

WHITEPAPER

Leveraging Nitrogen to Eliminate Methane Venting at New and Modified Sites Across North America (Greenfield Application)

By enabling zero-emission pneumatic operations from the onset, North American producers are ensuring compliance with methane regulations while delivering unparalleled reliability and flexibility.



TITLE

Leveraging Nitrogen to Eliminate Methane Venting at New and Modified Sites Across North America

CUSTOMER

Oil and gas producers in North America

APPLICATION

Zero-emission pneumatic device operations for new developments



Background

Well sites across North America are subject to methane regulations which require non-emitting pneumatic devices at new, modified, and existing wells. While pre-existing facilities have a longer timeline to convert pneumatics to non-emitting options, new facilities in many jurisdictions are not permitted to vent methane at any time. This includes new wells drilled at existing facilities and, in the USA, sites that have experienced modifications or recent construction, regardless of the age of the well or access to grid power.

Kathairos offers a robust solution for eliminating pneumatic venting at new, modified and existing facilities by utilizing liquid nitrogen to power pneumatic devices. Liquid nitrogen is stored onsite in a cryogenic tank and tied into existing operations, eliminating the need for methane as instrument gas, and the subsequent venting of methane during routine well site operations. Further, it is an extremely economical mitigation solution that requires zero upfront capital cost, operator involvement, replacement of existing systems, repair and maintenance or onsite power generation.

Regulatory Landscape

Multiple jurisdictions prohibit fuel-gas driven pneumatics at new or modified well site facilities:

- **Alberta, Canada:** [According to Directive O60 "Upstream Petroleum Industry Flaring, Incinerating, and Venting,"](#) any pneumatics installed on or after **January 1, 2022**, must "prevent or control vent gas from pneumatic instruments," with the exception of pneumatic pumps operating less than 750 hours/year (~31 days).
- **British Columbia, Canada:** [As per B.C. Reg. 282/2010 "Drilling and Production Regulation,"](#) a "facility permit holder of a facility that began operations on or after **January 1, 2021**, must not use at the facility a pneumatic device that emits natural gas," with the exception of pumps operating less than 750h/year.
- **Saskatchewan, Canada:** According to Directive PNG036 ["Venting and Flaring Requirements,"](#) "Licensees must not vent natural gas from pneumatic devices at facilities licensed on or after **January 1st, 2025.**"
- **United States:** [40 CFR Part 60 Subpart OOOOb](#) requires zero-emission pneumatics at all new or modified facilities by **May 7, 2025**. Affected facilities are not permitted to switch back to fuel gas.

Liquid Nitrogen Application at Greenfield Sites

The Kathairos nitrogen system provides an affordable and reliable solution for both new and existing wells. Historically, it has been common practice for operators to install instrument air packages at new facilities. However, many of the benefits of nitrogen systems – particularly their reliability and flexibility – are especially valuable at new sites, where performance is paramount and future vent rates are uncertain.

Benefits of the nitrogen system at new facilities:

- At new locations, **downtime isn't an option**. Kathairos provides a reliable, power-free solution that delivers reliable pressure and volumes. With 20+ million operating hours to date, Kathairos has a proven 99.98% uptime.
- Many oil and gas facilities are not close to electricity infrastructure and tying into the grid can be costly and time consuming. The nitrogen system is ideal for remote sites, as it **doesn't need power** (we only need an access road).
- **No need to size for maximum capacity**. We recognize that vent rates may change over the life-of-well. Kathairos doesn't size tanks for max capacity, but what we expect average consumption to be over the life-of-well. During periods of high activity, refill frequency may increase for a few weeks or months and then will decrease later on. This is unlike instrument air systems, which need to be designed for max capacity (which are often unknown) and may require operators to invest in an expensive system that is only warranted for a relatively short period of time.
- **Flexibility for uncertainty**. Uncertain if your new facility will be a single-well or a 12-well pad? Unsure of vent or production volumes? No problem—our tanks are easily interchangeable, allowing you to scale accordingly and optimize cost as needed throughout the facility's lifecycle.
- **Fast deployment**. Need a solution now? From the time we get site details, we can get a tank in the field in 8 weeks or less.
- **Quick installation**. The Kathairos system seamlessly ties-in to basic tubing and facility designs. Installation can be completed in half a day.
- **No maintenance back-up option**. For new sites that have an air compressor installed, nitrogen provides a reliable, maintenance-free back-up option, allowing operators to reduce the amount of equipment on-site and minimize cap-ex.

