Alternative Test Method (MATM-018): RedLook Methane Alternative Test Method - SENSIA RedLook System for Fugitive Emissions Monitoring

1. Scope and Application

1.1 Scope

This method outlines the procedure for using the SENSIA RedLook System as a Methane Alternative Test Method (MATM). A key component of this method is the SENSIA Mileva 33F Optical Gas Imaging (OGI) camera. Hereafter, "SENSIA RedLook System MATM" or, simply, "this method" refers to the holistic method described by this Alternative Test Method, utilizing the Mileva 33F OGI camera. This method is broadly applicable across the sector to demonstrate compliance with the guidelines 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 monitoring, as approved, per 40 CFR §60.5398b(b). Applicable sites could include but are not limited to single wellhead sites, small well sites, multi-wellhead sites, well sites with major production and processing equipment, centralized production facilities, and compressor stations.

1.2 Application

1.2.1 The application of this method is per the Environmental Protection Agency's (EPA) 40 CFR part 60 New Source Performance Standards (NSPS): Subparts OOOO, OOOOa, and OOOOb, and Emissions Guidelines (EG): OOOOc, for the Oil and Natural Gas Source Category.

1.2.2 The method is applicable to methane (CH_4, CAS No. 74-82-9) emissions from oil and gas facilities. This method can be used, as approved by the Administrator, in lieu of the applicable fugitive monitoring requirements in either 40 CFR §60.5397a or §60.5397b and inspection and monitoring of covers and closed vent systems in either 40 CFR §60.5416a or §60.5416b. This method may be used for fugitive monitoring requirements in 40 CFR §60.5397c and monitoring of covers and closed vent systems under 40 CFR §60.5416c when a state, local, or tribal authority incorporates the model rule (i.e. OOOOc) for the emission guidelines as part of their State Implementation Plan (SIP) or elsewhere approved as applicable.

1.2.3 The method is a performance-based method to determine whether individual component emissions remain below prescribed thresholds.

1.2.4 The method is a stationary in-situ sensor and is broadly applicable across the sector.

1.3 Method Sensitivity

1.3.1 The sensitivity of this test method is a one (1) kilogram per hour (kg/hr) alerting threshold as applied to the details of screening frequency (see Section 1.4).

1.3.2 This method can confirm the detection of fugitive emissions at a component-level spatial resolution (as defined at 40 CFR §60.5398b(b)(5)(iv)) and provides OGI imagery and video of the emission point so that an end user can visually define the source.

1.3.3 This method has a method detection limit (MDL) of 0.27 kg/hr at 90% probability of detection (PoD).

1.4 Data Quality Objectives

Adherence to the requirements of this method will ensure the data supporting the SENSIA RedLook System MATM objective will be accurate and of quality. The method's objective is to periodically screen for fugitive emissions at oil and gas infrastructure, alerting on detected emissions. The screening frequency of infrastructure in scope, as per the method detection threshold of 1 kg/hr and 40 CFR part 60 subparts OOOOa, OOOOb, and Emissions Guidelines (EG): OOOOc, for the Oil and Natural Gas Sector Operations is, at a minimum, quarterly at well sites, centralized production facilities, and compressor stations subject to audio, visual, and olfactory (AVO) inspections with quarterly OGI or EPA Method 21 monitoring, and semi-annually at well sites and centralized production facilities subject to AVO inspections and/or semiannual OGI or EPA Method 21 monitoring.

2. Summary of Method

2.1 Method Operating Principle Overview

The SENSIA RedLook System MATM is an autonomous solution which uses computer vision and machine learning algorithms to detect emissions in OGI video footage collected by SENSIA's proprietary OGI camera, the Mileva 33F. The underlying detection algorithms are locked in the sense that the detection principles do not change from deployment to deployment. The method has been deployed for a wide range of application cases, but this protocol describes the method's use for leak detection and repair (LDAR). The following sections provide a high-level overview of the method's data collection, data processing, and data reporting - all of which will be expanded upon in further sections.

2.2 Method Data Collection Overview

The data collection of the SENSIA RedLook System MATM is facilitated by the SENSIA Mileva 33F OGI camera(s). Briefly, OGI cameras are infrared (thermal) cameras which can visualize methane and various other gases that are inherently invisible to the human eye. The Mileva 33F creates images of long-wave infrared spectrum where methane and other hydrocarbons actively absorb; as a result, methane plumes become visible in the OGI camera footage. As such, the method collects the same data (OGI video footage) as an OGI operator would, using a handheld OGI camera. Prior to data collection, at each site monitored by the method, camera deployment engineering (siting) identifies the optimal number of Mileva 33F OGI cameras, and their installation location. During the camera deployment engineering phase, the Mileva 33F can optionally be mounted on a pan-and-tilt device, which autonomously moves the camera through a "tour" of monitoring views encompassing multiple equipment that require monitoring. Camera deployment engineering is highly site specific; SENSIA and the end-user will ensure the installation covers all equipment that requires monitoring by effectively optimizing viewing angles. Figure 1 is the Mileva 33F OGI camera.

Figure 1: The Mileva 33F OGI camera model.

2.3 Method Data Processing Overview

Data processing is carried out by the method's computer vision and machine learning algorithms, which run on the proprietary RedLook software. First, these algorithms autonomously transform incoming raw OGI video footage into data, which can be interpreted by detection algorithms. At a high level, this involves the algorithm observing the metadata at the individual pixel level, aiming to identify the contrast between pixels with the presence of gas and pixels without gas in the OGI video. Second, algorithms are used to scan the now converted OGI video footage for emissions, detecting them if they are present. These algorithms have been extensively trained on labeled emissions data in the form of OGI footage, reducing false negatives and false positives in field deployments. Third, the algorithms will identify emissions plumes in the OGI video footage by coloring them on the infrared image, enhancing plume visualization when end users review the OGI video footage. All these processes occur autonomously. Figure 2 is an example of OGI video footage which contains a detection that has therefore been colorized.

Figure 2: Example of an emissions plume detected by the SENSIA RedLook System MATM.

2.4 Method Data Reporting Overview

Data reporting occurs autonomously by the method and is focused on alerting the end user of detections via alarm events. Alarm events are communicated to the end user via email, and the control computer (further details in Section 6), via on-screen alerts, audible alerts, or standard communication protocols, such as Modbus TCP and OPC UA.

3. Definitions of Method

3.1 Definitions

3.1.1 **Alarm Event:** The notification which the end user receives once the SENSIA RedLook System MATM has detected an emission (Detection). The end user is notified via the Control Computer with details including time, location, and visual evidence as well as via email.

3.1.2 **Camera Deployment Engineering:** The SENSIA terminology for the siting procedure in which it is decided how many cameras are to be deployed, their locations, and which (if any) will utilize a pan-and-tilt device. This process is led by SENSIA and is site specific. Camera deployment engineering ensures that all equipment requiring monitoring receives an optimal viewing angle.

3.1.3 **Close Range Survey:** A handheld OGI or Method 21 inspection following EPA CFR 60.5397b.

3.1.4 **Commissioning**: The process conducted to configure the SENSIA RedLook System MATM for full operational readiness prior to deployment. This process occurs after camera deployment engineering and the installation of all required on-site equipment. It involves setting and validating all system parameters to ensure reliable detection, recording, and alarm functionality under site-specific conditions.

3.1.5 **Convolutional Neural Network (CNN):** A type of artificial neural network designed to process and analyze data with a grid-like structure, notably images. Convolutional layers apply filters across the input data to detect local patterns such as edges, textures, or shapes. SENSIA's detection algorithm component of the RedLook Software leverages Convolutional Neural Networks.

