

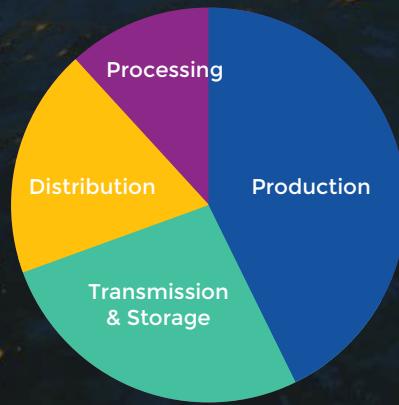


MethaneTrack™

An end-to-end Industrial Internet of Things (IIoT) system to detect and identify the location and size of methane leaks.

About Methane

Methane is a potent greenhouse gas second only to carbon dioxide. However, on a 100-year timescale, methane has 28 times greater global warming potential than carbon dioxide, and is 84 times more potent on a 20-year timescale. Methane is responsible for about 30% of the rise in global temperature since the industrial revolution.



The energy sector was responsible for nearly 130 Mt of methane emissions in 2023 – more than one third of the total amount attributable to human activity and second only to agriculture (around 145 Mt in 2017).

Sources: IEA Global Methane Tracker 2024 | ICF: 'Making sense of the noise', 2015

The Business Cost of Methane Emissions to Oil & Gas Companies

\$1B
ANNUALLY

LOST PRODUCT

Methane emissions can cost energy producers \$1 billion annually in lost commercial value. By taking action to stop methane leaks, the oil and gas industry can save money and slow climate change.

Source: The Stanford Report | March 13th, 2024



REGULATORY FINES

The Waste Emissions Charge (WEC) is a fee that applies to methane emissions from petroleum and natural gas systems. The WEC starts at \$900 per metric ton of methane in 2024, increasing to \$1,200 per metric ton in 2025, and \$1,500 per metric ton in 2026 and later.

Source: EPA.gov

Reducing methane emissions is one of the most effective ways to quickly slow the rate of climate change.

84X

more potent
than CO₂

30%

rise in global
temperatures
due to Methane

Why Methane Monitoring?



Environmental Responsibility

Methane is a potent greenhouse gas, and monitoring emissions helps reduce climate impact.



Regulatory Compliance

Many regions have already – or are starting to – require methane emissions monitoring and reporting and have announced fines for non-compliance.



Operational Efficiency

Identifying leaks and inefficiencies can lower operating costs.



Investor Relations / Reputation Management

Reducing emissions enhances public perception and industry credibility and is attractive to ESG-focused investors.

Introducing MethaneTrack™

Improve operational efficiency and quickly mitigate emission events with real-time detection, localization, and quantification of methane emissions*.



View real-time emissions measurement data



Confident compliance with legislation



Reduce the cost of LDAR & improve operational efficiency



Improve on-site safety by eliminating manual monitoring



Receive prioritized alerts to enable rapid repair for reducing emissions



Gain insights on failure causes for continual improvement



Automatic calculation & reporting on emissions to reduce the costs of tracking methane inventories



Ensure protection of sensitive emissions data

* NevadaNano also offers EmissionsTrack™ for Hydrogen and all Hydrocarbons emissions monitoring.

MethaneTrack™ IIoT System Overview

The MethaneTrack™ IIoT hardware consists of a gateway, an anemometer, and multiple endpoints deployed at each site.



1

MethaneTrack™ endpoints sample the surrounding air, measuring gas concentrations.

2

Encrypted data is transmitted to the cloud, where proprietary Leak Source Isolation™ algorithms analyze the data, along with the wind data from the anemometer, to quantify the leak size and pinpoint the leak location.

3

MethaneTrack's™ dashboard analytics and reporting platform visualizes the data and automatically alerts the right people that an emission event has occurred.