Nitrogen Systems to Fit Your Needs

Examples of when systems can be installed:

- A new well is added to an existing or new multi-well pad
- A well is drilled at a new standard pad location or exploratory pad location, where production, future usage levels are unknown
- Facility construction or retrofits occur
- Instrument air packages need to be replaced or backed up
- New pneumatic devices are added at a facilities

Data Analysis – Case Study

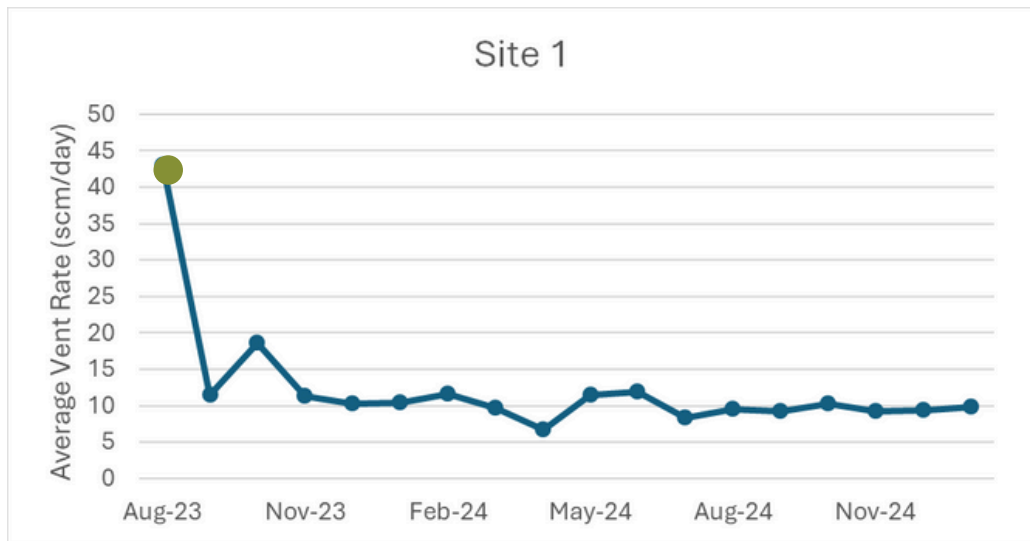
As of January 2025, Kathairos has eliminated a total of **23,026 tons of CO₂e** from 54 newly constructed (greenfield) sites in Canada. From these 54 well sites, Kathairos analyzed monthly vent rate data from mid-2023 to January 2025. The majority of the 54 sites had been operating for less than a year, making it challenging to assess outcomes given the influence of seasonality (ie. pump activity) on actual vent rates. However, we were able to identify a number of case studies that had been operating using nitrogen for longer than 18 months. These case studies were used to shed light on the following questions:

1. Do vent rates at new sites decline over time?
2. Does drilling a new well increase the vent rate at a facility?

Conclusions:

1. Do vent rates at new sites decline over time?

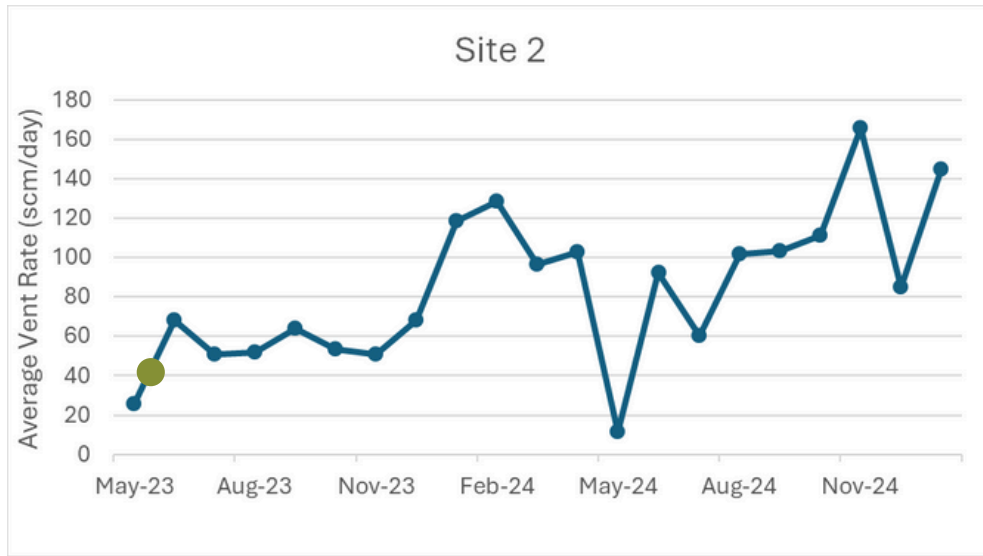
Using data collected over a 24-month time period, Kathairos analyzed the vent rate data of two new facilities: one with a single newly drilled well¹ (Site 1) and another with two newly drilled wells (Site 2). No new wells were added across both sites following the first drilling date. For Site 1, the average vent rate for the first 30 days of production (August 2023) was **353%** higher than a year later (August 2024). The vent rate showed a consistent rate of decline of **29%** following the drilling date, with an increase in October 2023 (likely due to pneumatic pumps being turned on). The average vent rate later showed a trend of levelling out.



Note: The green data points denote a new well being drilled/added to well site infrastructure

Conversely, at Site 2, the average vent rate showed a consistent increase following the drilling date aside from a sharp decrease occurring in May 2024 as a result of limited downstream capacity slowing well site activity for the month.

¹ Each well is associated with a Unique Well Identifier (UWI)

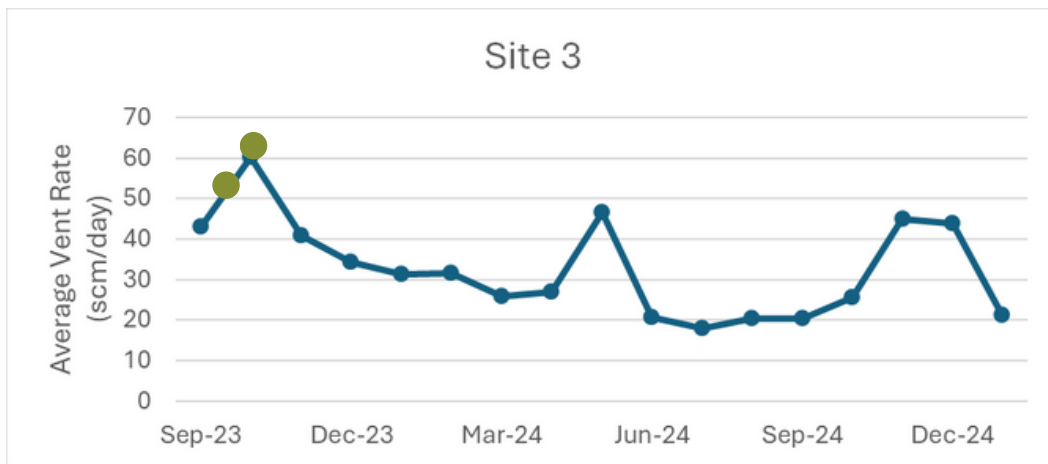


Based on these cases, it is possible – but not always the case! - that vent rates will be highest when a well first comes online, vent rates can fluctuate due to a variety of factors, both foreseen and unforeseen foreseen (temperature, pump activity, liquids volumes & composition, leaks, etc.).