3.1.6 **Control Block:** Encompasses the physical hardware and associated software necessary for data processing, autonomous emissions detection, and communication with the Mileva 33F OGI camera. The control block can be present either on, or off-site.

3.1.7 **Control Computer:** Runs the RedLook Software. The Control Computer also includes the user interface and dashboards, allowing for direct observation of the method's real-time monitoring data and facilitating communication of alarm events and system status. The control computer can be present either on, or off-site.

3.1.8 **Detection**: A discrete instance when the method clearly visualizes a gas plume that meets or exceeds the method's detection limit and is attributed to a specific source component. Detections trigger alarm events. Neither the defined method detection limit (0.27 kg/hr) nor the alerting threshold (1 kg/hr) are used as alarm filters.

3.1.9 **Detection Report**: A summary of all alarm events encountered during the periodic screening window. The detection report is generated by the end user upon completion of a periodic screening window where it can be viewed in the RedLook software, emailed to other parties, and is stored on the control computer hard drive.

3.1.10 **End User**: Refers to the personnel who interact with the method. Typically, this is the site operator, but as the method can be installed at unmanned sites and used remotely, this could be other personnel. The end user receives training from SENSIA in the use of the RedLook software. The end user will receive alarm event notifications and will be able to generate detection reports.

3.1.11 **False Negative:** Event in which a methane emission is present, but a detection is not identified.

3.1.12 **False Positive:** Event in which a methane emission detection is reported, but no actual emission is present.

3.1.13 **Field of View (FoV):** The angular extent of the area observable by a camera as determined by the installed lens and camera sensor geometry.

3.1.14 **Field Block:** Encompasses the physical hardware present at the site requiring monitoring. Includes the Mileva 33F OGI camera, pan-and-tilt devices if present, termination boxes used for communication and transfer of data to the control block, and a power source. Optional components include a 4G antenna for deployment at unmanned sites.

3.1.15 **Manned Sites:** Sites which have field personnel present daily. Follows a specific System Architecture.

3.1.16 **Methane Emissions Technology Evaluation Center (METEC):** METEC is a controlled-release test facility located at the Colorado State University (CSU) in Fort Collins, Colorado. In this facility, realistic oil and gas scenarios are simulated to test and benchmark methane leak detection and quantification technologies.

3.1.17 **Monitoring View**: The physical area and equipment visible within the camera image at a given camera orientation during monitoring. Fixed cameras will have a single monitoring view, while cameras utilizing pan-and-tilt devices will have a monitoring view associated with each tour stop. Monitoring views are selected and configured by SENSIA technicians.

3.1.18 **OGI cameras:** Specialized cameras that detect and visualize gases that are otherwise invisible to the naked eye. These cameras use infrared technology to capture the thermal radiation emitted by gases, allowing for the identification of gas leaks.

3.1.19 **Pan-and-Tilt Device:** A device capable of both horizontal (pan) and vertical (tilt) movement, designed to perform pre-programmed "tours" through various positions. As per this method, they are used in conjunction with a Mileva 33F OGI Camera to capture different monitoring views of the site, pointing at different equipment from multiple angles for comprehensive monitoring.

3.1.20 **Periodic Screening Window:** The period in which the SENSIA RedLook System MATM is actively collecting data as described in this method. The periodic screening window is a maximum of (five) 5 days. Within these 5 days, the method must collect data during a valid camera observation period. Periodic screening windows occur at the frequency defined in Section 1.4.

3.1.21 **Probability of Detection (PoD):** A measure representing the chance that a methane detection technology will successfully detect an emission of a certain mass emission rate when it occurs. A 90% PoD refers to the minimum emission mass rate at which a methane detection technology will achieve a methane detection 90% of the time.

3.1.22 **RedLook Software:** The overarching term for the proprietary software which runs on the control computer. The RedLook software processes and analyzes incoming OGI and meteorological data, runs the detection algorithms, contains user interfaces where the user receives alarm event notifications and detection reports as well as provides real time camera views, and facilitates autonomous communication to the end user via email and other optional communication protocols. The RedLook software manages data storage (all data is stored on hard drives at the control computer).

3.1.23 **Region of Interest (ROI):** The portion of the monitoring view which is subject to the RedLook detection algorithm. By default, the entire monitoring view is equivalent to the region of interest.

3.1.24 **Site:** An oil and gas single regulated or installation that is subject to monitoring.

3.1.25 **System Architecture:** The organization of the method's infrastructure. The SENSIA RedLook System MATM's infrastructure is divided into two main segments, or blocks: 1) the Field Block; and 2) the Control Block.

3.1.26 **TotalEnergies Anomalies Detection Initiatives** (TADI): A controlled release testing facility operated by TotalEnergies in Pau, France.

3.1.27 **Tour:** A predefined, automated sequence of camera movements through specified monitoring views or fields of view. Facilitated using a pan-and-tilt device.

3.1.28 **Tour Stop:** A single monitoring view along a given tour.

3.1.29 **True Negative**: Observation in which no detection is reported, and the system correctly identifies the absence of emissions.

3.1.30 **True Positive**: Observation in which a detection is reported, and the system correctly identifies the presence of emissions.

3.1.31 **Unmanned Sites:** Sites which do not have field personnel present daily. Follows a specific System Architecture.

3.1.32 **Valid Camera Observation Period:** 15-minutes of cumulative time during a periodic screening window where data (OGI video footage and meteorological conditions) is collected within the operational envelopes, and data is being properly moved through the system. A valid camera observation period must occur within a periodic screening window, or the periodic screening window is replaced with a handheld OGI survey.

3.2 Abbreviations

The following abbreviations are used within this document.

3.2.1 **API:** Application Programming Interface

3.2.2 **CNN:** Convolutional Neural Network

3.2.3 **FoV:** Field of View

3.2.4 **METEC:** Methane Emissions Technology Evaluation Center

3.2.5 **OGI:** Optical Gas Imaging

3.2.6 **PoD:** Probability of Detection

3.2.7 **ROI:** Region of Interest

3.2.8 **TADI:** TotalEnergies Anomalies Detection Initiatives

4. Method Interferences and Envelope of Operation

Operational envelopes are essential to ensure the method delivers the required data quality. To achieve this, conditions outlined in Table 1 must be met. Most of the conditions detailed in Table 1 are mitigated by ensuring that a valid camera observation period is achieved during the periodic screening window. A valid camera observation period is a 15-minute period of cumulative time. During this time, the camera collects data, and all conditions are within the bounds specified in Table 1. This 15-minute period must be achieved for all cameras on a site and must be achieved at all tour stops for cameras utilizing a pan-and-tilt device. If a valid camera observation period cannot be achieved due to any of the conditions outlined in Table 1, the periodic screening window is replaced by a comprehensive facility-scale OGI survey which meets the requirements of 40 CFR §60.5398b(b)(5)(iv) paragraphs (A) through (C). In most cases, SENSIA will employ an on-site weather station integrated with the RedLook software to verify environmental operational envelopes (temperature, wind speed, precipitation, and relative humidity in Table 1). In cases where a local weather Application Programming Interface (API) can provide data with enough temporal resolution to observe changes on a 2-minute time scale, the API can be used for operational envelope verification.

