EARTHVIEW

Formal Alternative Test Method

29 August 2025

Earthview Corporation: Periodic Screening System

1 Scope and Application

1.1 Scope

This method describes the required information and procedures for implementation and operation of the Earthview BluBird continuous gas monitoring system for periodic screening of site-level methane emissions at oil and natural gas production facilities.

This alternative test method is applicable for demonstrating compliance with the procedures in 40 CFR §60.5398b for fugitive emissions components affected facilities and compliance with periodic inspection and monitoring requirements for covers and closed vent systems, specifically demonstrating compliance through periodic screening in 40 CFR 60.5398b(b), as approved, per 40 CFR §60.5398b(d). This alternative test method applies to sites of any size and equipment configuration, including single- and multi-wellhead sites, compressor stations, and production facilities.

1.2 Application

1.2.1 This method describes the Earthview BluBird continuous gas monitoring system ("BluBird CMS") suitable for periodic screening at minimum detection thresholds of methane emissions at 5 kg/hr, 10 kg/hr, and 15 kg/hr. The BluBird CMS is a combination of field-deployed devices (the "BluBird node"), central data-processing facility, and client dashboard interface based on industrial internet of things (IIoT) technology. Each sensor package consists of an array of metal oxide semiconductor sensors (MOS), temperature and humidity sensors, and an anemometer. Methane emissions are detected through transport by wind or diffusion from emission sources to one or more sensor units. Active, consistent air flow into the sensor array is maintained by an air pump. One or more BluBird nodes are deployed on site. Each BluBird node is self-contained, powered by solar and battery or on-site power, and requires no routine maintenance.

1.2.2 The method is intended to ascertain whether site component emissions and combined site emissions of methane are below prescribed threshold levels.

1.2.3 The use of this test method is in keeping with the Environmental Protection Agency's 40 CFR part 60 New Source Performance Standards, Subparts OOOO, OOOOa, and OOOOb. The method is also applicable to the Environmental Protection Agency's Emission Guidelines OOOOc for the Oil and Natural Gas Source Category.

1.2.4 The test method applies to emission of methane (Table 1-1) from oil and gas facilities. Per approval by the Administrator, this method can be applied in place of monitoring and inspection of covers and closed vent systems in either §60.5416a or §60.5416b, and/or relevant fugitive monitoring requirements in either §60.5397a or §60.5397b. The method may be used for monitoring requirements under §60.5397c and §60.5416c if a tribal, local, or state agency

Earthview Corporation | 908 Dragon St Dallas TX 75207
303-438-8574 | eathview.io

includes the model rule for emission guidelines included in approved applicable cases such as State Implementation Plans.

1.3 Analyte List, CAS Numbers, Matrices

Table 1-1: *Analyte List, CAS Numbers, Matrices*

Compound Name	CAS number	Matrices
Methane	74-82-8	Air/gas emissions

1.4 Method Sensitivity

1.4.1 This test method addresses methane emission detection levels at rates of 5 kg/hr, 10 kg/hr, and 15 kg/hr with a 90% probability of detection. These levels are the threshold levels used to address prescribed regulatory responses. The inherent sensitivities of the BluBird CMS are listed in Table 1-2.

The operator is to develop monitoring plans specific for each site and select the methane emission detection level appropriate for site operating conditions, per the guidelines listed in Table 1 to Subpart OOOOB of part 60, title 40.

Table 1-2: *Method Sensitivity*

Detection Sensitivity	At least 0.4 kg/hr methane
Concentration Sensitivity	0.5 ppm methane
Sampling Temporal Resolution	Once per 30 seconds

1.4.2 This method is applicable to crude oil and natural gas sources, including compressor stations, centralized production facilities, and well sites, and is applicable for all oil and gas production basins in the United States.

1.4.3 This method characterizes emissions at a facility level spatial resolution, to confirm detection of fugitive emissions within the local boundaries of the site. Potential source locations within the site are determined using calculated emission rates as a function of wind direction and mapped locations of equipment on the site.

1.5 Data Quality Objectives (DQO)

Adherence to the requirements of this method will ensure the data supporting the technology's objective will be accurate and of known quality. The technology's objective is to screen for fugitive emissions from oil and natural gas production facilities that exceed the emissions detection limit and provide an alert to an operator that triggers a leak detection and survey response. A 24-hour period or the amount of time required to sample the facility will be used for the periodic screening period. The analysis identifies upwind emissions and excludes them from the estimated site emissions.

2 Summary of Method

2.1 Description of System

The BluBird CMS consists of a network of measuring and reporting fixed instruments, BluBird nodes, designed to detect, localize, and quantify methane emissions in real time. In this document, we refer to the field instrument portion of this system as the BluBird node, and the cloud-based software as the Gridded Pad Analysis and Quantification System (GPAQS). The BluBird Continuous Monitoring System (CMS) refers to the entire system - field sensors, firmware, cloud-based software, and cloud-based data dashboard. The workflow of the system from sampling, detection, localization, quantification, notification, and verification is described at a high level in Figure 1.

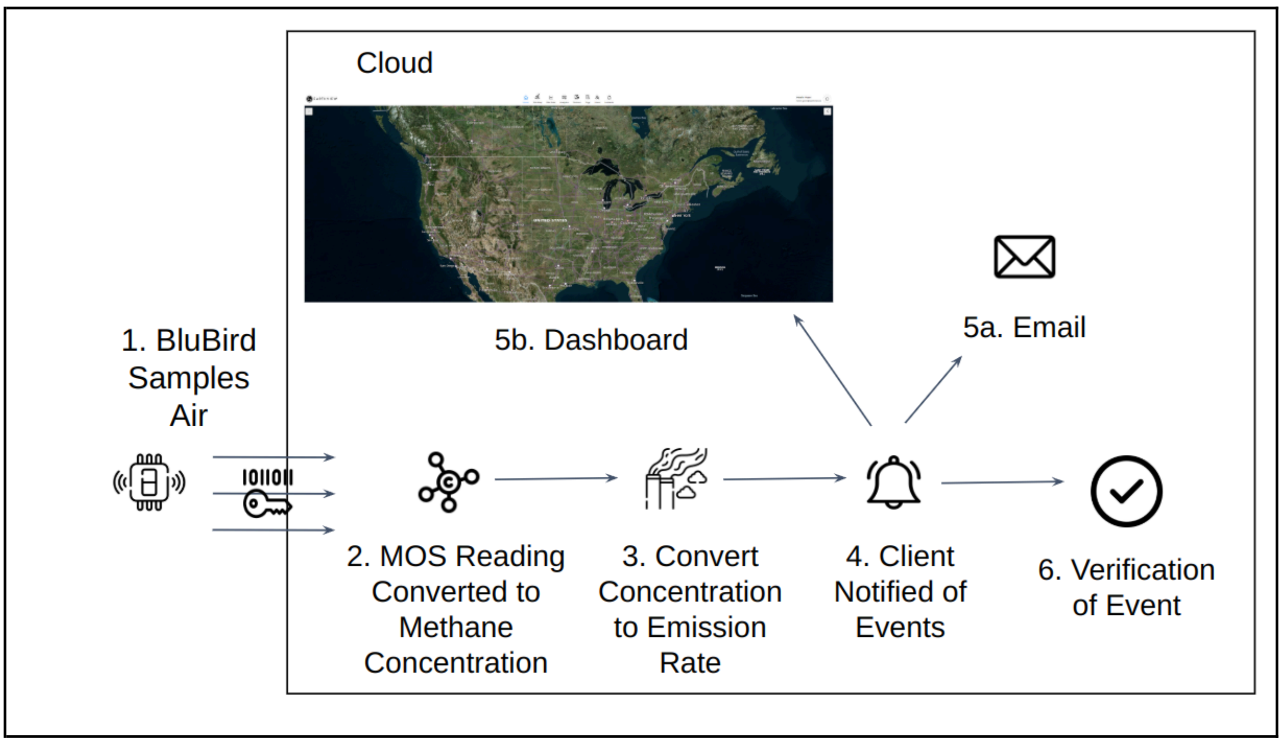

Figure 1*: High level workflow of the BluBird CMS.*

2.1.1 BluBird Node

The BluBird node is the physical device that takes methane measurements in the field. This includes the MOS sensors, mast, intake, stand, power system, anemometer, temperature, and humidity sensors, SD card, communications equipment, and pump. The BluBird node uses

MOS (metal oxide semiconductor) sensors to detect the presence of methane in ambient air. These MOS sensors are the primary components responsible for measuring analyte concentrations, as their quantifiable resistance changes with the introduction and cessation of subject gas species. The BluBird node uses a pump to draw in air from the atmosphere to ensure a consistent volume of approximately 0.3 liters per measurement cycle. The sample enters a sealed chamber where measurements are taken, including humidity, temperature, pressure, and the resistances of several MOS sensors. Methane concentrations are determined by a continuous process that estimates the “clean-air” MOS resistances. A significant difference in the estimated clean-air resistance and the actual measured resistance indicates the presence of analyte species. The other measurements like temperature and humidity are required to estimate this clean-air resistance.

