detection Platform

Insights from Controlled Release Testing in Alberta

EXECUTIVE SUMMARY

In March 2025, Carbon Management Canada (CMC), on behalf of the Alberta Methane Emissions Program (AMEP), conducted controlled gas releases to evaluate the performance of Eotrac's vehicle-mounted methane detection system.

Across **94 double-blind blind measurement events**, the Eotrac system achieved **96% detection accuracy** during active release scenarios and recorded **no false positives** during non-release periods. Notably, the technology demonstrated a **94% detection rate for releases below 0.5 kg/hr**, a critical threshold for regulatory screening.

These results confirm the system's suitability for **rapid, facility-scale methane detection**, enabling oil and gas operators and regulators to identify, prioritize, and respond to emissions effectively.

INTRODUCTION

Methane is a potent greenhouse gas with roughly **25 times the warming potential of carbon dioxide** over a 100-year timeframe, and reducing emissions from methane is one of the most cost-effective ways to curb near-term climate change. In Alberta, where the oil and gas sector generates approximately **71 percent of the province's anthropogenic methane emissions**, regulators are implementing increasingly stringent detection and reporting requirements. Programs like the **Alberta Energy Regulator's Directive 60** mandate regular surveys using approved technologies such as optical gas imaging or portable analyzers, while the **Highwood Report** outlines both standard and **Alternative Fugitive Emissions Management Program (Alt-FEMP) frameworks** that allow innovative, performance-based approaches using aerial, mobile, and continuous monitoring methods.

Eotrac's **vehicle-mounted detection platform** answers this call by offering a **fast, scalable, and cost-effective way to survey oil and gas sites**. Unlike traditional point-sampling methods, Eotrac integrates high-precision methane sensing, wind and geolocation measurements, and real-time data visualization into a single, roof-mounted unit. This design aims to support regulatory compliance by meeting or exceeding performance tiers specified in Alt-FEMP frameworks, improves operational efficiency through rapid site coverage, and enables target prioritization by triaging leaks based on magnitude. With both detection and classification capabilities, Eotrac empowers operators to find and address emissions more proactively, delivering emissions insights in timelines and formats that align with emerging regulatory expectations.

In this white paper, we provide an overview of the Eotrac vehicle-mounted methane detection platform, outline the methodology used in the Alberta Methane Emissions Program controlled release trials, and present the key results from this testing to illustrate the system's performance across a wide range of real-world emission scenarios.

TECHNOLOGY OVERVIEW

Eotrac's methane detection and quantification solution integrates cutting-edge sensing technology with user-friendly, scalable deployment practices.

Measurement Device

- **Laser-based methane sensor** using Tunable Diode Laser Spectroscopy (TDLS).
- Integrated **2D sonic anemometer** for wind speed/direction and **GPS** for precise geolocation.
- **Sampled air is continuously drawn** into an enclosure for high-precision methane measurement (detection limit ≤0.4 ppm).
- **Data outputs:** Methane concentration, wind, and location data for post-processing and mapping.

Deployment & Reporting

- **Quick setup:** Single-person installation on roof racks in under 10 minutes.
- **Survey protocol:** Five loops around the site, typically <10 minutes per event at 5–10 km/h.
- **Rapid turnaround:** Post-processed reports delivered within 24 hours (near-real-time capabilities in development).

This combination of **speed, accuracy, and portability** makes the system ideal for upstream oil and gas sites where operational efficiency is key.