Table 1: Summary of Method Interferences and Envelope of Operation

Condition	Summary	Mitigation
Temperature	Temperature range for Mileva 33F OGI camera operation must be between -20°C and +50°C	Temperature is autonomously monitored via integration with the RedLook software and an on-site weather station or local weather API. Periods where the temperature is outside this range do not count towards a valid camera observation period.
Wind Speed	Wind speed must be between 0.8 and 11 meters per second (m/s) to ensure adequate plume transport.	Wind speed is autonomously monitored via integration with the RedLook software and an on-site weather station or local weather API. Periods where the wind speed is outside this range do not count towards a valid camera observation period.
Precipitation	Precipitation can interfere with the collected OGI footage. There must be no precipitation during a valid camera observation period.	Precipitation is autonomously monitored via integration with the RedLook software and an on-site weather station or local weather API. Periods where the precipitation is present do not count towards a valid camera observation period.
Relative Humidity	Relative humidity must be between 0% and 95%.	Relative humidity is autonomously monitored via integration with the RedLook software and an on-site weather station or local weather API. Periods where the relative humidity is outside this range do not count towards a valid camera observation period.

Condition	Summary	Mitigation
Sunlight	The camera must not point directly into sunlight as sunlight obscures collected OGI footage.	During the camera deployment engineering siting procedure, it is required that cameras must be installed higher than the equipment requiring monitoring, in such that they can point down and away from direct sunlight. The camera must be installed at a minimum of 10 meters (about 32.8 feet) above ground. If new, higher equipment is installed on site, the camera(s) must be re-sited.
Camera Visual Line of Sight	The line of sight from the camera to the equipment requiring monitoring must be unobstructed.	During the camera deployment engineering siting procedure, it is required that there are no obstructions in any installed camera(s) lines of sight. If new equipment is installed, the camera deployment engineering siting procedure will be re-conducted to ensure no obstructions.
Distance between camera and monitored sources	As per the 35mm lens configuration of the Mileva 33F camera in this method, the camera must be no more than 50 m (about 164.04 ft) from the monitored source.	During the camera deployment engineering siting procedure, it is required that all camera(s) are within 50 m (about 164.04 ft) of the equipment requiring monitoring. If new equipment is installed, the camera deployment engineering siting procedure will be re-conducted to ensure all monitoring distances are within 50 m (about 164.04 ft).
Power and communication	Data must continuously move through all method components via ethernet and / or cellular communication.	Periods with lost data due to lack of power or connection do not count towards a valid camera observation period.

5. Safety

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

5.1 Field Safety

All personnel responsible for deploying the Mileva 33F OGI camera must be trained in relevant field safety protocols, including working at heights, electrical safety, and hazard recognition in oil and gas environments. Additionally, personnel should be trained to wear appropriate personal protective equipment (PPE) and follow site specific safety guidelines defined by the facility's safety protocols.

5.2 Explosive Environment Safety

The Mileva 33F OGI camera is certified for use in potentially explosive environments. It holds ATEX certification (EN 60079:2013; II 3 G Ex eC IIC T4 Gc), which permits deployment in Zone 2 hazardous areas where flammable gas atmospheres are not likely to occur in normal operation but may exist for short periods. The system is also EMC-compliant (EN 61326:2013), ensuring it does not interfere with other electronic equipment and remains resilient to electromagnetic disturbances on site.

5.3 Installation Safety

Installation of the Mileva 33F OGI camera requires site access, equipment setup on elevated structures, and power supply integration. As such, it introduces specific safety concerns beyond routine field practices. Table 2 lists the safety considerations to be made when installing the Mileva 33F OGI camera component of the SENSIA RedLook System MATM.

Table 2: Summary of Safety Considerations Applicable to the On-Site Deployment of the Mileva 33F OGI Camera.

Safety Item	**Summary**
Proximity to Equipment	Mileva 33F OGI camera(s) installation must consider minimum safe distances from pressurized systems, flammable equipment, heat-generating equipment, or emission sources as defined by the site operator. Operation near live equipment must comply with site-specific hazard controls.
Working at Heights	The Mileva 33F OGI camera(s) is typically installed at minimum heights of 10 m. Personnel must use approved fall protection and follow all elevated work procedures.
Stability of Installation	The Mileva 33F OGI camera installation structure must be stable and not introduce vibration or movement during operation. The Mileva 33F OGI camera must be installed following the correct protocol to ensure it is safely fixed to its mounting structure. Guywires can be used for mast-mounted systems.
Electricity Safety	Power supply setup must follow electrical safety standards. Lockout/tagout (LOTO) procedures apply when integrating with external sources.

Safety Item	Summary
Weather Exposure	Extreme weather conditions, such as strong winds or heavy precipitation, can provide hazards to worker safety. Weather conditions should be reviewed before field deployment.
Moving Objects	Install Mileva 33F OGI cameras away from high-traffic zones to minimize the risk of collisions between the cameras and vehicles or moving equipment.
Site Personnel Hazards	The setup and operation of the physical, onsite components of the SENSIA RedLook System MATM must not interfere with the safe movement or focus of site personnel. Equipment must be clearly marked and stabilized.

6. Equipment and Supplies

The equipment and supplies necessary for the SENSIA RedLook System MATM are best described through the method's system architecture. The system architecture breaks the necessary components down into the field block, and control block.

6.1 Field Block

The field block encompasses the physical hardware present at the site requiring monitoring. The field block includes:

6.1.1 **Mileva 33F OGI Camera:** A fixed, automated OGI camera designed for continuous methane monitoring. It uses a cooled infrared sensor to detect hydrocarbon gas plumes by capturing thermal contrast in the scene. Subcomponents of the Mileva 33F OGI camera include the lens, which directs infrared radiation onto the infrared sensor, and the onboard electronic boards which facilitate OGI camera operation as outlined by §60.5397c.

6.1.2 **Camera Housing:** A durable, weatherproof enclosure that protects the internal components of the Mileva 33F OGI camera from environmental factors such as dust, moisture, and temperature extremes. This housing ensures that the camera can operate effectively in various outdoor conditions.

6.1.3 **Pan-and-Tilt Device:** A device capable of both horizontal (pan) and vertical (tilt) movement, designed to perform pre-programmed tours through various tour stops. As per this method, it is used in conjunction with the Mileva 33F OGI Camera to capture different monitoring views of the site, pointing at different equipment from multiple angles for comprehensive monitoring.

6.1.4 **Power Supply:** A reliable source of power that ensures the proper functioning of the Mileva 33F OGI camera and the pan-and-tilt device. It can include an external connection or a combination of solar panel and batteries, depending on the site's requirements and deployment configuration.

6.1.5 **Termination boxes**: Used to transmit power to the Mileva 33F OGI camera and communicate with the control block. The termination boxes communicate with the Mileva 33F OGI camera(s) via Gigabit power over ethernet (POE) switches and communicate with the control block via fiber optic cables, ethernet, or wireless 4G connections, depending on deployment architecture. As with the Mileva 33F OGI camera(s), the number of required termination boxes varies based on the deployment site.

6.2 Control Block

The control block encompasses the physical hardware and associated software necessary for data processing, autonomous emissions detection, and communication with the OGI camera(s) and can be present either on or off site. The control block includes:

6.2.1 **Control Computer**: Runs the RedLook software. The end user interacts with the RedLook software at the control computer through user interfaces and dashboards, allowing for direct observation of the method's real-time monitoring data. Alarm events and detection reports are generated on the RedLook software on the control computer. The computer control can be on or off-site.

6.2.2 **Server Rack Cabinet**: Contains power over ethernet switch, wiring, electric protection, and all other required communication equipment for communication between the field block, the control block, and the end user if located offsite.

6.3 System Architecture

The SENSIA RedLook System MATM system architecture can be arranged in two orientations based on whether the site is manned (i.e., field personnel present on-site daily during operations) or unmanned (i.e.,field personnel not present on-site). The core differentiator is how the field block communicates with the control block. In a system architecture for manned sites, the field block communicates with the control block via fiber optics or ethernet cables. In this architecture scheme, RedLook software analytics are run on the control computer allocated to the control block. In a system architecture for unmanned sites, the field block communicates with the offsite control block via a 4G wireless connection. In this architecture scheme, RedLook software analytics are run on the edge computer inside the termination box. Figure 3 and Figure 4 present simplified overviews of the manned and unmanned system architecture, respectively.