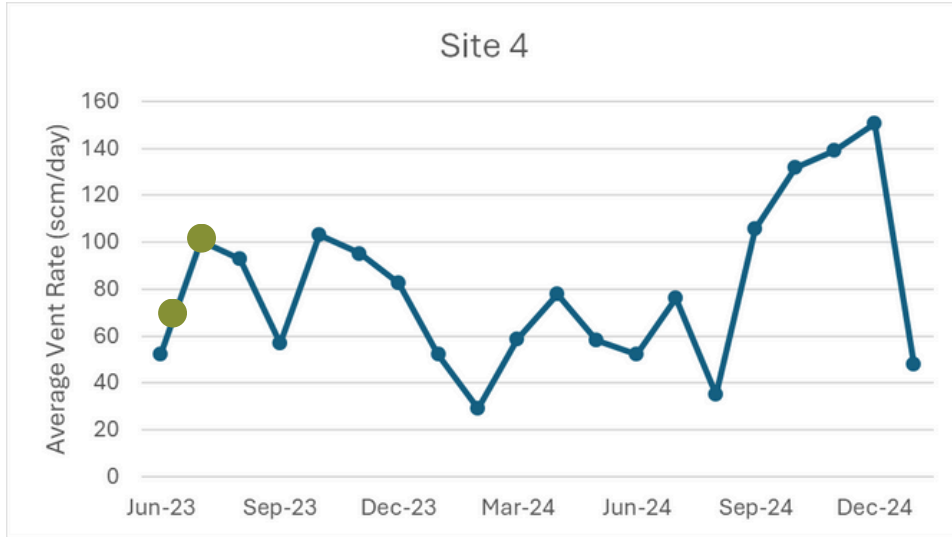
2. Does drilling a new well increase the vent rate at a facility?

In most cases, each time a new well is drilled and added to the infrastructure of the well site, an increase in vent rate occurs. However, the length of time this increase occurs is not predictable and vent rates can vary significantly once a well starts producing.

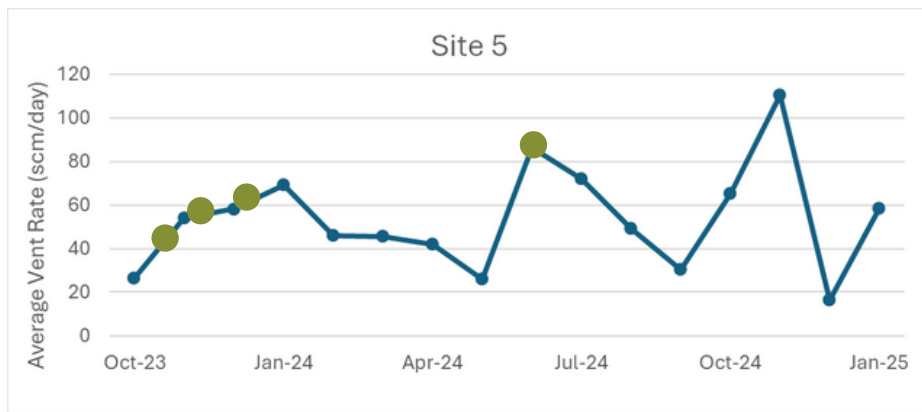
In the instance of Site 3 (below), an operator had 4 wells drilled in September 2023. In the first 30 days of consumption (September 2023), the average vent rate was **111%** higher compared to the following year (September 2024). In October 2023, 2 more wells were added. Following this addition, the vent rate continued to increase, being **136%** higher compared to a year later. Over the course of the remaining 15 months, the average vent rate trended downward.