2.2 Deployment

This method describes the deployment of the BluBird nodes, including the determination of the number of sensors needed for each site and the placement of these devices within 100 meters from the production equipment. This distance threshold is based on plume dispersion modeling of the distance at which an emission rate of 1 kg/hr can be detected by the BluBird CMS under typical atmospheric conditions (defined as a wind speed of 2 m/s and neutral surface layer stability.)

2.3 Emissions Measurement

The BluBird CMS senses methane via transport of gas from the leak source(s) to the BluBird node(s) by winds and/or diffusion processes. Leak rates and source locations are calculated by Earthview using inverse dispersion modeling, consisting of either the standard Gaussian plume model or variants of the Gaussian model optimized for low wind speeds and/or short distances between the leak source and the BluBird nodes. BluBird nodes measure gas concentrations, wind speed, and wind direction at each node, along with other information useful for determining atmospheric stability and gas dispersion conditions. These are determined for each observation within Earthview’s cloud-based data processing system (GPAQS). Earthview uses GPAQS to map the production facility onto a grid, with each grid cell defined according to whether it contains a potential leak source, along with additional information about the source (such as equipment type, height, etc.). GPAQS uses this grid-based information to evaluate leak rates from a finite set of potential leak locations. Earthview uses statistical analysis of the aggregated data across multiple sensors deployed at a site to determine the most likely leak source locations. The resulting distance between source and sensor, along with local winds and dispersion conditions, is used to estimate mass emission rates of methane.

3 Definitions of Method

3.1 Air sample refers to the volume of air drawn into the BluBird node and exposed to the BluBird node sensors, followed by release of the sample into the outside air.

3.2 TDLAS refers to a class of tunable diode laser spectrometers that Earthview uses to provide reference methane concentrations in the field and laboratory.

3.3 BluBird CMS refers to Earthview's combination of field sensor unit (BluBird node) and the companion edge software and cloud-based software that make up the BluBird continuous monitoring system for methane.

3.4 BluBird dashboard is the user interface that allows Earthview staff and customers to display, download, and interact with site data.

3.5 BluBird node is the field instrument portion of the BluBird CMS that is deployed on site. This includes the sampling mast, the MOS sensor chamber, pump and air tube subsystem, power system, communications system, the anemometer, and temperature, and humidity sensors.

3.6 Concentration sensitivity is taken to be the smallest increment of methane concentration that can be reliably determined above the general noise level. Concentration sensitivity of the BluBird CMS, in terms of a concentration by volume, is estimated to be approximately 0.5 ppm.

3.7 Continuous monitoring defines the nature of the BluBird CMS, which involves continuous measurement of air samples on a site. Continuous is defined here as operating 24 hours per day, every day, with a data transmission rate of once per 30 seconds.

3.8 Data quality indicators refer to the set of checks that Earthview carries out on sensor data and derived parameters.

3.9 Detection limit is defined as the lowest practical limit of a measurement that is repeatable and consistent with other sensor behavior. For BluBird CMS, detection limits are approximately 0.5 ppm of methane concentration or better than the 1 kg/hr detection limit at 90% probability of detection.

3.10 Dispersion coefficients are key parameters of the Gaussian plume model that define the lateral and vertical spread of methane within a Gaussian plume.

3.11 Earthview is the commercial vendor who created the BluBird CMS, and which contracts with a site operator to deploy, maintain and operate the BluBird CMS.

3.12 Earthview cloud computing center is where BluBird node data from the field is transmitted for processing and analysis.

3.13 Emission rate quantification is the series of data processing and analysis steps that Earthview uses to estimate methane emission rates using the BluBird node-measured methane concentrations and other site measurements.

3.14 Inverse Gaussian plume modeling refers to the mathematical model used to calculate emission rate from measured methane concentration.

3.15 Mass sensitivity is taken to be generally equivalent to the smallest increment of mass that can be reliably detected above the general noise level. Mass sensitivity of the BluBird CMS, in terms of a methane emission rate, is estimated to be approximately 0.1 kg/hr.

3.16 Metal oxide semiconductor sensor is the type of sensor(s) used in the BluBird node to measure methane and volatile organic compound (VOC) content in the air samples.

3.16.1 MOS sensor refers to metal oxide semiconductor sensor.

3.16.2 MOS 1/ gas1 refers to one of three MOS sensors contained in the BluBird node sensor chamber.

3.16.3 MOS 2/ gas2 refers to one of three MOS sensors contained in the BluBird node sensor chamber.

3.16.4 MOS 3/ gas3 refers to one of three MOS sensors contained in the BluBird node sensor chamber.

3.17 Monte Carlo simulation refers to the approach that Earthview uses to assign a range of uncertainty to estimated emission rates.

3.18 Screening Period refers to the time required for all equipment locations of a site to be sampled by the network of BluBird nodes.

3.19 Sensor chamber is the sealed chamber within a BluBird node, where air samples are measured.

3.20 Sensor Read is a packet of data sent from the BluBird node to the Earthview Cloud for calculating methane concentrations.

3.21 Earthview Technician is the Earthview personnel trained in required Standard Operating Procedures (SOPs) to install, register, and maintain BluBird devices in the field.

4 Interferences

Table 4-1: *Interferences Applicable to the BluBird CMS Method*

Condition	Parameter Affected	Situation	Mitigation
Site Access	Gas and meteorological	Requires access to the production site	Can be limited to perimeter of the site

	measurements; cell connectivity		
Structure Interference	Methane and meteorological measurements	Structures between the BluBird node and emission source affects gas transport and quantification	Position BluBird nodes accordingly
Structure Interference	Cell connectivity	Structures between the BluBird node and emission source can affect cellular communication	Position BluBird nodes accordingly; use enhanced cell antenna
Offsite emissions	Methane measurements	Offsite methane emissions need to be excluded from site emissions assessment	BluBird CMS detects offsite methane presence and subtracts it from the site-measured emissions
Intermittent cellular coverage	BluBird CMS data transmission	Cell connectivity is needed for data transfer and system monitoring	During periods of dropped cell coverage, data are stored onboard individual BluBird nodes and then transmitted in full once cell connectivity is reestablished
Node damage due to site activities, animals, vandalism	Methane and meteorological measurements	Nodes can be damaged by vehicle traffic, animals, or other factors	Damage is determined by automated system monitoring. Damaged systems are repaired in the field or replaced by Earthview
Solar panel obstruction	System power	Extreme, persistent snowpack, vegetation growth, or installation of new structures can impact solar charging	Solar charge rate and battery voltage are tracked by automated system monitoring, and addressed by

			Earthview if necessary
Extreme wind	BluBird node operation	Extreme wind speed (appx. > 75 mph) may disrupt or dislodge the node.	Omit data during periods of extreme wind. Repair device if disrupted or dislodged.
Extreme low air temperature	BluBird node air pump operation	Operation at air temperatures below -40 deg. F can damage the air pump	Earthview can place the pump in a sleep mode
Low or high relative humidity	Digital twin sensor modeling	Sensor-chamber reported humidity falls below 0.5% or above 99%	Readings are excluded from emission rate calculations
Sour Gas	Methane Measurement	Exposure to silicon or high concentrations or sulfides can damage the sensor.	Node conditions are monitored and replaced in the highly unlikely event of sensor damage.

4.1 Planning for Interferences

Installation and operation of the method are carried out by Earthview, after consultation with the site operator. Prior to installation, Earthview and the operator review the site characteristics, including access, locations of equipment, and any special situations that might need to be accommodated.

4.2 Site Interferences

4.2.1 Site Access

Installation and operation of the Earthview BluBird CMS do not have any requirements beyond normal access to the site.

4.2.2 Site Configuration

Earthview uses company developed workflows to determine optimal site configuration. The workflows are detailed in Section 8.1.

4.2.2.1 Structure Interference

Structures located between an emission source and a sensor node will affect wind flow during the transport of methane from source to sensor. The added mixing due to turbulence is a factor in the accuracy of emission rate calculations. Rate calculations will be most accurate for relatively open sites.

4.2.2.2 Structure Cellular
Placement will also consider the potential for possible obstruction of cellular transmission due to large structures.

4.2.3 Communications Quality
The method requires a stable communication method from the field to Earthview Cloud Servers. This can be accomplished via cell, Wi-Fi or satellite.

4.2.4 Off-site Emissions
Methane emissions that originate from a location other than the target site itself need to be identified and excluded from emissions calculated for the site. The BluBird CMS addresses this automatically, using wind direction to determine which node(s) are at the upwind edge of the site. If elevated concentrations are observed at these nodes, this background concentration is subtracted from concentrations measured downwind. More detail is provided in Section 12.2.