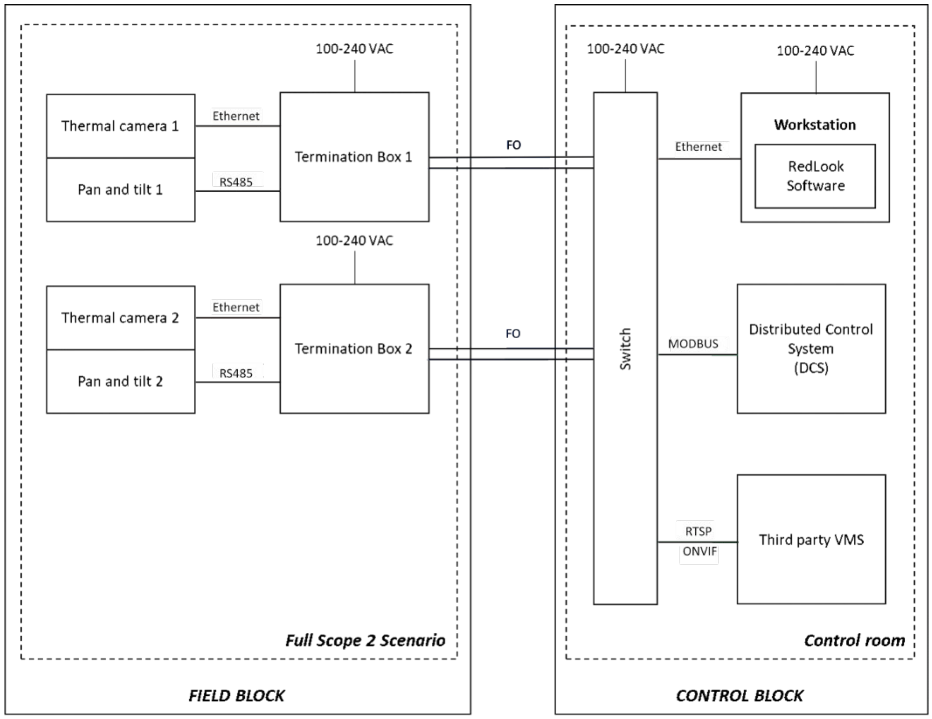

Figure 3: High-level overview of the System Architecture for Manned Sites.

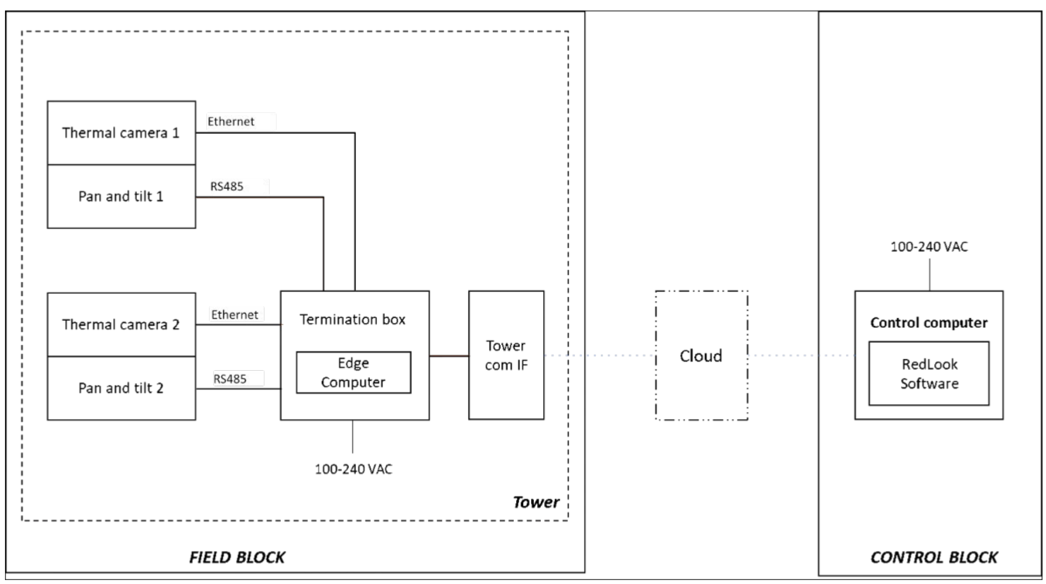

Figure 4: High-level overview of the System Architecture for Unmanned Sites.

7. Reagents and Standards

This method uses instrumentation that does not require laboratory reagents or standards.

8. Data Collection and Method Input Sourcing

8.1 Siting Overview

The following is an overview of the steps taken during siting and installation. A detailed siting framework is provided in Appendix A. The siting procedure (referred to by SENSIA as camera deployment engineering) involves SENSIA technicians deciding on the optimal number of cameras, their locations, and heights. These decisions are all made in tandem with the end user to ensure comprehensive and effective coverage of all equipment requiring monitoring. SENSIA technicians will use all available facility documentation including GPS coordinates, satellite images, site layout plans, 3D model(s) of the site, and photographs of the site and components to be monitored. The following are the requirements considered during siting.

8.1.1 Camera line-of-sight verification: Each camera shall have an unobstructed line of sight to all assigned monitoring areas, with no permanently installed physical obstructions within the established monitoring view.

8.1.2 Camera height verification: Each camera will be installed at an elevated position sufficient to ensure unobstructed coverage of all assigned monitoring areas and shall not be oriented toward the sun at any time. Cameras are installed at a minimum height of 10 m.

8.1.3 Detection range verification: Each camera shall operate within the maximum detection range of 50 m (about 164.04 ft).

8.1.4 Camera count verification: The deployed camera count shall be sufficient to ensure complete coverage of all components requiring monitoring in accordance with this method.

8.1.5 Site survey: SENSIA technicians will validate the proposed system configuration on site, in coordination with the end user, to confirm final camera installation locations and overall feasibility. Qualified SENSIA personnel inspect each proposed camera location and corresponding monitoring views by using portable OGI cameras where necessary; this is done to ensure camera placement is optimal and that the final configuration delivers the expected performance.

8.2 Data Inputs

Upon completing camera deployment engineering and installation, all data associated with the method can be collected during periodic screening windows. Table 3 is a summary of the data collected by the method.

Table 3: Summary of Instruments and Sources used in Data Collection.

Instrument/Source	Variables	Use
Mileva 33F OGI Camera	OGI image and video footage of the monitoring view.	Primary instrument for collecting emission plume data.
RedLook Software	Video and still images, thermal contrast, time-stamped alarm data, and image metadata	The RedLook Software employs detection algorithms onto the thermal video footage collected by the Mileva 33F OGI camera. The RedLook Software presents the video footage to the end user on the user interface of the control computer for alerting, localization and repair, and reporting purposes.
Proprietary Training Dataset	Annotated infrared images of emission plumes from previous field deployments.	Enables training RedLook Software's detection algorithms for the detection of emissions under a wide range of field scenarios. This method's detection performance has been developed using an extensive a-priori dataset containing hundreds of thousands of infrared images collected under a wide range of environmental conditions.
Meteorological Data	Wind speed, temperature, and relative humidity.	The method will collect wind speed, temperature, and relative humidity data via an on-site weather station integrated with the RedLook software. In cases where a local meteorological API can provide data at sufficient temporal resolution to observe changes on a 2-minute timescale, the API may be used in lieu of an on-site weather station.