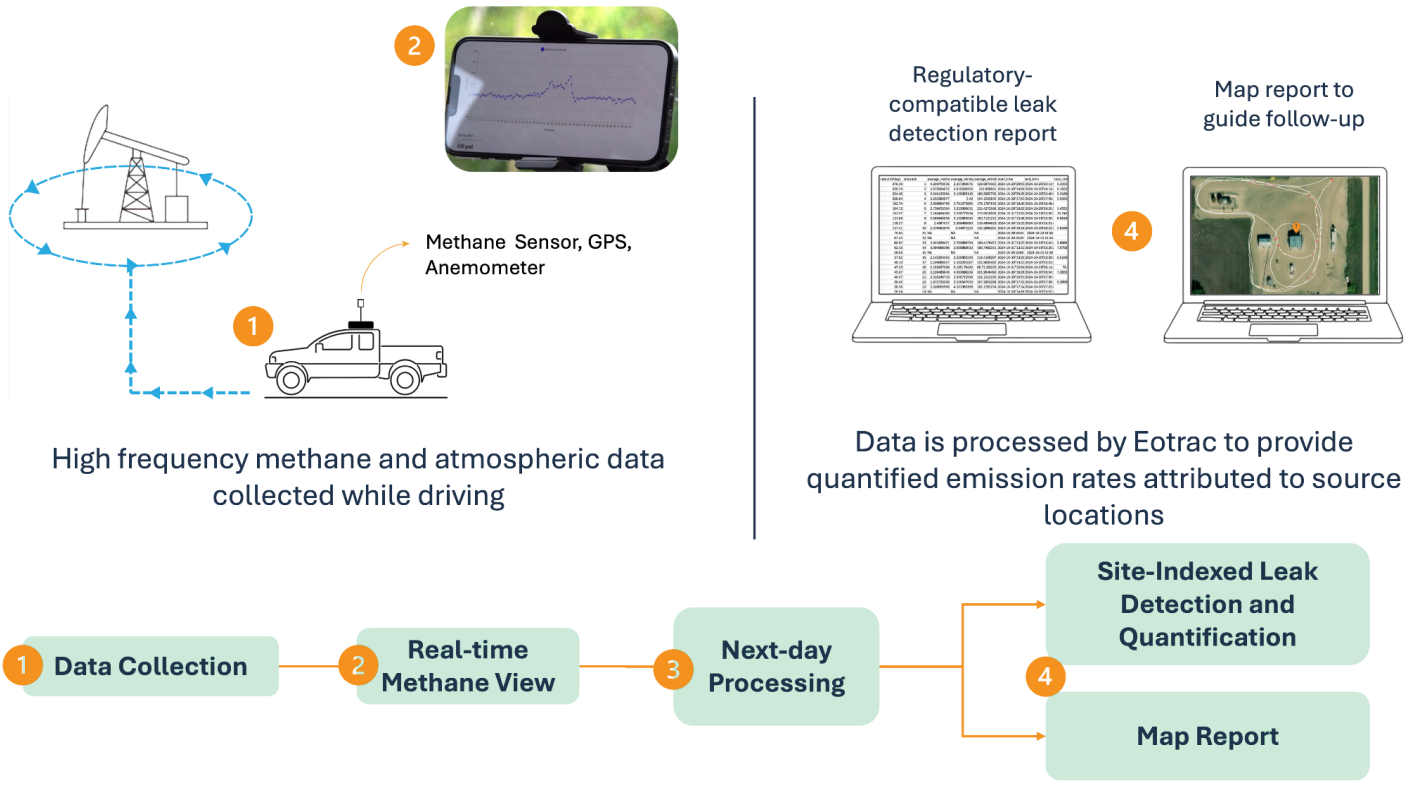

***Figure 1**. The Eotrac system collects data as you drive. **Step 1:** Install the device, then drive 3–5 loops around the site. No need to exit the vehicle or remove the device between sites. A real-time view **(2)** shows methane hotspots as you drive, helping infer leak location and severity. **Step 3:** Eotrac processes the data, typically within 24 hours. **Step 4:** You receive a spreadsheet-style report listing each site, leak status, and estimated emission rate, formatted for regulatory use. An interactive map report is also provided to support follow-up and interpretation.*

STUDY METHODOLOGY: CONTROLLED RELEASE TESTING

Controlled release testing took place **March 24–28, 2025**, at the Carbon Management Canada (CMC) test site, following AMEP's standard controlled release procedures.

Protocol Highlights

- **Double blind testing:** Flow rates and release points were unknown to Eotrac during measurement.
- **Scenarios:** Single-source, multi-source, and non-release events.
- **Release rates:** 0.02–3.57 kg/hr of methane.
  Release heights: Ground level up to 4.95 m.
- **Weather:** Air temperatures ranged from -5.3 °C to 14.4 °C, with average wind speeds of 3.8 m/s (see wind rose, Figure 1).