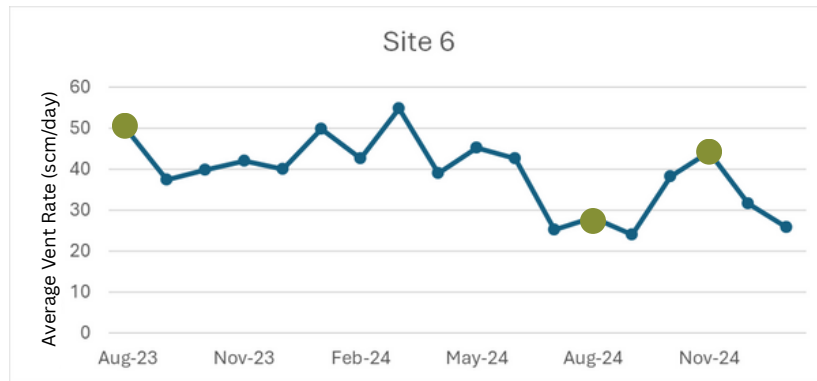
In the case of Site 4 (below), 3 wells were drilled in June 2023. In July 2023, an additional 4 wells were added to the well site infrastructure. The vent rate immediately following the addition of these 4 wells in July was **23%** higher than during the same month the following year. Yet year over year trends for other months were mixed, with winter vent rates higher in 2024 than 2023.



At Site 5 (below), 2 wells were drilled in October 2023. In November and December 2023, 2 additional wells were added each month to the well site infrastructure. Two more wells were added in June 2024. While the vent rate was higher in the immediate period following the addition of the new wells, fluctuations over the remaining months show that the addition of a new well – in and of itself – is an insufficient determinant of vent rate.



For Site 6 (below), 8 wells were drilled in August 2023. In August 2024, 3 wells were added to infrastructure increasing well count to 11. This addition was unique in that it caused a decrease in average vent rate when comparing data from a year prior. In November 2024, the operator added an additional 4 wells to the site, increasing well count to 15. The average vent rate decreased over the course of the data collection period, even though new wells were being added.



To conclude, adding new wells to a facility often (but not always) leads to higher initial vent rates. However, it is rarely the case that these vent rates will be the highest vent rates the facility experiences. Even when controlling for seasonality, it is possible for vent rates to increase, and not just steadily decline over time.

The main take-away from these case studies is that **pneumatic vent rates at new facilities can vary significantly over time in ways that cannot always be attributed to stage of production.**

Given fluctuating and uncertain vent rates at new wells, how should operators prepare?

By providing a flexible, scalable solution, Kathairos ensures that emissions reduction remains efficient, even as site conditions evolve. Operators do not need to size systems for max capacity. Rather, Kathairos is able to adjust the nitrogen refill frequency to match changes in vent rates.

Additionally, with the ability to swap or adjust tank sizes as needed, operators can seamlessly match vent rates without disruption, avoiding costly delays and ensuring compliance with emissions regulations. This adaptability makes Kathairos an essential partner in helping oil and gas producers achieve their sustainability goals while maintaining operational efficiency.

Looking Ahead: Kathairos for Greenfield Sites

With regulations requiring immediate action for all new or expanded well sites, Kathairos technology is actively being deployed to ensure full compliance from day one. Tanks are scaled to match site-specific consumption needs and are easily adaptable to changes in production volumes, eliminating the inefficiencies of oversized, costly systems.

Designed for harsh climates and remote locations, the Kathairos system requires no external power source, no maintenance, and no moving parts—ensuring 100% reliability with low ongoing costs. Once in use, there are no parts replacements, no risk of theft-related disruptions, and no unexpected downtime, making it the most dependable and cost-effective emissions reduction solution on the market.

Discover how Kathairos can help you meet methane requirements at new facilities while optimizing your operations.

To learn more, contact:

Mitch Jones
Technical Account Manager
mjones@kathairos.com

John “Bunkie” Westerheide
Chief Revenue Officer
jwesterheide@kathairos.com