8.3 Periodic Screening Workflow

The SENSIA RedLook System periodic screening procedure encompasses a pre-screening Quality Assurance/Quality Control (QA/QC) check, simultaneous data collection, processing, detection, alerting, and reporting. The periodic screening workflow is structured around ensuring enough valid data is captured through the requirement to achieve a valid camera observation period within a periodic screening window. Figure 5 is a visual overview of the periodic screening workflow.

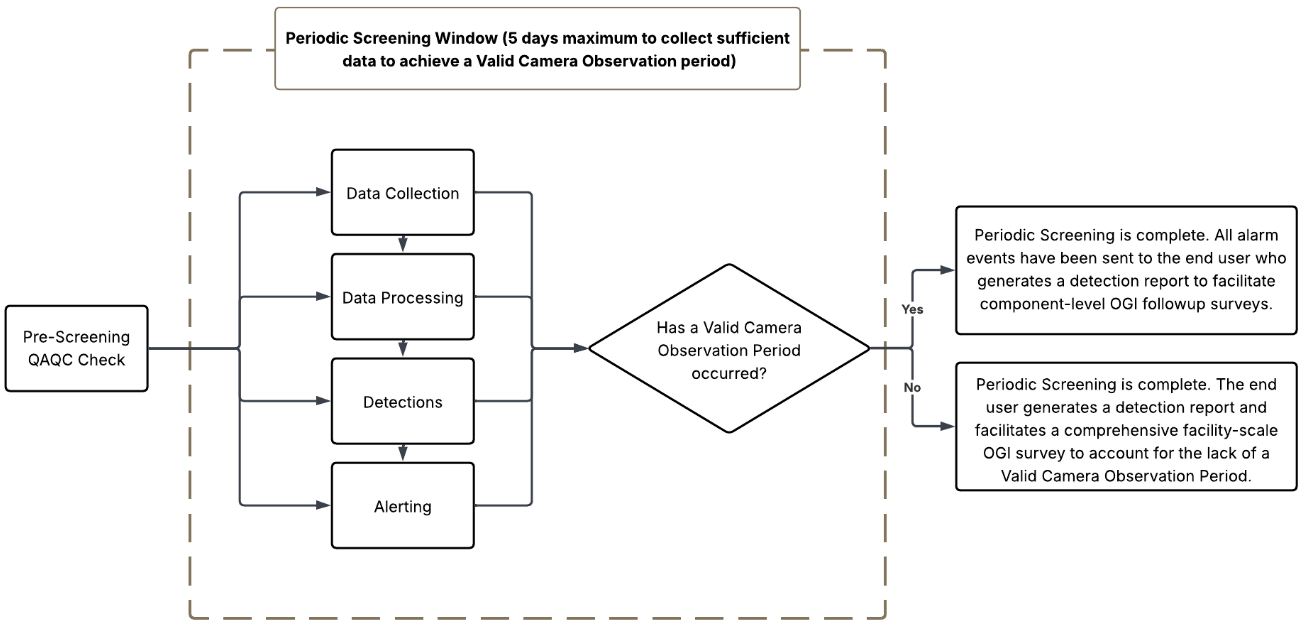

Figure 5. SENSIA RedLook System MATM periodic screening workflow.

8.3.1 Pre-Screening Operational Envelope Check

24 hours prior to each periodic screening window, a pre-screening Quality Assurance/Quality Control (QA/QC) check is automatically run by the RedLook Software. This check verifies data (i.e., OGI footage and API and/or weather station meteorological data) is being collected and distributed through the system as intended and that power is present. If data is not being properly collected or distributed and/or there is no power, the system will not enter the data logging phase of the periodic screening window, and the end user will be notified.

8.3.2 The Periodic Screening Window: Data Collection

The periodic screening window is a period of up to 5 days during which data is being actively collected by the system. Data collection includes OGI video footage by the Mileva 33F OGI camera; meteorological data which is collected via an on-site weather station integrated with the RedLook software, or via a local weather API where it provides sufficient temporal resolution, as described in Section 4, and all metadata associated with RedLook system monitoring. The periodic screening window will continue until a valid camera observation period is encountered. A valid camera observation period is 15 minutes of cumulative monitoring time where all data is being collected while operating conditions are within the operational envelope ranges. The valid camera observation period must be achieved for all monitoring views present in the site deployment. A fixed camera has a single monitoring view, and this monitoring view must achieve 15 minutes of cumulative data collection during which all operating conditions are within their operational envelopes. A camera installed on a pan-and-tilt device has a monitoring view associated with each tour stop. Each monitoring view (each tour stop on pan-and-tilt) must accumulate ≥15 minutes within envelope conditions. Each tour stop has a dwell time of 2 minutes. There is no required number of tour stops for pan-and-tilt.

8.3.3 The Periodic Screening Window: Data Processing

While data is being collected during the periodic screening window it is simultaneously being processed, OGI footage is processed into raw data, which then has the RedLook detection algorithm applied to it to facilitate emissions detections. Meteorological data collected via the on-site weather station or, where applicable, the integrated weather API is continuously evaluated to check if it falls within (or outside) of the operational envelope.

8.3.4 Periodic Screening Window: Detections and Alerting

At any point during the periodic screening window the RedLook System will create an alarm event if a detection is encountered. A detection happens when the RedLook System detection algorithm identifies a methane plume within a monitoring view. An alarm event is a response to a detection, and it represents the notification the end user receives. Each alarm notification is sent through the RedLook software to the user interface on the control computer as well as an email to the responsible end user. The responsible end user in charge of generating the detection report (see Section 15.5). The alarm event contains a still image of the emissions plume which resulted in the alarm, the date and time it was encountered, its location, and the camera which identified it while the control computer notification is an icon which appears at the top of the screen. All alarm events are stored as unique video files and associated reports on the control computer.

8.3.5 Reporting

Upon completion of the periodic screening window, all alarm events and associated data are collected in a detection report. This detection report is manually generated by the end user via the RedLook software on the control computer. Regardless of the outcome of the periodic screening window, a detection report is created. For example, if there are no detections, or if the system fails to achieve a valid camera observation period, a detection report is still generated reflecting the outcome of the periodic screening window.

9. Quality Control

This section describes the quality-control measures implemented throughout the SENSIA RedLook System MATM to ensure quality results. Quality control checks for Mileva 33F OGI camera via the RedLook software autonomous data quality checks, the auxiliary equipment (pan-and-tilt unit, termination boxes, and control block), the data transmission, and the manufacturing process (adhering to all quality and compliance requirements). Table 4 presents the quality assurance and quality control (QA/QC) measures to ensure successful operation of the SENSIA RedLook System MATM.

Table 4: Quality Assurance and Quality Control Metrics.

Instrument / System Component	QA/QC Procedure	Acceptance Criteria	Frequency of QA/QC Procedure	Corrective Action
Mileva 33F OGI Camera	Camera operability check	Camera powers on, produces usable OGI video, and records time-stamped footage	Prior to each Periodic Screening Window	Do not initiate screening; review system, power and communications and repair or replace as required.
RedLook Software	OGI video integration check	OGI video is being sent to the RedLook software and is interpretable by the detection algorithm	Once at installation and after any hardware change	Do not deploy; SENSIA technician to troubleshoot incoming OGI video
RedLook Software	Data transfer	In unmanned sites, data is being properly transmitted between field and control block via 4G wireless connection	Prior to each Periodic Screening Window	Any period during which data is not transferred due to network failure does not count toward the valid camera observation period. If a valid camera observation period cannot be achieved within the periodic screening window, a handheld OGI survey is conducted per 40 CFR §60.5398b(b)(5)(iv) paragraphs (A) through (C).
Mileva 33F OGI Camera	Optical integrity check	Image free of persistent artifacts, saturation, or glare that would obscure monitoring views	Prior to each Periodic Screening Window	Do not initiate screening; trained SENSIA technician will assess optical integrity and adjust feed, service camera, or replace camera as required.
Camera Mount / Structure	Physical stability check	Camera mounting secure; no unintended movement	Once at installation and after any hardware change	Secure or reinstall mount.
Pan-and-tilt (if applicable)	Movement and positioning check	Unit completes full programmed tour without error	Once at installation, prior to every survey, and after any hardware change	Do not initiate screening; reconfigure, repair or service unit.