In total, **94 measurement events** were conducted: 79 single-source, 12 multi-source, and 3 non-release events.

RESULTS & DISCUSSION

Across the 94 measurement events conducted during the Alberta Methane Emissions Program trials, the Eotrac vehicle-mounted methane detection system demonstrated **high detection accuracy**, identifying emissions in **87 of 91 active release events**, corresponding to a **detection rate of 96 percent**. All three non-release events were correctly identified as having no emissions present, resulting in **zero false positives** across the entire campaign.

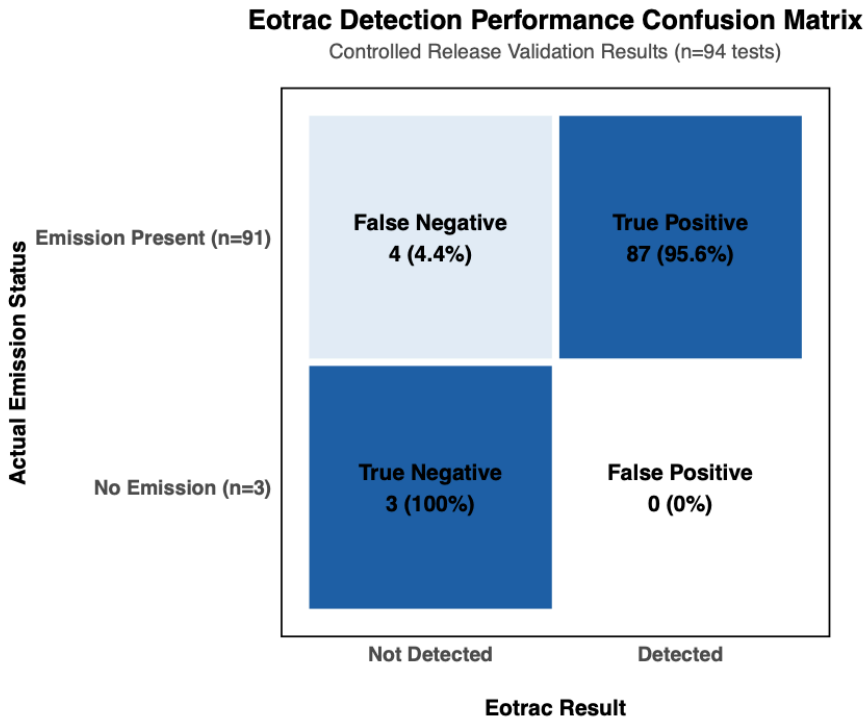

***Figure 2**. Confusion Matrix showing the detection performance of Eotrac for all measurement events. This matrix is constructed of two rows (i.e., Emission Present and No Emission), in which the Eotrac Result columns (i.e., Not Detected or Detected) add up to 100% for each row. Colour saturation is used to show the proportion of each result.*

Detection performance was most challenged at the very lowest release levels. All four missed detections occurred at a **release rate of 0.025 kg/hr**, the smallest rate tested. However, detection improved sharply as release rates increased, achieving a **100 percent detection rate at 0.05 kg/hr**, which was sustained across all higher release rates up to **3.57 kg/hr**. Importantly, the system achieved a **94% detection rate for releases below 0.5 kg/hr**, exceeding the >90% threshold commonly required by regulatory screening programs for technology approval.