The MethaneTrack™ Endpoint

Precise, portable, and virtually maintenance-free



A complete “Fix-and-Forget” solution

- **No field calibration**
Immunity to saturation and poisoning and no field calibration eliminates the prohibitive cost of quarterly calibration trips & sensor replacements.
- **Highly accurate detection powered by The MPS™**
Detection range from 50 to 1M ppm with built-in environmental compensation for temperature, relative humidity, and pressure for near-zero false positives.
- **Very wide operating range & self-testing**
-40°C to 75°C operating range with up to 100% relative humidity. Built-In Self-Test (BIST) capability continuously evaluates the system to ensure it is operating to specification.
- **5-year battery life and 15-year sensor life**
No wiring and long battery and sensor life reduces the need for frequent on-site visits and ensures uninterrupted monitoring.
- **Certified as *Intrinsically Safe***
Class 1, Div. 1 and Zone 0 certified and global safety certifications such as FM, CSA, IECEx, ATEX, and IP65+.



5-YEAR
BATTERY LIFE



15-YEAR
SENSOR LIFE



Simple and efficient installation in minutes

- ✓ Mounted onto existing infrastructure
- ✓ No need for wiring.
- ✓ A typical site installation can be completed by a single technician in just a few hours – enabling installation of several sites per day per installer.

Close-Proximity, Continuous Monitoring™

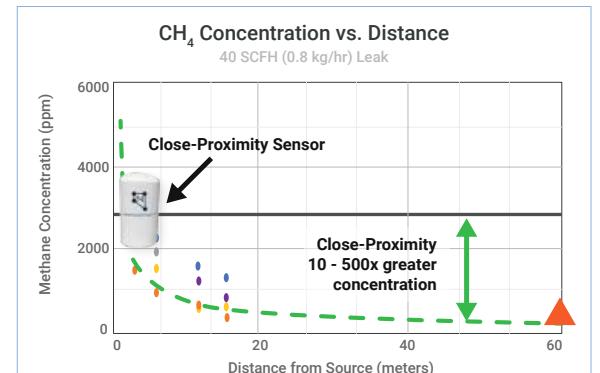


WITH PROXIMITY COMES ACCURACY

MethaneTrack™ endpoints are certified **Intrinsically Safe**, which means they can be **installed inside the hazardous area** and mounted next to--or even on--a potential leak source.

NevadaNano calls this method *Close-Proximity Continuous Monitoring*™ - a breakthrough approach that enables immediate detection to **obtain the most precise measurements of emission location and emission rates**, due to proximity to the emission source.

- Immediate detection before the wind dilutes and distorts the gas plume
- Ultra-low false positives
- Highly accurate emission localization
- Best in class quantification of the emission rate





Improve LDAR efficiency and minimize risk of fines with continuous, remote monitoring

Technicians are directed to the leak location, reducing the time they spend on-site and increasing the speed at which repairs can be conducted.

With real-time alerts and detailed analytics, operators can address issues swiftly and prevent costly emissions events before they escalate.

- ✓ Eliminate manual monitoring
- ✓ Fewer site trips
- ✓ Less time on-site
- ✓ Dramatically speed-up time to repair