4.3 Weather Interferences
The BluBird CMS operates under a broad range of weather conditions and is tolerant of extreme conditions. Operating ranges are noted in the BluBird node specification sheet (Table 9-1) included in Section 9. A heavy, persistent snow cover may temporarily reduce the effectiveness of the solar panels. Snow or rime buildup on the wind sensors may temporarily affect the wind readings.

4.4 Sensor Performance Interferences
MOS sensors such as those used in the BluBird node are known to be highly sensitive, but affected by a variety of factors that can mask this sensitivity (Schutz et al., 2017). Key influencing factors are noted below.

4.4.1 Humidity
Moisture content of the air sample influences the response of the gas sensors used (e.g., Abdullah et al., 2020; Wang and Zhou, 2022), and so must be addressed as part of data processing. The approach used for this is outlined in Section 12.1.1.

4.4.2 Sensor Poisoning
MOS sensors are long-lasting and resistant to contamination. However, exposure to high concentrations of certain gases or contaminants can permanently alter the sensor surface, reducing its sensitivity. These include substances containing silicone (which can be found in some lubricants, desiccants, and hydraulic fluids, for example), and prolonged exposure to high concentrations of sulfur-containing gases, including hydrogen sulfide and sulfur dioxide. However, prolonged exposures to levels sufficient to cause poisoning are very unlikely in an open setting such as well pads.

5 Safety

This method may not address all potential safety scenarios associated with its use. It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to performing this test method.

5.1 Site Safety

The sensor nodes operate autonomously. Earthview technicians are only required on site for network installation, occasional maintenance, and removal. Earthview technicians undergo any specialized training needed for site access. Standard safety practices are followed. In most cases, maintenance can be done by the operator's staff, with instructions provided by Earthview.

5.2 Precautions

When installing a node's fiberglass air intake mast, attention should be taken to not contact any overhead structures or wires. Earthview technicians are well-trained professionals with years of experience working in the oil and gas industry.

6 Equipment and Supplies

The following equipment and supplies are required for installation and are provided by Earthview. Other capabilities such as data processing and analyses are provided by Earthview's cloud computing system, with no extra requirements for specific equipment and supplies needed to interact with that system. QA/QC specifications are listed in Section 9, Table 9-1.

6.1 System Performance Specifications and Operating Ranges

Table 6-1: Performance specifications and ranges

Parameter	Component or Sub System	Accuracy	Specification or Range
Measurement reporting frequency	BluBird Node		~ 30 seconds
Air temperature[1]	Air temperature sensor (sensor chamber)	+/- 0.2° C	-40° to 125° C operating range
Relative humidity[1]	Air humidity sensor (sensor chamber)	+/- 1.5%	0-100% operating range; 0.5% to 99% processing range
MOS resistance	MOS Sensor Array (All MOS Sensors)	0.1% of reading	1000-120000 ohms processing range
wind speed	Wind Anemometer	+/- 1.5 m/s	0 to 35 m/s
wind direction	Wind Anemometer	+/- 11.3°	0 to 360°

[1] *Deployed within sensor chamber*

CH4 concentration measurement (avg. % absolute error; avg. absolute error)[2]	BluBird CMS	10% and/or within +/- 3 ppm	0 to 75 ppm
CH4 concentration measurement (avg. % absolute error; avg. absolute error)[3]	BluBird CMS	10%	75 to 200 ppm
CH4 concentration measurement (avg. % absolute error; avg. absolute error) 3	BluBird CMS	10%	200 to 500 ppm
CH4 concentration measurement (avg. % absolute error; avg. absolute error) 3	BluBird CMS	10%	500 to 1000 ppm
CH4 concentration minimum useable detection resolution 2, 3,[4]	BluBird CMS		0.5 ppm above background
CH4 concentration resolution	BluBird CMS		0.1 ppm

6.2 BluBird Node

BluBird nodes (Figure 2) will be supplied by Earthview for installation on site. Each of these nodes consists of the main components listed in Figure 2. The number of nodes used per site, and their positioning, are determined by Earthview and the customer, discussed in Section 8.

[2] *Based on comparison of co-located BluBird nodes with Aeris Sentinel reference-grade instruments in an outdoor field setting with single-blind simulated natural gas leak events. "Error" is defined here as the difference between the Aeris measurement and the BluBird CMS measurement. A portion of this error can be attributed to differences in air sampling locations and sampling times*

[3] *Based on laboratory measurements primarily using an TDLAS reference-grade instrument with calibration gas mixtures*

[4] *Based on CSU METEC ADED single-blind field testing using detection overlap criterion for single-release experiments for release rates up to 6 kg/h (see Maslanik et al., 2024; Ilonze et al., 2025; Maslanik, 2025).*

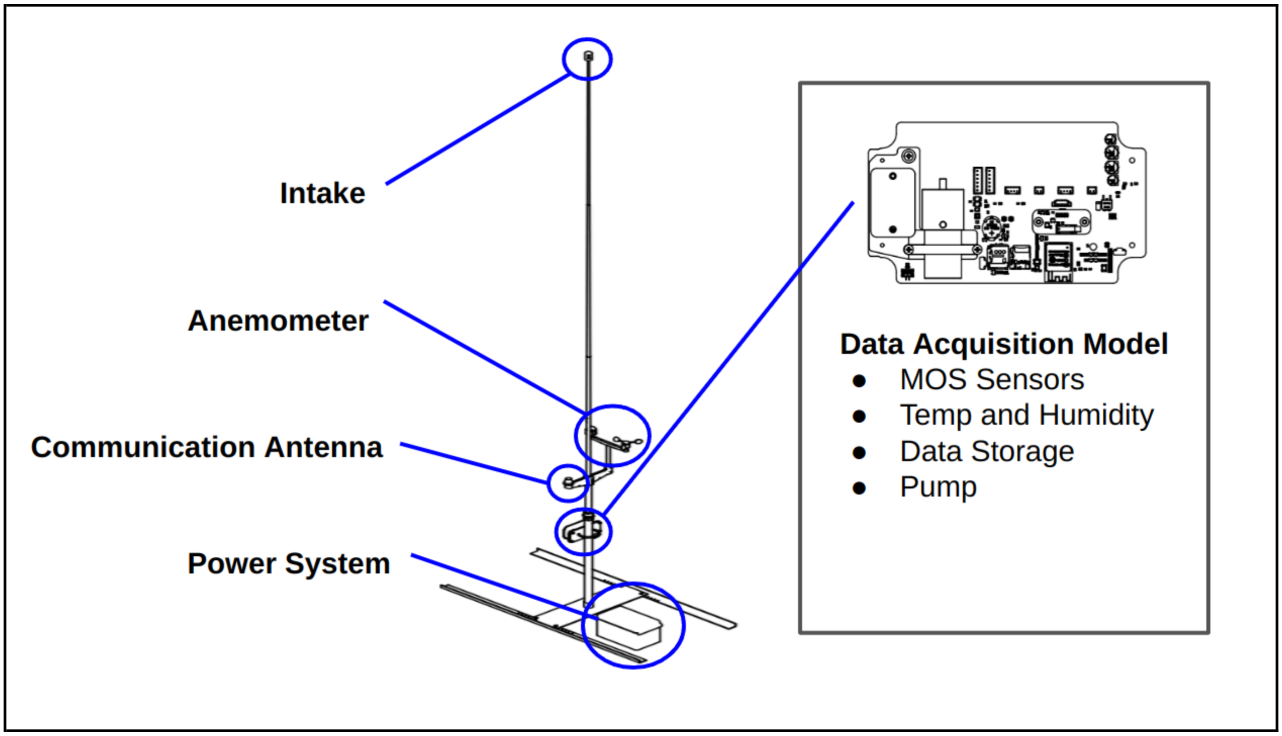

Figure 2: *Earthview BluBird node. Consists of a stand, solar panel, battery, instrument case, cellular antenna, wind sensors, and adjustable mast with air intake.*

6.2.1 Mast and Intake

The air intake uses a custom-designed intake mounted onto a fiberglass mast. Teflon tubing extends from the intake, through the inside of the mast, into a connection on the BluBird node enclosure. The standard installation height of the intake is approximately 15 feet. The sampling height may be increased if production equipment could not reasonably disperse to a 15-foot sampling height.

6.2.2 BluBird Stand

The Earthview BluBird node is placed in a pre-defined fixed location, as determined in section 8, to prevent directional and rotational movement.

6.2.3 Power System

Each BluBird node is equipped with its own power system, consisting of a solar panel and battery supply. In the event of insufficient sunlight, or other factors, the system can be configured to run off a wired connection.

6.2.4 Anemometer

Wind speed and wind direction are measured and reported by each BluBird node on a site. The standard BluBird node installation uses a wind anemometer installed at each device. Instrument specifications are provided in Table 6-1.

6.2.5 Data Acquisition Module
The data acquisition subsystem is housed in a water- and dust-resistant enclosure that mounts onto the support base (Figure 3). This enclosure encompasses the sensors that measure air samples, the air pump to draw in the air samples, and the system electronics that control operations, data transmission, onboard storage, power management, and data transmission.