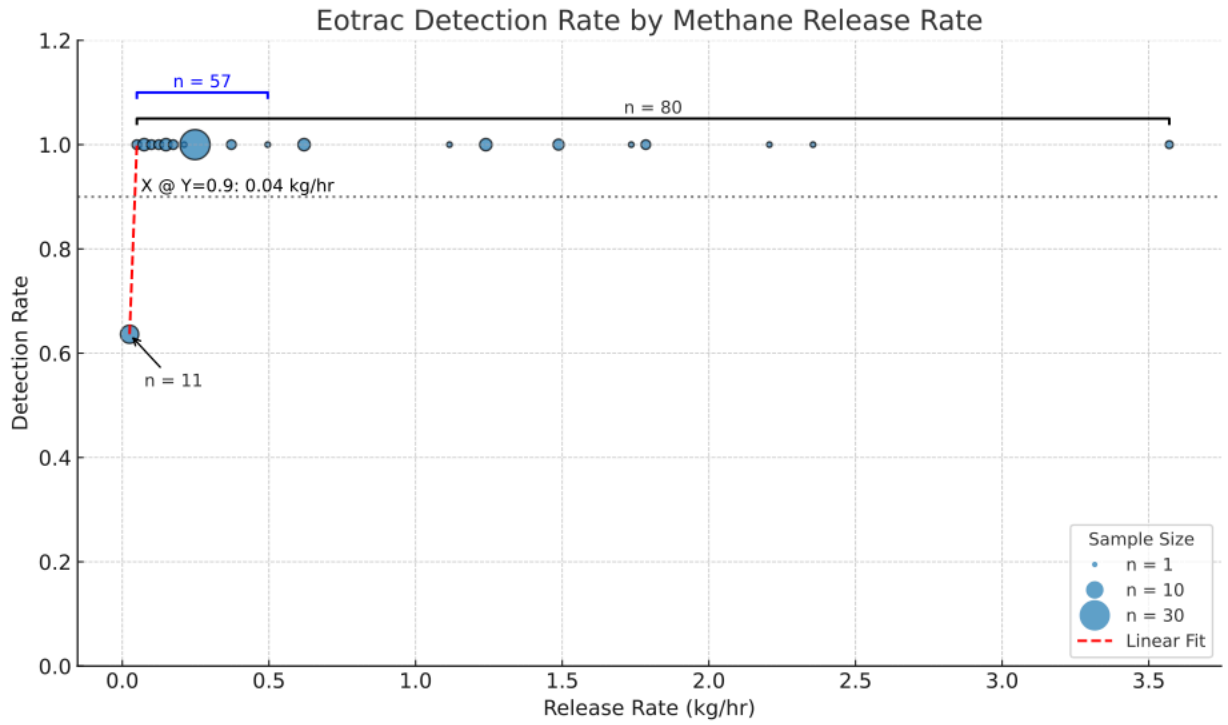

***Figure 3**. Detection rate as a function of controlled gas release rate. These data represent the 91 of 94 measurement events in which CMC ground truth confirms that gas was being released from the site.*

Detection performance was not meaningfully influenced by source type or release height; under the conditions at the CMC facility, plume dispersion from different configurations did not appear to reduce system effectiveness.

In addition to binary detection, the trials examined how closely Eotrac's estimated emission rates aligned with ground truth values. Across the **87 successful detections**, there was a general positive correlation between estimated and actual release rates, but with **considerable scatter at the lowest release rates**. The system **systematically overestimated emissions below 1 kg/hr**, with relative errors sometimes between **two and five times the actual release rate**. However, the absolute size of these errors remained modest; for example, an error of 0.08 kg/hr at a 0.02 kg/hr release appears large in relative terms but represents only a small operational difference. For releases at or above **2 kg/hr**, Eotrac's estimates more closely matched the ground truth values, showing improved quantification performance at larger emission scales.