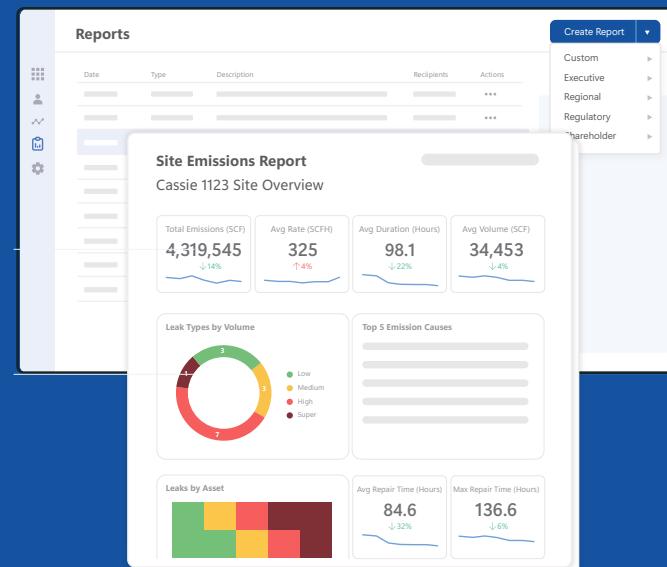
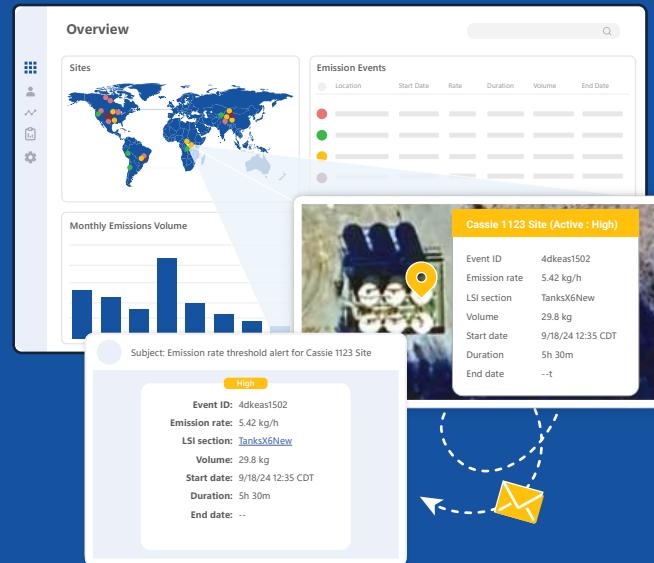


Ensure the protection of sensitive data with multi-layer security

- ✓ Single Sign-On (SSO) multi-factor authentication
- ✓ Customizable Role Based Access Control (RBAC)
- ✓ Comprehensive data encryption of data
- ✓ Vulnerability and penetration testing

MethaneTrack™ Dashboard Analytics & Reporting

Emissions tracking & compliance made easy



Empowering teams to seamlessly work together

- Monitor all levels from enterprise to site and assets.
- Visualize the location and size of emissions.
- Real-time alerts automatically notify the right people.
- Enable users to focus on their area of responsibility.
- Distinguish between operational and fugitive emissions.

Simplified regulatory compliance with customizable reports

- Reduce the cost of tracking and reporting emissions with automatic tabulation of total emissions.
- Validate emissions compliance performance with complete, historical emissions records for individual sites, regions, and countries to support OGMP activity, comply with EPA regulations 0000b & 0000c, and Fit for 55 legislation.
- Meet the needs of different stakeholders such as operators, executives, regulators, and shareholders, with pre-built and configurable reports.

National Gas Transmission Extends MethaneTrack™ Monitoring Pilot at Bacton Gas Terminal with Great Success



Installation of 155 endpoints in just 3 days



Multiple leaks detection & notification



Leak locations confirmed

Overview

A large site trial to test the MethaneTrack™ system with National Gas Transmission to detect, locate, and determine the size of leaks occurring at the Bacton Gas Terminal. It was required that each detected leak would include start and stop times and be visualized in an easy-to-read manner that could allow Bacton engineers to investigate the causes of the leak and, if possible, address the cause and fix the leak.

Rapid Setup and Deployment

With such a large site, 155 endpoints were installed to monitor 7 key leak areas, with 2 anemometers, all connected to 2 LoRa gateways, for seamless data integration and cloud connectivity. Due to the battery enabled endpoints, installation of 155 endpoints was in just 3 days, and required no additional wiring or affected any operational teams on site.

Results

During the 6-month deployment at the Bacton Terminal, NevadaNano's MethaneTrack™ system detected a total of 161 leak events ranging from less than 1 scfh (0.03 kg/hr) up to 9.1k scfh (231 kg/hr). Total emissions from the monitored portions of the site were 9,990 kg during this period.

The 161 leaks that were detected were those normally present at the site, ranging from seals beginning to leak, operational venting and recompression, and fugitive emissions. On-the-ground investigations performed by site engineers confirmed that the MethaneTrack™ location was typically within 5m of known leak locations and was able to consistently detect persistent emissions greater than 1.0 L/min and occasionally detect leaks as small as 0.2L/min.