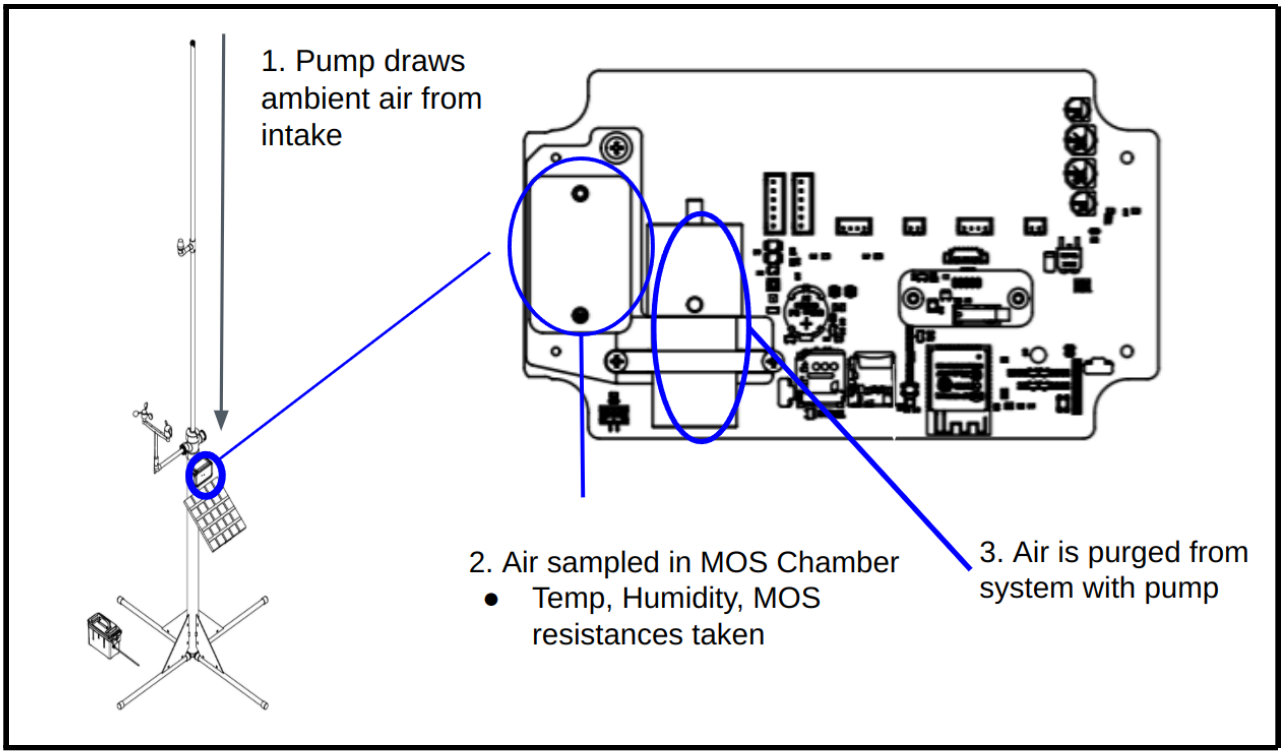

Figure 3: *BluBird node air flow system sampling.*

6.2.5.1 Air Temperature and Humidity
Operating specifications and accuracies of the temperature and humidity sensors are provided in Table 6-1. Temperature and relative humidity are measured by these instruments.

6.2.5.2 Pump
BluBird node uses a diaphragm-type pump (Figure 3) to pull air through the partial vacuum of the tubing, through the MOS sensor chamber, and out through the pump. The air passes through the sensor chamber before the pump to avoid potentially introducing contaminants such as lubricants or plastic outgassing from the pump into the air sample.

6.2.5.3 MOS Sensor Chamber
The MOS sensor chamber is the component that senses the presence of methane. There is an array of MOS sensors used that are responsive to methane at different concentration levels, and aids in the detection of VOCs. Electrical resistance is measured in the MOS sensor chamber,

from each of the MOS sensors, which is converted to methane concentrations in the BluBird CMS cloud.

6.3 Data Storage and Transfer

6.3.1 Onboard Data Storage

Each BluBird node includes a memory card to store data locally. If the cellular or Wi-Fi connection is interrupted, measurement data continues to be stored on the card. When Wi-Fi or cell coverage eventually returns, the data is then transmitted to ensure continuous sampling. [5]

6.3.2 Data Transfer

The underlying driver of the communications, time tagging, and positioning subsystem is that all data collected must be readily transmitted to the Earthview cloud processing center, augmented with necessary information including sample time stamps and device position. This is achieved by using a cellular modem equipped with GPS, along with Wi-Fi capability. A common modem integrated circuit (IC) is used that is capable of handling a variety of protocols.

6.3.3 Communication Equipment

The BluBird node has a small communications antenna that has both cellular and Wi-Fi capabilities. The default option is to use cellular to connect to the internet. The site's Wi-Fi can be used if cell reception is poor. Data packet sizes have been minimized to the lowest byte size possible to minimize data transmission costs. Different antennas are used depending on cell transmission quality.

6.4 Server Firmware Communications

The physical hardware is equipped with Earthview proprietary firmware that instructs the hardware how to function. The firmware has a wide range of functionality besides sampling for methane that aids in device health checks and ensuring a streamlined system. Firmware updates are carried out via cellular, so no maintenance visits are required to change operating modes or to add functionality.

6.5 Technician Installation Equipment

Earthview technicians will be responsible for the installation and occasional maintenance of BluBirds on a facility. The required equipment needed for installation includes all equipment from sections 6.1-6.4 and the following in Table 6-2.

Table 6-2: *Installation equipment needed for a BluBird installation on a facility.*

Equipment	Function
Mobile Device (cell phone, laptop, or tablet)	Register a device to a monitoring facility, confirm location, and validate data transmission.

[5] If an SD card is filled the oldest data is overwritten

GPS tool	Validate GPS coordinates of device location.
Compass	Validate the orientation of the wind anemometers and solar panel.

6.6 Bump Testing Equipment

The equipment necessary to perform a bump test on a BluBird is listed in Table 6-3.

Table 6-3*: Equipment needed to perform bump test on BluBird.*

Equipment	**Description**
Nafion Tubing	Bring calibration gas up to ambient humidity. At least 180 cm should be used. The calibration gas should have humidity within 5% of the BluBird node-reported humidity for outside air.
Tedlar Bag	Medium used to hold calibration gas for testing. The bag needs to be at least 5 liters in capacity.
Reference Gas Canister	Known concentration of methane, mixed with inert gas. Required mixtures include air-zero (nitrogen and oxygen with zero methane or other trace gases) and a known mixture of methane concentrations. At least 5 liters of each gas should be available per test. A methane concentration of at least 100 ppm is recommended.
Gas Regulator	Means of regulating the flow of gas into the BluBird. A flow rate of 0.5 liters per minute or less is recommended. A low flow rate allows more time for gas to approach outside-air humidity as it passes through the Nafion tubing.
BluBird	The BluBird node to perform methane bump testing on.
Clock	Method of recording start and stop times of bump test.
Connectors	Connectors for connecting the Nafion tubing, gas canister, Tedlar bag and BluBird node. Connectors such as pieces of tubing can be

	HTPE teflon, vinyl or rubber, but NOT silicone, since silicone will damage the MOS sensor.

7 Reagents and Standards
For calibration bump testing of the system, a calibration gas consisting of a known concentration of methane (100 ppm is recommended) in a standard air-zero mixture is employed, combined with a gas flow regulator with an approximately 0.5 liter per minute flow rate. The calibration gas must be humidified to within 5% of ambient relative humidity. (See Section 10.2 for a description of the recommended bump test procedure, including equipment and humidifying procedure.)

8 Sample Collection, Preservation and Storage
This section provides an overview of the BluBird deployment process, installation requirements, QA/QC checks, data collection procedures, and record keeping.

8.1 Site Planning
Prior to deployment, the site is diagramed with various georeferenced tooling, production equipment is identified and measured, historical wind information is collected, on-site and off-site interferences are identified, and Earthview's proprietary algorithm is run to identify the most optimal node configuration. All site planning will be done by Earthview in collaboration with the client. Site planning is recorded as defined in Section 8.2.3 with records maintained by Earthview and copies sent to the client.

8.1.1 Site GPS Coordinates
The latitude and longitude coordinates of the centroid and corners of the monitoring facility are collected in decimal degrees (DD) to the 6th. decimal place.

8.1.2 Equipment Information
The latitude and longitude coordinates and height of production equipment are collected in advance of installation. The size, shape and location of production equipment is collected either by the operator, an Earthview technician, by using georeferencing map tools, or drone imagery. If additional equipment is added to the site the operator must communicate this with Earthview, so placement can be optimized.

8.1.3 Historical Wind Information
Based on the location of the site, one year of weather information is collected from the nearest weather station[6]. This wind data includes the frequency, magnitude and direction of wind measurements. This wind information is sourced from a 3rd party.