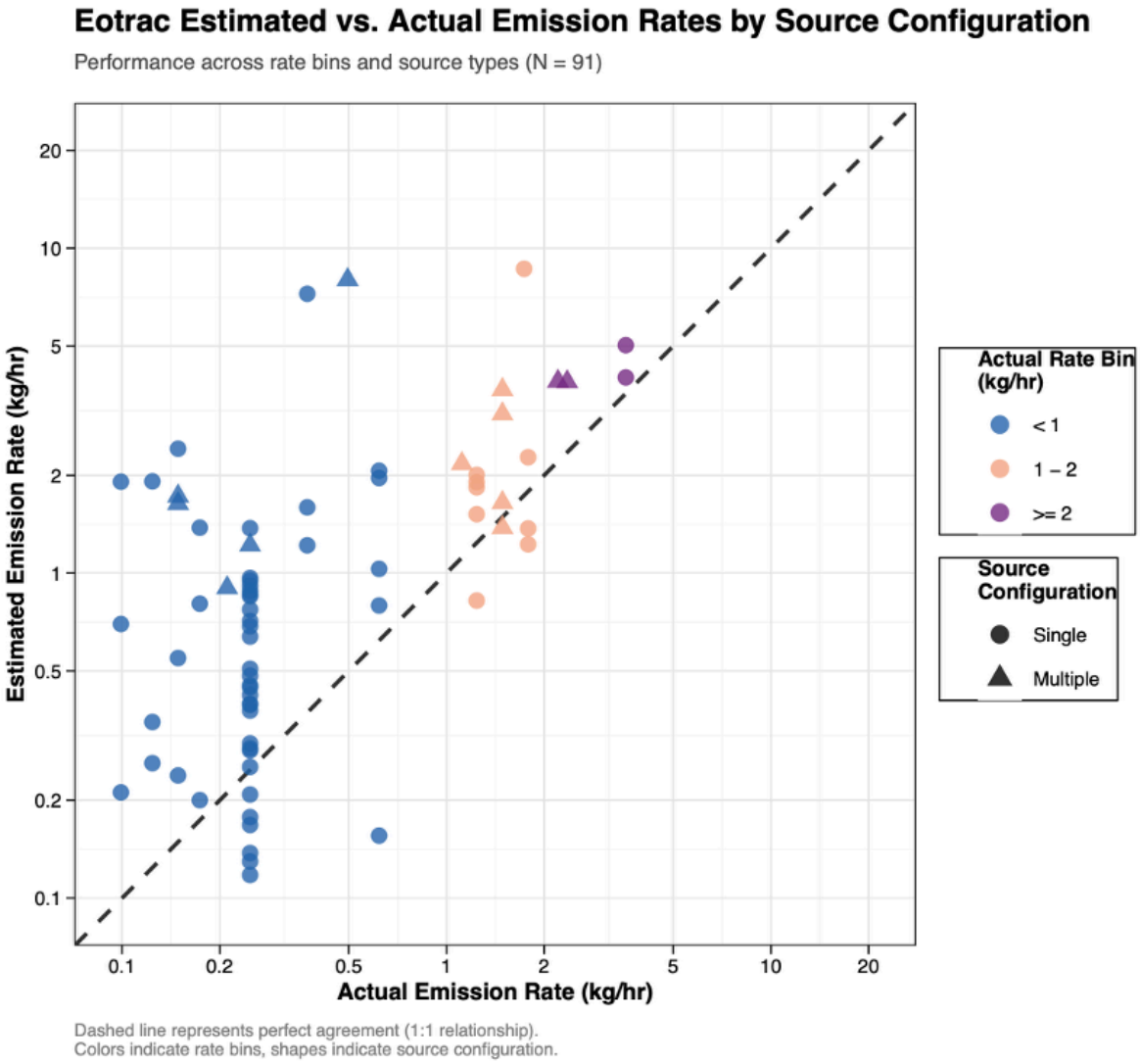

***Figure 4**. Eotrac estimated emission rate compared to actual emission rate. These data represent the 87 of 91 measurement events in which CMC ground truth confirms that gas was being released from the site and Eotrac successfully detected the emission.*

Recognizing that precise quantification at the smallest release levels can be operationally less critical, a triage-based framework was applied to the data. Emissions were categorized into three bins: **less than 1 kg/hr, 1–2 kg/hr, and greater than 2 kg/hr**. Using this classification, **75 percent of detections were placed into the correct category**, providing an effective means of prioritizing emissions based on magnitude.