Instrument / System Component	QA/QC Procedure	Acceptance Criteria	Frequency of QA/QC Procedure	Corrective Action
Pan-and-tilt (if applicable)	Tour completeness check	All programmed monitoring views visited at least once	Once at installation, prior to every survey, and after any hardware change	Do not deploy; reconfigure, repair, or service unit.
Monitoring Views	Clear line of sight	No physical obstructions present within Monitoring Views	Prior to each Periodic Screening Window	Remove obstruction.
Monitoring Views	Line of sight continuity	No physical obstructions present within Monitoring Views	Continuously during each Periodic Screening Window via end user review of live camera feed	Any period during which an obstruction is present does not count toward the valid camera observation period. If a valid camera observation period cannot be achieved within the periodic screening window, a handheld OGI survey is conducted per 40 CFR §60.5398b(b)(5)(iv) paragraphs (A) through (C).
Monitoring Views	Baseline view maintained	The monitoring views must have no material discrepancies from the baseline view (the view established during installation) including changes to site conditions, operational activities, or altered equipment placement	Prior to each Periodic Screening Window	Do not deploy; a trained technician must re-position camera to ensure the equipment groups intended to be monitored in the baseline view are sufficiently covered
Detection Algorithm	Runtime execution check	Algorithm running continuously with no fault state	Continuous during periodic screening window	Halt screening and resolve fault.
Control Computer / Storage	Data recording integrity check	OGI video and detection outputs are recorded and retrievable	Continuously during periodic screening window	Halt screening and repair storage.

Instrument / System Component	QA/QC Procedure	Acceptance Criteria	Frequency of QA/QC Procedure	Corrective Action
System Clock / Timekeeping	Timestamp verification	Video and detection outputs have valid timestamps	Prior to each periodic screening window	Correct system time.
Detection Output	Alarm generation verification	Detection events generate alarms and detection reports	During periodic screening window	Investigate fault; repeat screening.
Reporting System	Alarm event and detection report retention check	Detection reports and associated video retained and accessible	After each periodic screening window	Halt screening and restore reporting system.
Camera Lifecycle	Service interval verification	Camera within manufacturer-recommended service interval	Annually	Service or replace camera.

10. Calibration and Standardization

10.1 Calibration Procedures

The OGI cameras comprising the SENSIA RedLook System MATM are factory-calibrated prior to shipment. No field recalibration of the OGI camera is required, provided that the transport, handling, installation, and commissioning procedures described in this section are performed by trained SENSIA personnel in accordance with SENSIA's standard operating procedures. Sections 10.1.1 through 10.1.3 describe the procedures for verifying that factory calibration integrity is maintained through delivery and installation prior to commissioning. Sections 10.1.4 through 10.1.7 commissioning, the routine SENSIA process of preparing the system for emissions monitoring through the configuration of key parameters that facilitate the detection, recording, and alarm notification processes of the SENSIA RedLook System MATM. These parameters are configured using the RedLook Software via the user interface on the control computer by trained SENSIA personnel.

10.1.1 Prior to shipment, each OGI camera unit is packaged by SENSIA personnel in accordance with SENSIA's standard equipment packaging procedures. These procedures include ensuring the OGI camera is protected against physical shock and vibration during transit and must include sealed enclosures to prevent moisture ingress. Shipments must be clearly marked as fragile.

10.1.2 Upon receipt of the OGI camera unit at the deployment site, SENSIA-trained personnel must conduct a post-shipping inspection prior to installation. This inspection must confirm the following: (a) the shipping enclosure shows no evidence of damage, impact, or moisture ingress; (b) the camera housing, lens assembly, and connectors are free of physical damage or contamination; and (c) [if applicable: any shock or tilt indicators included in the packaging have not been triggered]. If any condition in (a) through (c) is not satisfied, the unit must not be installed and must be returned to SENSIA for assessment before deployment. Results of the post-shipping inspection must be recorded in the deployment log as described in Section 15.

10.1.3 Prior to initiating the commissioning phase described in Sections 10.1.4 through 10.1.7, SENSIA personnel must perform the following installation checks to confirm the system is operating within the parameters established during factory calibration: (a) verify that the camera firmware version matches the factory-calibrated configuration, as confirmed via the RedLook Software interface; (b) confirm that the camera optical path is unobstructed and the lens is free of contamination; (c) confirm that all electrical and data connections are fully seated and secure; and (d) confirm that the camera field of view and physical orientation are consistent with the siting plan established per Appendix I. If any condition in (a) through (d) is not satisfied, the deficiency must be corrected prior to proceeding with commissioning. Results of the installation checks must be recorded in the deployment log as described in Section 15.

10.1.4 **Establish Monitoring Views**: The end user and SENSIA will collaboratively define the monitoring views for the Mileva 33F OGI camera. In situations where the Mileva 33F OGI camera is not installed on a pan-and-tilt unit, the monitoring view is the default view from the camera. In situations where the camera is installed on a pan-and-tilt unit, SENSIA and the end user will define the tour stops, each of which represents a monitoring view, using the RedLook Software.

10.1.5 **Establish Regions of Interest (ROIs) Within Each Monitoring View**: Using the RedLook Software's user interface, regions of interest (ROIs) are established. Detections and alerting are tied to the ROI. By default, the ROI is equivalent to the monitoring view and any detection within the monitoring view will lead to an alarm event.

10.1.6 **Finalize the monitoring plan**: In situations where a pan-and-tilt unit is used, the order of tour stops is set after establishing the camera monitoring views and ROIs. The default/minimum tour stop time of the SENSIA RedLook System MATM is 2 minutes per tour stop.

10.1.7 **Establish alarm protocols**: Alarm notification settings include how the alarm is transmitted to the end user. Method requirements are email and sound/visual alarms at the control computer, annotations on the user interface of the RedLook Software. Other preferred methods of notification are established during this phase. These could include Modbus TCP, OPC UA and hot relay to analog devices.

10.2 Standardization: Training Requirements

Only specialized and trained SENSIA personnel or contractors are allowed to manufacture and commission any aspect of the SENSIA RedLook System MATM. All personnel who operate the SENSIA RedLook System MATM must hold a current certification under the SENSIA RedLook Certificate Program - OGI Continuous Monitoring, as described in Appendix C.

10.3 Maintenance

SENSIA RedLook System maintenance requirements as outlined in Table 5. The outcomes of all maintenance activities are recorded by the end-user in internal tracking systems.

Table 5: SENSIA RedLook System MATM Maintenance Requirements.