[6] Earthview personnel may review the historical weather data beyond a year to confirm any outliers and may choose to use additional information to populate the historical wind information.

8.1.4 On-site Interferences

On-site interferences are identified and mitigated. Nodes may not be placed in a drive area (trafficked area where trucks will drive). Nodes are placed within 100 meters from the nearest production equipment. Nodes will not be placed in areas with solar interferences such as trees, tall tanks etc. Consultation with the client is done to ensure node placement does not interfere with site activity.

8.1.5 Off-site Interferences

Nodes will be strategically placed to filter out potential offsite methane emissions sources. For example, a landfill being in close proximity to a pad would need a device between the landfill and the site it is monitoring so it can create a perimeter of offsite and onsite emission sources.

8.2 Determining Number of Devices and Location

The number of devices and their location will depend on a variety of factors including the prevailing direction of the winds, the size and shape of the site, the location and height of production equipment and on-site and off-site interference considerations. The BluBird nodes will typically be placed along the perimeter of the site.

8.2.1 Algorithm

Earthview's proprietary algorithm for node placement, at a high level, works as follows. First pull the historical wind information for one year of data from the nearest weather station provided by a 3rd party. Identify the production equipment on site and mark the latitude and longitude coordinates and approximate heights. Identify the potential node locations, typically perimeter fence line positions. Place nodes to optimize the amount of time production equipment is upwind from the nodes and ensure the entire site can be sampled in under seven days. The inputs and outputs of the algorithm are displayed in Table 8-1.

Table 8-1: *Inputs and outputs of Earthview's site planning algorithm.*

Inputs	**Outputs**

• Potential node locations
• Production equipment (location and heights)
• Historical wind data (**not stored**)
	• Optimized node locations
	  o Number of nodes
	  o Position of nodes

8.2.1.1 Distance to Sources

Blubird nodes operate optimally within 100m of production equipment. Using the inverse Gaussian Plume Model of an emission event, using 0.5 ppm sensitivity in the BluBird nodes a distance of 100m would be needed to detect a 1 kg/h event. When identifying potential algorithm locations, this is considered.

8.2.1.2 Downwind Considerations

BluBird nodes must be located downwind from production equipment based on historical, prevailing wind patterns for the site, as determined by Earthview's node placement algorithm.

8.2.2 Client Review and Approval

The customer will review the siting plan and confirm that the proposed node placements will not interfere with day-to-day site operations. A record of this approval will be stored in Earthview's cloud database and shared with the client.

8.2.3 Recordkeeping

The exact record keeping of the site planning is detailed in Table 8-2.

Table 8-2: *Record keeping of site planning.*

Record Name	**Data Saved**
Proposed Site Plan	• Number of nodes on the site. • Geolocation of node placement. • Geolocation and height of production equipment.
Client Approval	• Date and time of client approval.
Final Site Plan (if client has revisions or if approved as is)	• Number of nodes on the site. • Geolocation of node placement. • Geolocation and height of production equipment.

8.3 Device Installation

This section outlines the QA/QC procedures, physical installation steps, and digital setup instructions for installing a BluBird at a facility.

8.3.1 QA/QC

Before a device can be sent to the field for installation, it must pass internal QA/QC inspection outlined in Section 9.1. Continuous health monitoring is done on a twice per 6-hour block basis to ensure the health of the devices.

8.3.2 On Site Installation

Each BluBird node must be installed and mounted according to the procedures outlined below. Installation will be performed by an Earthview technician. Earthview provides all necessary tools, the BluBird node, and associated auxiliary equipment for installation at the predetermined site. All installation steps will be documented and stored for auditability.

8.3.2.1 Unpack and Inspect
Remove the Blubird node and auxiliary equipment from packaging. Visually inspect all components for damage.

8.3.2.2 Mount Stand
Install the pre-manufactured mounting stand, position in north-south orientation. Secure the stand firmly in place. The installer will use a compass to verify that the stand is oriented within ±5 degrees of true north.

8.3.2.3 Install BluBird Node
Mount the BluBird node to stand using the backplate and hose clamps. Ensure the device faces north. Tighten clamps using a drill.

8.3.2.4 Mount Solar Panel
Secure solar panel to its pre-designated mount. Thread into place and tighten ensuring the solar panel is oriented facing south.

8.3.2.5 Sampling Hose
Insert the teflon sampling hose through the pre-drilled hole in the mounting stand base. Leave approximately 20 ft of slack extending above the mount.

8.3.2.6 Install Auxiliary Sensor Mount
Attach the auxiliary sensor mount, pre-manufactured with cell antenna and wind anemometer, to the mounting stand in a north-south orientation. Secure orientation of wind mounting component with set screws so that wind direction is oriented to true north. Feed the teflon tubing through the auxiliary sensor mount. Validate with a compass that the wind anemometer is oriented within ±5 degrees of true north. The auxiliary sensor mount including the wind anemometer is mounted 5 ft above the ground.

8.3.2.7 Set up Mast Assembly
Attach pneumatic quick-connect fitting from the mast to slacked teflon hose from step 8.3.2.5. Extend the mast to its height of approximately 15ft, using the friction lock mechanism. Insert the mast into the center of the Auxiliary Sensor Mount. Pull excess hose slack about 5-6 ft through the base. Trim excess hose to leave approximately 5 inches exposed. Connect the hose to the BluBird node sample intake

8.3.2.8 Connect Instruments and Antennas
Connect the pre-wired wind anemometer and cellular antennas from the auxiliary sensor mount to the pre-defined terminals on the BluBird node.

8.3.2.9 Install Battery
Place the battery and battery case at the base of the mount. Connect the battery to the BluBird node battery terminal using the provided power cable.

8.3.2.10 Connect Solar Panel
Plug in the Solar Panel into the designated solar terminal on the BluBird node.

8.3.3 System Startup and Registration
Each BluBird node must be registered in the Earthview cloud platform following physical installation to enable data transmission. Registration is completed using the Earthview operations mobile application and is performed by the Earthview technician.

8.3.3.1 System Startup
The BluBird node will automatically boot and begin sampling upon power connection.

8.3.3.2 Log into Operations Application
Log into the Earthview operations mobile application using authorized credentials.

8.3.3.3 Select "Install Node"
From the main application menu, select the Install Node action.

8.3.3.4 Scan QR Code
Scan the QR code located on the BluBird node label using the mobile device's camera. The QR Code uniquely identifies the BluBird node.

8.3.3.5 Confirm Device ID
Verify that the scanned Device ID matches the printed ID on the BluBird node label.

8.3.3.6 Assign to Site
Select the appropriate customer and site to which the BluBird node is being installed.

8.3.3.7 Confirm Device Location
Confirm the GPS coordinates of the installed device. This can be edited through the interactive map tool.

8.3.3.8 Save Assignment
Click Save to complete the registration process. A confirmation message will be displayed upon successful assignment.

8.3.3.9 (Optional) Verify Data Transmission
Select Get Reads to retrieve and view the last 10 data readings from the BluBird node to verify communication with the cloud server.

8.4 Data Collection
This section outlines how the BluBird node collects and transmits environmental data.

8.4.1 Data Transmission
BluBird nodes collect readings continuously. These data are transmitted to the Earthview Cloud in near real time for analysis and stored locally on the memory card. Data validation is not done by the BluBird node, data validation is done by the BluBird CMS in the cloud environment.

8.4.2 Local Data Storage
Data is stored locally on the BluBird node's memory card. In case of cellular communication loss, data stored on the memory card will be automatically transmitted when connectivity is restored.

8.4.3 Communication
BluBird nodes securely transmit data over cellular networks or Wi-Fi. In remote deployments where both options are unavailable, alternative connectivity solutions, such as satellite internet, may be used to ensure uninterrupted data transmission.

8.5 Data Storage
Device data is consumed by the Earthview Cloud Platform and stored in a database. Local data is stored on the device's SD card.

8.5.1 Sensor Data Stored
Earthview stores the electrical resistances from the MOS sensors, wind speed and direction, atmospheric data including humidity, temperature and pressure, which are required for calculating methane concentrations and emissions rates.

9 Quality Control

9.1 Summary QA/QC Metrics
The QA/QC procedures and acceptance criteria to ensure the network is operating in a sufficient state are found in Table 9-1.