Next Steps: Trial Extended & Expanded

National Gas Transmission has extended the trials of both sensor deployments, using the Bacton install to learn more about how the system can be integrated with site operations, and the Future Grid install to develop the hydrogen and hydrogen-blend detection capabilities of the system.



The methane aspect of the project was a great success – we have shown that the system can be deployed with relative ease across our AGI sites, which will ultimately enable significant reductions in methane emissions from the network.

Additionally, the live field work to test the system's hydrogen capabilities is a truly innovative first step towards the safe operation of a hydrogen network – ensuring we can minimize emissions from future hydrogen sites.

More work is needed across the industry in the hydrogen detection space, and we are proud to work with NevadaNano to develop their promising technology.

Alistair Carvell
Innovation Engineer
National Gas Transmission

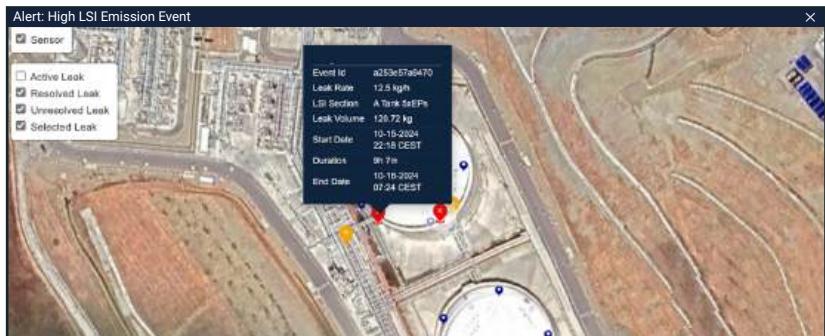
Global Energy Producer in Europe Chooses MethaneTrack™ to Monitor Floating Roof Tanks to Minimize Fugitive Emissions



Installation of 10 endpoints in just a few hours

Leak ID	Leak Type	LSI Section	Start Date (2024)	Leak Rate (kg/h)	Duration	Leak Volume (kg)	End Date (2024)	Recurrent Date (2024)	Event ID
LSI-0000000000000000	High Priority	A Tank 5sEPs	10-01-2024 09:39 CEST	15	1h:30m	2992	10-03-2024 16:31 CEST		0000000000000000
LSI-0000000000000001	High Priority	A Tank 5sEPs	10-04-2024 14:49 CEST	11.2	2h	0.00	10-04-2024 14:49 CEST		0000000000000001
LSI-0000000000000002	High Priority	A Tank 5sEPs	10-05-2024 07:04 CEST	12.4	2h:30m	99.98	10-05-2024 14:27 CEST		0000000000000002
LSI-0000000000000003	High Priority	A Tank 5sEPs	10-05-2024 23:06 CEST	12.8	0h:30m	100.72	10-06-2024 01:34 CEST		0000000000000003
LSI-0000000000000004	High Priority	A Tank 5sEPs	10-05-2024 04:19 CEST	15	0h:30m	10.64	10-05-2024 04:19 CEST		0000000000000004
LSI-0000000000000005	High Priority	A Tank 5sEPs	10-05-2024 10:48 CEST	4.4	0h:30m	1.56	10-05-2024 10:48 CEST		0000000000000005

Leak detection & notification



Alert showing multiple leak locations and volume of a selected leak

Overview

A major global energy producer has chosen NevadaNano's MethaneTrack™ continuous monitoring solution to help detect and mitigate costly emissions from their floating roof tanks.

Rapid Setup and Deployment

Ten endpoints were installed along with 1 anemometer, connected to 1 LoRa gateway for seamless data integration and cloud connectivity. Due to the battery enabled endpoints, installation of the endpoints were completed in just a few hours, and required no additional wiring or affected any operational teams on site.

Immediate Leak Detection & Localization

During the 2 months after the MethaneTrack™ system was online, the system reported several LSI events.