Subsystem	Item	Frequency	Performer	Location	Time
Mileva 33F OGI Camera	Lenses visual inspection	Monthly	End User	On site	<1 hour
Mileva 33F OGI Camera	Lenses manual cleaning	Monthly	End User	On site	< 1 hour
Mileva 33F OGI Camera	Lenses replacement	5 years	SENSIA Technician	SENSIA HQ	< 1 month
RedLook Software	Alarm system verification	Weekly	End User	On site	1 hour
RedLook Software	RedLook performance self-diagnose	Weekly	End User	On site	1 hour
RedLook Software	RedLook remote verification (under contract after first year)	Monthly	SENSIA Technician	Remotely	1 hour per camera
RedLook Software	Records and events verification	Weekly	End User	On site	1 hour per camera
RedLook Software	Storage verification	Monthly	End User	On site	< 1 hour
RedLook Software	Recording back up	Monthly	End User	On site	5 hours
RedLook Software	System general inspection	Annually	End User	On site	1 day

11. Analytical Procedure

[Reserved]

12. Detection and Alerting

12.1 Detection

12.1.1 The SENSIA RedLook System MATM detects fugitive methane emissions by applying detection algorithms to OGI video footage collected by the Mileva 33F OGI camera. These algorithms autonomously process in real time the incoming OGI video footage into data which can be interpreted by the detection algorithms. RedLook Software detection analytics compare and contrast the behavior of pixels with the presence of gas and without gas (plume vs background) in the OGI video footage. The main parameters under analysis are the radiometric contrast (digital levels) and the temporal variability of the gas plume. These algorithms have been extensively trained on emissions data. The emissions data used for training the algorithms consist of hundreds of thousands of labeled images collected from historical OGI deployments, encompassing a wide variety of environmental conditions and background types. While not every possible scenario has been explicitly characterized, the detection model has been built to generalize based on the analysis of the plume, not the background itself. The robustness of this model training drastically reduces the occurrence of false positives. Once emission plumes are identified by the algorithms, the gas plumes are colorized and labeled on the infrared image displayed on the RedLook Software's user interface on the control computer to allow end users to easily view the emission events in real-time during review. For this MATM, a detection occurs each time a visualized plume is present for any amount of time with the minimum of 15-minute monitoring period for each tour stop.

12.2 Alerting

12.2.1 Alarm events are generated whenever there is a detection in the OGI video footage in any ROI within a monitoring view. These alarm events are transmitted to the end user via both the control computer (sound and visual alarm indicators on the RedLook Software's user interface) and via email.

12.2.2 For the purposes of this ATM, detections are not subject to filtering based on emission rate or any other attribute. As such, all detections result in alarm alerts. Therefore, any emission events detected by the SENSIA RedLook System MATM require follow-up actions to be facilitated by the end user / operator.

13. Method Performance

13.1 METEC Testing Background

The SENSIA RedLook System MATM underwent testing at the Methane Emissions Test and Evaluation Center (METEC), a controlled release testing facility located at the Colorado State University, from June 17, 2024, to June 28, 2024, to evaluate this method's performance. The testing was carried out by GTC Analytics, who also led the post-testing analysis. The testing methodology was based on the METEC Advancing Development of Emissions Detection (ADED) protocol. The SENSIA RedLook System MATM was tested under conditions and parameters which are encompassed within those outlined in the envelope of operation in Section 4. During the METEC testing, the performance of the SENSIA RedLook System MATM was evaluated based on detecting emissions from fixed release points on site. This testing procedure was not conducted comparably as it did not test relative to a reference method.

13.2 METEC Test Parameters

13.2.1 Table 6 lists the testing parameters which applied during the METEC testing campaign in June 2024.

Table 6: Summary of METEC Testing Parameters.

Testing Parameter	**Specification**
Blinding	The testing was blinded to SENSIA and to GTC Analytics. After the test was conducted, emissions data was shared with GTC.
Controlled Releases	During the testing, there were 202 distinct controlled releases, ranging in duration from 14 to 18 minutes.
Release Locations	Releases originated from two groups of equipment: wellheads (5W) and tanks (4T). Both groups of equipment had 3 sources from which emissions originated.
Emission Release Rates	0.00068 kg CH_4/hr to 6.70 kg CH_4/hr.
Ambient Temperature Ranges	11.70°C to 34.40°C, with a mean temperature of 24.6°C.
Ambient Wind Speed Ranges	0.81 m/s to 11.12 m/s, with a mean of 3.96 m/s.
Camera Placement	The Mileva 33F OGI camera was placed on a pan-and-tilt unit at a height of 35 feet above ground.
Pan-and-Tilt Tour Operations	The pan-and-tilt unit was set up to move the Mileva 33F OGI camera to view two preset positions, or tour stops. Each tour stop positioned the Mileva 33F OGI camera to capture one of the two equipment groups (5W and 4T) with just the equipment group on monitoring view of the Mileva 33F OGI camera. The pan-and-tilt unit would stop for 2 minutes at each tour stop and alternate between the two tour stops for the entire duration of testing.
Lenses	The Mileva 33F OGI camera was equipped with a 35 mm lens during the METEC testing campaign, with an approximate FoV of 18° x 13°.

13.2.2 Figure 6 is imagery of the METEC facility during the testing procedures from June 17, 2024, to June 28, 2024.

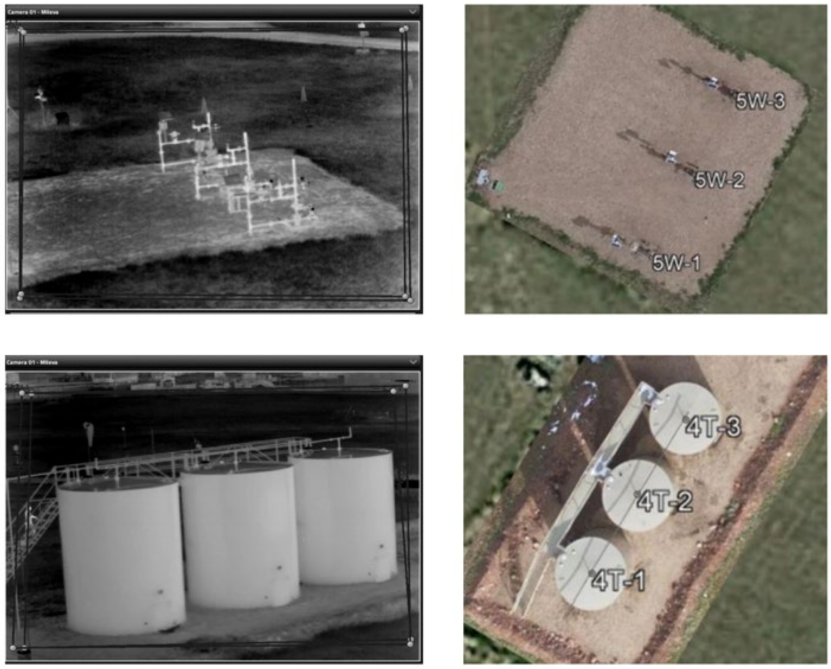

Figure 6: Aerial and thermal imagery of the wellheads (5W) and tanks (4T) release points from the METEC testing campaign.

13.3 METEC Testing Results

13.3.1 METEC testing PoD results are shown with emission rate corrected for wind speed (wind normalized), and emission rate not corrected for wind speed (non-wind normalized). When emission rate is non-wind normalized, the method achieves a 90% PoD of 0.27 kg/hr. When the emission rate is wind normalized, the method achieves a 90% PoD of 0.05 kg/hr/m/s. These values of the 90% PoD were obtained from testing conditions where all testing parameters fell within the acceptable operating ranges described in the envelope of operation described in Section 4. Figure 7 and Figure 8 present the PoD curves derived from the classified detection and controlled release records. These PoD curves show a logistic regression performed against true positive and false negative results.