Table 9-1: *Quality assessment and assurance criteria.*

Component or Sub-system	Parameter	Measure	Acceptance Criteria	Frequency of Check	Corrective Action
voltage supply rail	voltage supply to sensors	volts	4.8 - 5.5 V	every data packet	excluded
voltage supply rail	voltage supply to sensors	volts	> 80% of readings in window between 4.8-5.5 V	twice every 6 hours	repair/replacement
air pump	pump motor function	air circulation	active air flow	once on initial signoff	replacement
system status LEDs	operation	brightness/color	expected performance	once on initial signoff	replacement

onboard data storage SD card	operation	read/write	expected performance	once on initial signoff	replacement
real-time clock	system clock time	date/time	time matches timestamp of local device	once on initial signoff	replacement
cellular connection	connection strength	dBm	80% of readings > -100 dBm	twice every 6 hours	system re-set/re-boot
system battery	power availability	volts	80% of readings > 11 V	twice every 6 hours	replacement
data transmission	server communication	reading reception	at least one reading sent	twice every 6 hours	system re-set/re-boot
data transmission	transmission frequency	reading reception	180 readings in 3-hour window	twice every 6 hours	system re-set/re-boot
firmware test	firmware version	version #	correct firmware version	once on initial signoff	retry/replacement
MOS sensors	sensor resistances	value range	1000 - 120000 Ohms	every data packet	excluded
MOS sensors	sensor resistances	value range	> 80% of readings in operating window of 1000 - 120000 Ohms	every data packet (approx. twice/minute)	replacement
anemometer	wind direction	degrees	0-360 degrees	every data packet	replacement
anemometer	wind direction	degrees	overall consistency with other site anemometers	weekly	adjust alignment
anemometer	wind speed	km/h	0-240 meters per second	every data packet	excluded
anemometer	wind speed	km/h	> 80% of readings in operating window of 0-240 km/h	twice every 6 hours	repair/replacement
air temperature (sensor chamber)	temperature operating range	degrees celsius	0-150 degrees	every data packet	excluded
air temperature (sensor chamber)	temperature operating range	degrees celsius	> 80% of readings in operating window of 0-150 degrees	twice every 6 hours	repair/replacement
air humidity (sensor chamber)	relative humidity operating range	percent	0.1-90 (%)	every data packet	excluded
air humidity (sensor chamber)	relative humidity operating range	percent	> 80% of readings in operating	every data packet	repair/replacement

			window of 0.1-90 (%)		

10 Calibration and Standardization
Calibration and standardization of the three MOS sensors in each BluBird node follow the procedures listed in this section.

10.1 Calibration
For each individual MOS sensor, an automatic baseline calibration approach is used to provide a single-point calibration referenced to background air conditions. This is combined with a machine learning-based model constructed for each sensor based on measured resistance and atmospheric conditions. The model predicts an expected clean-air resistance for each time step, which, when used as the denominator in the ratio of measured to clean-air resistance, helps compensate for changes in sensor behavior as well as variations in factors such as humidity and air temperature. These sensor models are updated continually and individually for each MOS in the field.

10.2 Optional Bump Testing
An optional bump test may be performed to validate sensor performance; the following method is recommended. To test the BluBird node MOS sensors and the sensor-to-CH4 concentration algorithm, the BluBird node is supplied with a calibration gas consisting of a mixture of methane and "air zero", augmented with a humidifying device. A methane concentration of 100 ppm is preferred although other concentrations can be used. Prior to supplying the calibration gas, a reference period is needed during which the BluBird node draws outside air through the same humidifying device.

Note: Total time to conduct this replicate testing in filed conditions is expected to take approximately 30 minutes

10.2.1 Bump Testing Procedure
The testing can be done any time of day or time of year. Avoid doing the tests when it is raining or snowing or during heavy fog conditions or immediately before or after rainfall. The testing procedure is outlined below in Table 10-1, as an example form to input observations.

Table 10-1: *Bump test procedure table as a form to fill in the blanks during a bump test.*

Step #	Action	Recordings
1	Record the methane calibration gas cylinder number (S/N)	
2	Record the methane calibration gas concentration - (ppmv)	

Step #	Action	Recordings
3	Assemble the required test apparatus items (Nafion tubing, Tedlar bag, gas canister, gas regulator)	[redacted]
4	ID# of BluBird node is being tested	
5	Assure that BluBird is connected to the internet.	[redacted]
6	If newly installed BluBird, allow at least 2 hours of runtime	[redacted]
7	Record the start date (MM/DD/YYYY)	
8	Record the start time (hh:mm)	
9	Disconnect the air intake tube from the air intake nipple at the bottom of the BluBird node enclosure	[redacted]
10	Connect the calibration gas canister to the Tedlar bag using the entire length of Nafion tubing	[redacted]
11	Fill the Tedlar bag with approximately 5 liters of calibration gas (this will take about 10 minutes using a 0.5 liter per minute regulator). (Routing the gas through the Nafion tubing helps bring the calibration gas closer to the outside-air humidity level.)	[redacted]
12	Connect the Tedlar bag to the BluBird node intake, using the entire length of Nafion tubing	[redacted]
13	Record time when the Tedlar bag was connected to BluBird node intake (hh:mm)	

Step #	Action	Recordings
14	Allow the BluBird node to draw in the reference gas through the Nafion tubing via the BluBird node's air pump. Keep the Tedlar bag connected until it is empty	
15	Measured Bump Test Run Number 1 – Methane (ppmv)	
16	Record the time when the the Tedlar bag is disconnected – (hh:mm) Note: Allow the BluBird node to draw outside air for at least 5 minutes before the start of each bump test.	
17	Record time when the Tedlar bag was connected to BluBird node intake (hh:mm)	
18	Allow the BluBird node to draw in the reference gas through the Nafion tubing via the BluBird node's air pump. Keep the Tedlar bag connected until it is empty	
19	Measured Bump Test Run Number 2 – Methane (ppmv)	
20	Record the time when the the Tedlar bag is disconnected – (hh:mm)	
21	Record time when the Tedlar bag was connected to BluBird node intake (hh:mm)	
22	Allow the BluBird node to draw in the reference gas through the Nafion tubing via the BluBird node's air pump. Keep the Tedlar bag connected until it is empty	
23	Measured Bump Test Run Number 3 – Methane (ppmv)	

Step #	Action	Recordings
24	Record the time when the the Tedlar bag is disconnected – (hh:mm)	
25	Bump Test Average – Methane (ppmv)	

10.2.2 Assessing Results of Bump Test

If the average of the estimated methane concentrations is within 20% of the known concentration the bump test is considered valid, given the calibration gas used was within 75-200 ppm.

11 Procedure

Earthview's periodic screening procedure for this method is prescribed as follows.

11.1 Sensor Deployment

Preliminary site-specific information from the operator is acquired, site planning is generated by Earthview's algorithm and approved by the operator, following the procedures in section 11.1.1 though 11.1.5.

11.1.1 Collect site-specific information from the operator, including GPS coordinates, drone or satellite imagery, equipment locations and heights, potential emission sources, drive areas, and any offsite interference considerations.

11.1.2 Retrieve historical wind data from the nearest weather station.

11.1.3 Determine the number and optimal placement of BluBird nodes using the methodology in Section 8.2.

11.1.4 Prior to deployment, final site placement is confirmed by the operator. Once approved, conduct installation following the procedures in Section 8.3

11.2 Data Acquisition

11.2.1 After installed the BluBird nodes collect and transmit sensor-level data, as described in Section 8.4. Upon receipt of this information, this data is processed by Earthview's Cloud System, which combines sensor readings with atmospheric information to generate methane concentration values.

11.2.2 All collected data is stored securely on Earthview's managed Cloud Server.

11.3 Data Processing

11.3.1 Sensor level data is collected from BluBird nodes and converted to a methane concentration as outlined in Section 12.1. The atmospheric conditions and concentrations detected by the system will localize the source and generate an emission rate for fugitive emissions.

11.3.2 Concentration readings from BluBird nodes observing site emissions must exceed the average concentration observed by BluBird nodes observing exclusively offsite emissions, as discussed further in Section 12.2.

11.4 Data Reporting

Each periodic screening report is typically delivered to the operator within 72 hours of the screening's completion. The report is sent via email and includes the following information:

(a) **Site Information**: Name, Latitude, Longitude
(b) **Periodic Screening Period**: Start Time, End Time, Duration
(c) **Emissions Exceeding Threshold:**
  (i) Start Time
  (ii) End Time
  (iii) Duration
  (iv) Equipment Location: (Latitude, Longitude, and Name)
  (v) Emission Rate

11.5 Data Retention

This section outlines the data and records maintained by both Earthview and the operator in connection with periodic screenings conducted using this test method. Records required by other work practices, such as those related to OGI surveys and repairs, as specified in the applicable subparts, are outside the scope of this retention policy.

11.5.1 GPS Location of each BluBird node during screening in decimal degrees to the 6th decimal place

11.5.2 Sensor Data during periodic screening as detailed in Section 8.5.1.

11.5.3 Methane Concentration calculations from periodic screening

11.5.4 Summary of periodic screening results including details of any detected events exceeding the threshold, including magnitude, duration, and location

11.6 Maintenance Events

11.6.1 Periodic screening should be scheduled at times when no maintenance-related emission events are expected. If a maintenance event occurs during the screening period, the operator should provide written notification to Earthview including the following details:

(a) Start Time
(b) End Time
(c) Equipment
(d) Description of Event

11.6.2 The operator and Earthview are required to retain copies of the submitted maintenance report for recordkeeping purposes.