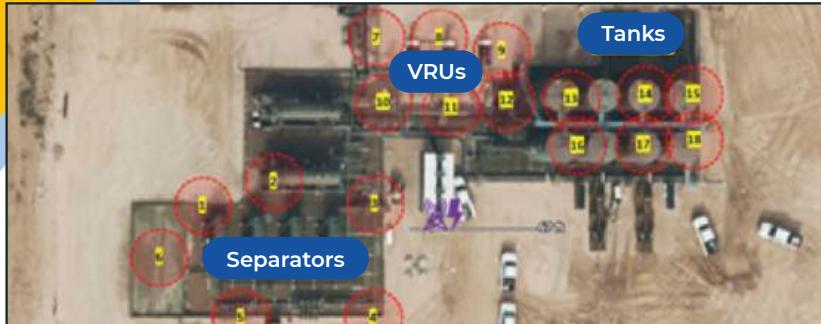
By looking at the emission data and comparing it to tank fill levels during the leak events, operators determined there must be some damage to the tank wall at a certain height.

On-the-ground investigations performed by the operators confirmed that there was damage in the tank wall in two locations.

Results

MethaneTrack™ allowed the operators to fill the tank with confidence to minimize fugitive emissions, regardless of the level of product in the tank.

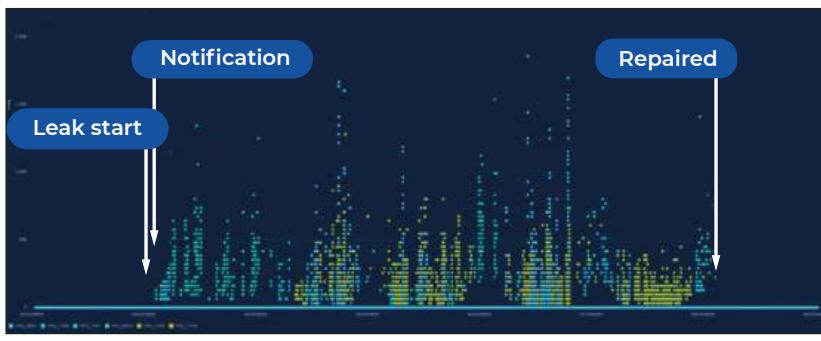
MethaneTrack™ Pilot Program in Permian Basin Achieves 95% Reduction in Methane Emissions



Installation of 18 endpoints in under 3 hours



Alert showing location and volume of leak



Real-time emission event data

Overview

Large upstream customer in the Permian Basin seeking to enhance environmental responsibility and operational efficiency engages NevadaNano for a MethaneTrack™ pilot program.

Rapid Setup and Deployment

Quick Installation: Eighteen MethaneTrack™ endpoints were installed and online within 3 hours, meeting customer requirement of simple, quick, and easy setup.

Immediate Leak Detection & Localization

Real-Time Detection: MethaneTrack™ Identified a significant leak event immediately after commissioning.

Precise Repair Guidance: Pinpointed leak location in VRU area to direct repair team to the exact leak source

Results

Fast Resolution: Leak repaired within 5 days, with a 95% decrease in emissions for the leak event.

Sustainability Impact: Showed measurable progress toward facility's environmental goals.

Operational Efficiency: Reduced potential long-term costs associated with prolonged emissions.

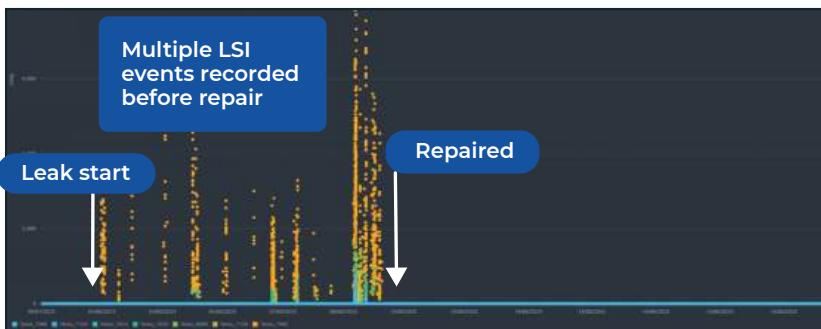
Thief Hatch Leak Detected by MethaneTrack™ Quickly Identified, Resulting in Rapid Repair



MethaneTrack™ endpoint mounted on tank near thief hatch



Alert showing location and volume of leak



Real-time emission event data

Problem

Tank and thief hatch emissions contribute to more than half of the greenhouse gas (GHG) emissions in the upstream oil and gas sector.