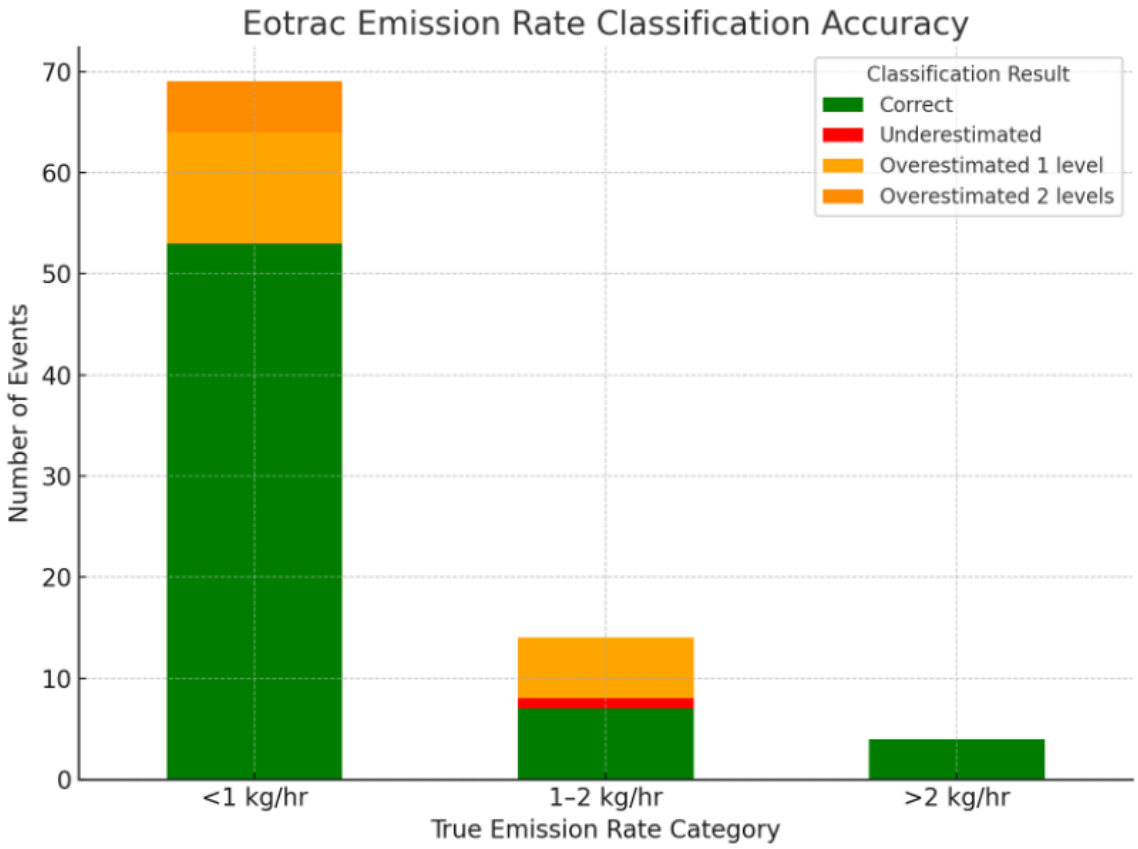

***Figure 5**. Triage success rate when classifying emission detections based on Eotrac's emission rate estimate. Emissions were classified into one of three bins: <1, 1-2, or >2 kg/hr. These data represent the 87 of 91 measurement events in which CMC ground truth confirms that gas was being released from the site and Eotrac successfully detected the emission.*

CONCLUSIONS

The Alberta Methane Emissions Program trials have provided clear validation of the Eotrac vehicle-mounted methane detection system, demonstrating its effectiveness across a wide range of controlled release scenarios. The system achieved **a 96 percent detection rate across 91 active release events**, with **zero false positives during non-release periods**, reflecting strong reliability in real-world conditions. Particularly notable was its ability to detect **94 percent of emissions below 0.5 kg/hr**, a range that is highly relevant for meeting the most stringent regulatory screening requirements. By maintaining **100 percent detection for emissions at or above 0.05 kg/hr**, the platform proved capable of consistently identifying leaks that are operationally meaningful.

Beyond detection, the system demonstrated value as a tool for **classifying and prioritizing emissions**. While quantification showed variability at very low release rates, it maintained a **75 percent success rate in correctly categorizing emissions into operationally relevant bins (<1, 1–2, >2 kg/hr)**, enabling operators to effectively triage and direct resources toward the most significant leaks. With **fast deployment, 24-hour reporting turnaround, and near-real-time capabilities in development**, the Eotrac platform offers a practical, scalable solution for operators and regulators aiming to meet evolving emissions management and reporting requirements.