11.6.3 The identified maintenance event should be excluded from the periodic screening results and will not trigger follow-up inspection requirements.

11.7 Intermittent Events

Certain equipment, such as gas-fired pneumatics and compressors, may produce brief, non-sustained methane concentration spikes as part of normal operations (e.g., gas driven pneumatics) or maintenance (e.g., liquids unloading).

11.7.1 This method considers an intermittent event as any detected methane emission lasting less than two hours.

11.7.2 Intermittent events may be excluded from the periodic screening report unless other indicators of equipment malfunction are present.

12 Data Analysis and Calculations

This section outlines the data analysis and calculations to convert a sensor reading into a methane mass emission rate. The analysis is described at a high level in Figure 4.

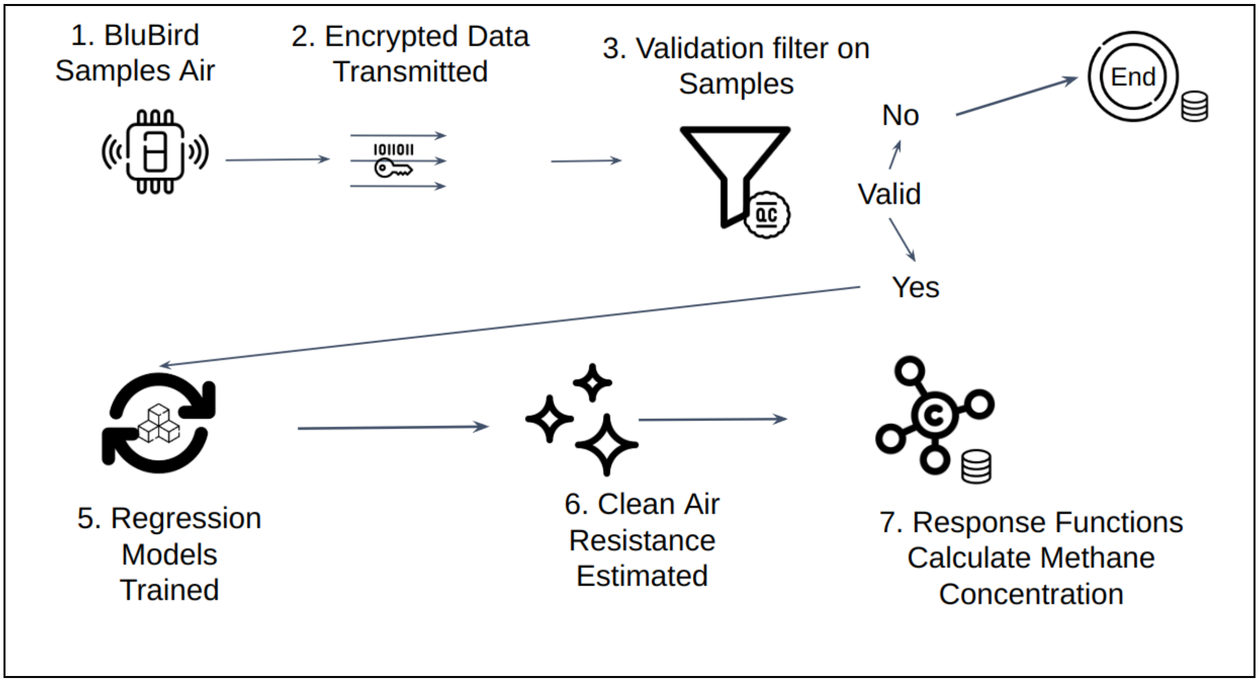

Figure 4*: Conceptual workflow of MOS Sample to methane concentration calculation.*

12.1 Methane Concentration from Sensor Reading

Earthview converts MOS sensor readings to a methane concentration by estimating a clean air background resistance and using response functions to convert the ratio of the observed resistance over a clean air resistance to measure a methane concentration.

12.1.1 Clean Air Resistance

The estimation of a "clean air" background resistance, Ro, is critical to the operation of the BluBird CMS. This resistance represents the expected MOS resistance if the air sample contained only a background level of methane. This approach builds a digital model individually for each individual MOS sensor using real-time data, allowing the model to evolve, incorporating changes in sensor behavior.

12.1.2 Response Functions

The predicted resistance provided by the sensor model along with the observed resistance is used to calculate the concentration of gas in the sample. The resulting ratio of observed and predicted resistance (Rs/Ro) is used to estimate methane concentration using selected response functions.

Note: A variety of data sets has been used by Earthview to develop these functions, including results in published literature, lab experiments with calibration gases, and co-located field measurements with research-grade air monitoring instruments. These response functions are quite consistent between different BluBird nodes.

12.2 Background Methane Concentrations

To quantify emissions, the system must estimate the background methane concentration entering the Blubird monitoring area. This is calculated using wind direction, device placement, and methane readings.

Note: In Figure 5, BluBird nodes in the southeast and northeast are upwind of any production equipment and thus detect only offsite methane. The average reading from these devices is used as the background concentration during emissions calculations.

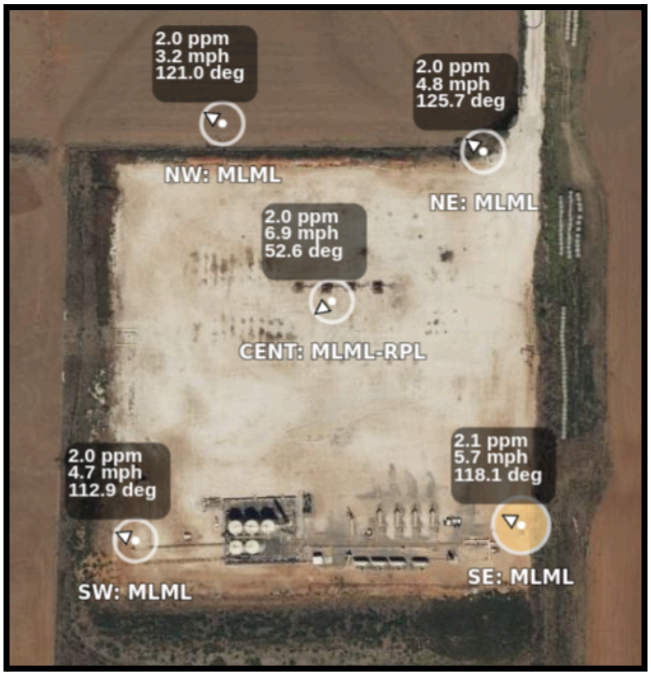

Figure 5: *Production facility with 5 sensors deployed.*

12.3 Emission Rate Calculation

Calculation of emission rate uses Gaussian plume dispersion modeling. These steps are contained within Earthview's GPAQS. Details of GPAQS analysis and calculation steps are provided in Section 12.3.1 and 12.3.2.

12.3.1 Plume Dispersion Modeling

Plume dispersion modeling is used to convert the methane concentrations into emission rates. Earthview uses an inverse version of the standard Gaussian plume model (e.g., Hanna et al., 1982), along with modifications to address special conditions. The main aspects of the models are outlined below.

12.3.1.1 The parts per million methane concentration can be converted to a grams per cubic meter concentration via Equation 1, that takes the measured pressure and temperature into account:

Equation 1. *Methane parts per million concentration to grams per cubic meter concentration conversion.*

$$c = \frac{c_{ppm} PM}{10^6 RT}$$

Whereas:

c: methane concentration	*[g / m³]*
c_{ppm}: methane concentration (parts per million)	*[1]*
P: atmospheric pressure	*[Pa]*
T: chamber temperature	*[K]*
R: ideal gas constant	*[J / K . mol]*
M: molar mass of methane	*[g / mol]*

12.3.1.2 The emission rate is then determined using the Gaussian modeling approach found in Equation 2

Equation 2. *Gaussian plume dispersion model.*

$$q = \frac{2\pi c w \sigma_y \sigma_z}{f(y, \sigma_y)\left[f(z+h, \sigma_z) + f(z-h, \sigma_z)\right]}$$

$$\sigma_y = A_y x + B_y ; \ \sigma_z = A_z x + B_z$$

$$f(r, \sigma) = exp\left[-\frac{r^2}{2\sigma^2}\right]$$

Whereas:

q: emission rate	*[g / s]*
c: methane concentration	*[g/m³]*
w: wind speed	*[m/s]*
h: vertical distance between sensor and leak source	*[m]*
x: horizontal distance between sensor and leak source	*[m]*
y: horizontal distance from plume center	*[m]*
z: vertical distance from plume center	*[m]*

A_y, B_y: y direction dispersion coefficients *[1]*
A_z, B_z: z direction dispersion coefficients *[1]*

12.3.2 Modification to Plume Modeling for Short Distances and for Low Wind Speeds
To help mitigate limitations of the standard Gaussian plume model for short plume travel distances and/or low wind speed conditions, Earthview applies alternative models more suited to these conditions. The low wind speed model is applied when measured wind speeds are less than 2 m/s. The short distance transport model is applied when the estimated distance between source and sensor is less than 20m.