Solution

Close-Proximity Continuous Monitoring™

Customer Installation

MethaneTrack™ endpoints installed just above 6 tank thief hatches at a client site in Texas.

Leak Detection & Notification

Real-Time Detection: Identified a several leaks, within the first 24 hours of installation.

Precise Repair Guidance: Directed customer to check a specific thief hatch location.

Results

Technician confirmed identified thief hatch had a damaged seal and repaired it, minimizing environmental impact and lost product.

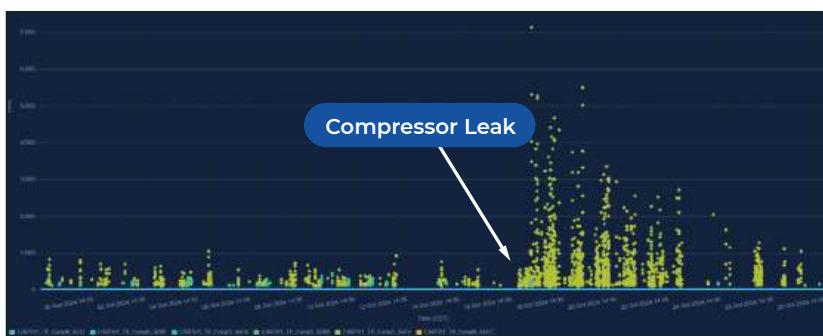
MethaneTrack™ Helps Customer Identify and Control Leaks from On-Site Compressors, Reducing Emissions Significantly



MethaneTrack™ endpoint mounted on tank near compressor



Alert showing locations of multiple leaks



Real-time emission event data

Problem

Compressor monitoring is required for regulations and compliance. While they are a significant source of leaks, they do not leak continually so periodic monitoring is unlikely to detect issues.

Solution

Close-Proximity Continuous Monitoring™ around the compressor to monitor drives, slip, shafts, joints, relief lines and seals.

Rapid Leak Detection & Localization

Real-Time Detection: Identified leakage coupled with compressor usage and run time data.

Precise Repair Guidance: Pinpointed the leaking compressor and where on the compressor, to dramatically improve time to repair.

Results

Pattern Detection: Allowed customer to see time-of-day and day-of-week when leaks were occurring.

Sustainability Impact: Identified assets that required replacement or upgrades.

Operational Efficiency: Link to compressor run-time data provided enhanced leak analytics and validation.

MethaneTrack™ Solves Emissions Challenges with Close-Proximity Monitoring Near Pump Jacks and Well Heads



MethaneTrack™ endpoint in close proximity to compressor



Alert showing leak quantification and location

Problem

How to detect emissions at the well head, when the gas dissipates at a distance 10 feet from the leak source.

Solution

Close-Proximity Continuous Monitoring™
MethaneTrack™ endpoints secured on existing pump jack and well head infrastructure.

Rapid Leak Detection & Localization

Real-Time Detection: Identified a significant issue other technologies failed to detect or localize.

Precise Repair Guidance: Pinpointed which pump jack shaft was producing fugitive emissions to dramatically speed up time to repair.

Results

Fast Detection
Leak identified within minutes

Sustainability Impact
Showed measurable progress toward facility's environmental sustainability goals.

Operational Efficiency
Dispatch team knew exactly where to go to repair. Reducing LDAR costs.



About NevadaNano

NevadaNano provides safety and climate solutions for many of the world's largest corporations, with innovative multi-gas sensing products and continuous IoT monitoring systems based on our proprietary MPS™ sensor platform.

More information at www.nevadanano.com

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