12.4 Emission Action-Level Analysis for Periodic Screening
Periodic screening per 40 CFR §60.5398b(b) requires that all portions of the site be observed during a screening survey. To achieve this, Earthview's system measures site emissions for enough time to allow every piece of production equipment to be sampled by at least one BluBird node. Here, this is defined as the wind direction aligning such that a vector drawn from a grid cell intersects a node. Once all parts of the site have been sampled in this manner, any emission events observed over the threshold emission rate are recorded. The survey results are typically provided to the operator within 72 hours of completion of the survey period.

12.4.1 Data in Support of Action-Level Investigative Analysis
If a periodic screening survey detects confirmed emissions above the relevant thresholds listed in Part 60 tables 1 and 2, the operator is required to investigate the emissions as described in 40 CFR 60.5398b(b)(5). The ATM system supports this in various ways that can be useful to the operator. For example, daily emission estimates can be provided, which the operator can use to monitor the progress of repairs and to document that requirements have been met.

13 Method Performance

13.1 Performance Specifications
Section 6.1 defines the required operational ranges for the BluBird CMS in Table 6-1.

13.2 Aggregate Detection Threshold
The aggregate detection threshold of this method is 5 kg/hr, 10 kg/hr and 15 kg/hr, with a 90% probability of detection. These values are based on a combination of field and lab testing, including the controlled release analyses referenced in Section 16. Test result data are available upon request.

13.3 Probability of Detection
The method has been shown during field testing to provide a probability of emission detection of at least 90% for emissions of at least 0.4 kg/hr (Figure 6) and (Table 13-1).

Table 13-1: *90% probability of detection and minimum detection thresholds for BluBird CMS.*

Parameter	Specification
CH4 emission rate for 90% Probability of Detection [7]	< 1 kg/hr
CH4 emission rate minimum detection level [7]	0.1 kg/hr

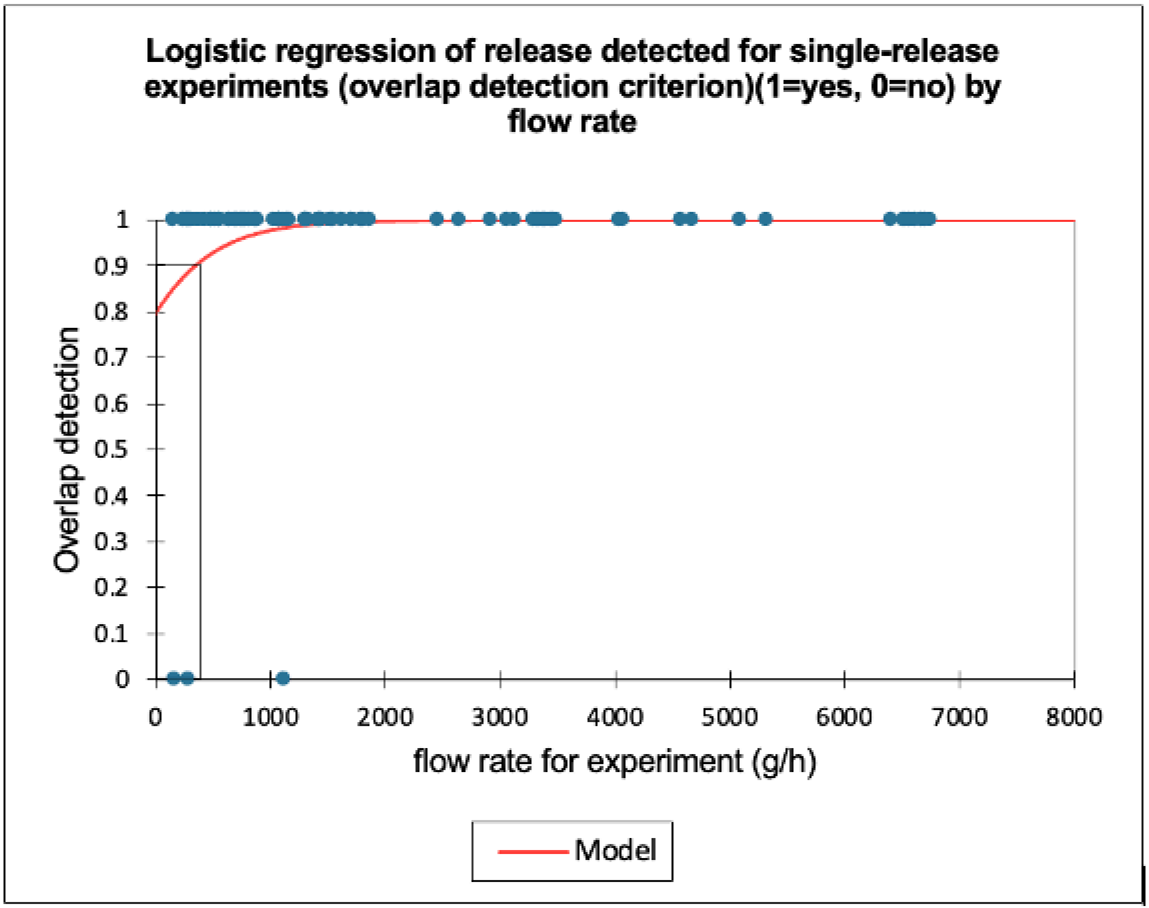

Figure 6: Probability of detection as a function of leak flow rate for experiments consisting of a single release. Detection reports that qualified as true positives based on the overlapping criterion were included. For this data set, the 90% POD level is reached at a gas flow rate of 330 g/h (see Maslanik, 2025).

14 Pollution Prevention

[reserved]

[7] *Based on CSU METEC ADED single-blind field-testing using detection overlap criterion for single-release experiments for release rates up to 6 kg/h (see Maslanik et al., 2024; Ilonze et al., 2025; Maslanik, 2025).*

15 Waste Management

[reserved]

16 References

Abdullah, A.N., K. Kamarudin, S.M. Mamduh, A.H. Adom and Z.H.M. Juffry, 2020. Effect of environmental temperature and humidity on different metal oxide gas sensors at various gas concentration levels. 2nd. Joint Conf. on Green Engineering Tech & Appl.Computing,IOP Conf Series: Materials Science and Engineering, 864, 012152, doi:10.1088/1757-899X/864/1/012152.

Chai, H., Z. Zheng, K. Liu, J. Xu, K. Wu, Y. Luo, H. Liao, M. Debliquy and C. Zhang. 2022. Stability of metal oxide semiconductor gas sensors: A review. IEEE Sensors Journal, Vo. 22, No. 6, 5470-5481.

Dhall, S., B.R. Mehta, A.K. Tyagi, and K. Sood, 2021. A review on environmental gas sensors: Materials and technologies. Sensors International, Vol. 2, 100116.

Earthview, 2024. BluBird v2 specification sheet.

Hanna, S.R., G.A. Briggs and R.P. Hosker, Jr., 1982. Handbook of atmospheric diffusion. DOE-TIC-11223, published by Technical Information Center, U.S. Dept. of Energy, 102 pp.

Ilonze, C., E. Emerson, A. Duggan and D. Zimmler, 2024. Assessing the progress of the performance of continuous monitoring solutions under a single-blind controlled testing protocol. Env. Sci. and Tech., https://doi.org/10.1021/acs.est3c08511.

Isaac, N.A., I. Pikaar, and G. Biskos, 2022. Metal oxide semiconducting nanomaterials for air quality gas sensors: operating principles, performance, and synthesis techniques. Microchimica Acta, 189:196, https://doi.org/10.1007/s00604-022-05254-0

Maslanik, J.A., 2025. Key takeaways from 2024 METEC ADED single-blind testing. Earthview white paper WP-2025-1, 10 pgs. (See WP-2025-1_Key_ADED_Takeaways.pdf in Supplementary Materials.

Maslanik, J.A., K. Schneider, and K. Yoon, 2024. Earthview BluBird performance during the 2024 METEC ADED project: Preliminary results for probability of detection and minimum detection levels. Earthview white paper WP-2024-6, 11 pgs. (See WP-2024-6 in Supplementary Materials).

METEC, 2024. Continuous monitoring final report. ADED 2024 testing program – Performer: Earthview, 21 pp. (Included as CMReport_Earthview_v3_2024.pdf in Supplementary Materials).

Schutze, A., T. Baur, M. Leidinger, W. Reimringer, R. Jung, T. Conrad, and Tilman Sauerwald, 2017. Highly sensitive and selective VOC sensor systems based on semiconductor gas sensors; How to? Environments, 4, 20, doi:10.3390/environments4010020.

Wang, Y. and Y. Zhou, 2022. Progress on anti-humidity strategies of chemiresistive gas sensors. Materials, 15, 8728. https://doi.org/10.3390/ma15248728.

17 Additional Tables, Diagrams, Flowcharts, and Validation Data

[reserved]