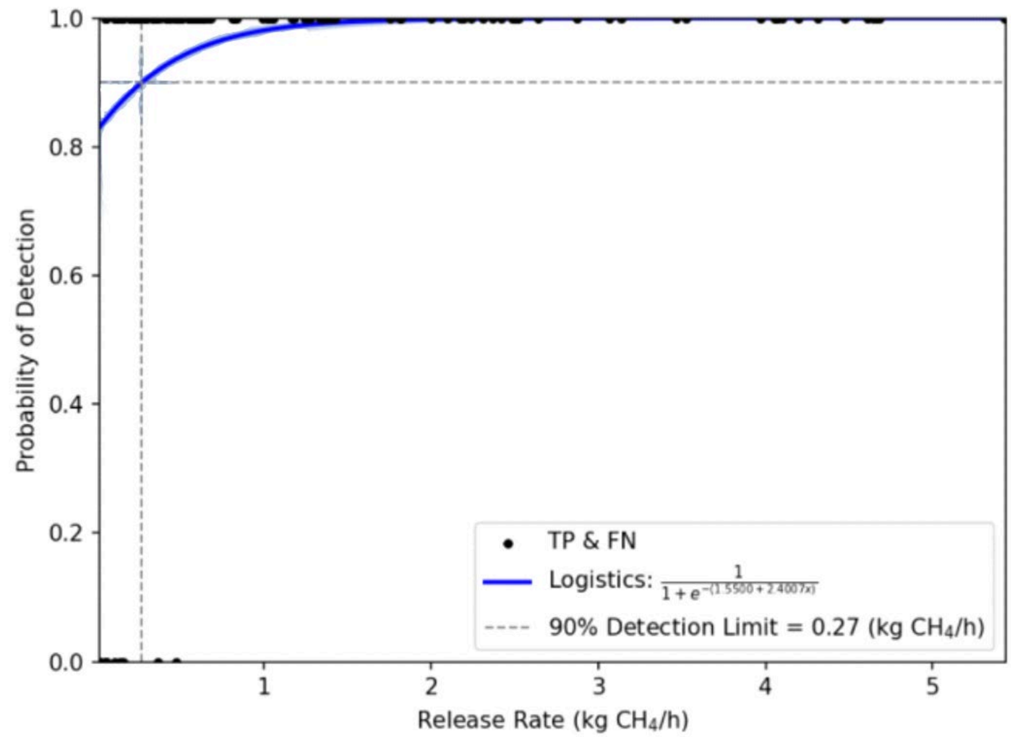

Figure 7: SENSIA RedLook System MATM utilizing the Mileva 33F OGI camera non-wind normalized PoD curve. PoD versus emission rate (kg CH_4/hr) assessed with logistic regression including all true positives and false negatives. True positives and false negative detections are shown with markers at y=1 and y=0, respectively. The regression is performed on bootstrapped results to show a cloud of curves to illustrate uncertainty in the result.

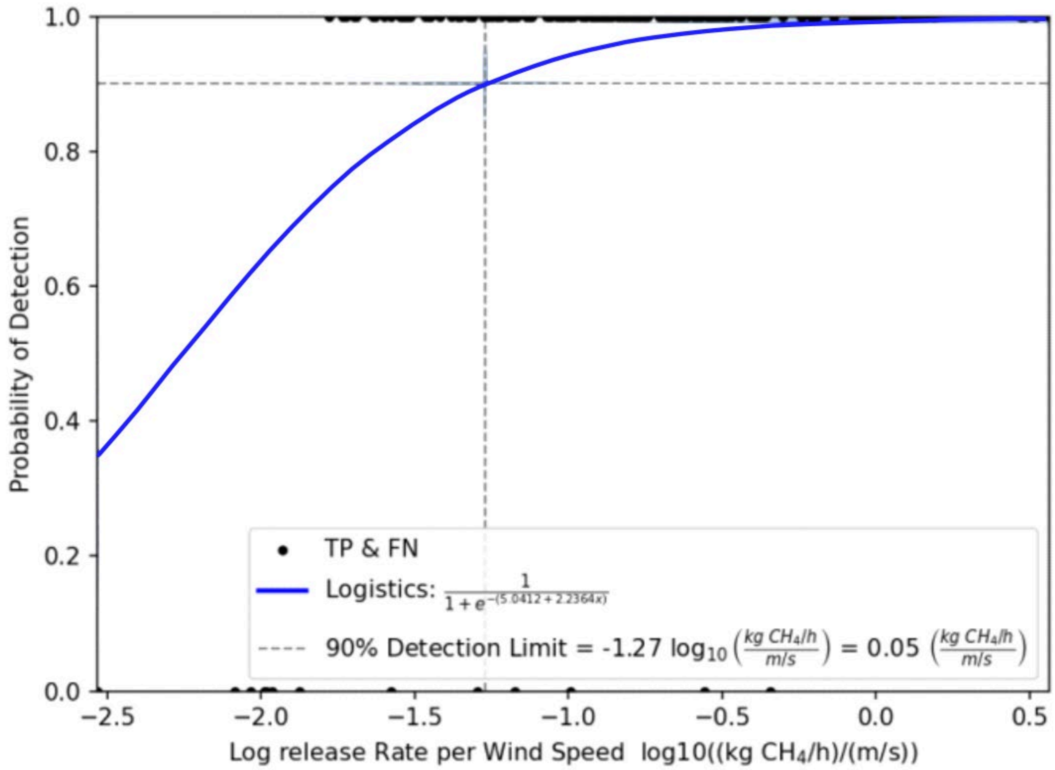

Figure 8: SENSIA RedLook System MATM utilizing the Mileva 33F OGI camera wind normalized PoD curve. PoD versus wind normalized emission rate (kg CH_4/hr)/(m/s) assessed with logistics regression. including all true positives and false negatives. True positive and false negative detections are shown with markers at y=1 and y=0, respectively. A log scale has been applied to better visualize the PoD curve.

13.3.2 Table 7 presents the results of the SENSIA RedLook System MATM in detecting controlled releases during the METEC testing campaign in June 2024. Table 8 presents the SENSIA RedLook System MATM's performance in localization precision by listing the number of true positive detections identified at the equipment unit, equipment group, and facility-level during the METEC testing campaign in June 2024. Table 9 presents the localization accuracy (i.e. the fraction of reports identified as true positive) at each level of precision which are equipment unit, equipment group or better (i.e. equipment unit and equipment group), and facility or better (i.e. equipment unit and equipment group and facility).

Table 7: Classification of Controlled Releases and alarm events from the SENSIA RedLook System MATM.

Level	True Positive	False Negative	False Positive	Excluded from Analysis	Total
Controlled Releases	189	13	-	36	238
Alarm events	189	-	1	7	197

Table 8: SENSIA RedLook System MATM METEC Localization Precision Performance.

Level	True Positive Count
Equipment Unit	163
Equipment Group	26
Facility	0

Table 9: SENSIA RedLook System MATM METEC Localization Accuracy Performance.

Level	Localization Accuracy (%)
Equipment Unit	85.8
Equipment Group	99.4
Facility	99.4
False Positive Fraction	0.5

13.4 TADI Testing: Background

Over four weeks in June and September 2024, SENSIA participated in controlled release testing run by Stanford University and TotalEnergies at the TotalEnergies Anomalies Detection Initiatives (TADI) site in Pau, France. 15 commercial and academic measurement systems were evaluated including the SENSIA RedLook System utilizing the Mileva 33F as described in this method. Testing followed a single-blind format, in which participants were not told the true release rates, nor the location of the release points, nor whether the emission rate was non-zero in each time slot (participants were aware of the release start and stop time as a structured time format with announcement was used). For ease of coordination and planning among the teams on site, a pre-determined schedule was followed. Each release occurred for approximately 45 minutes, followed with a 15-minute break for plume dispersion, ensuring a return to background levels of methane concentration between tests.

13.5 TADI Testing: Results

Table 10 is a summary of true positive (TP), false positive (FP), true negative (TN), and false negative (FN) releases by the SENSIA RedLook System MATM using the Mileva 33F camera. Figure 9 is a probability of detection curve for emissions below 30 kg/hr. While a 90% PoD was not provided in this investigation, only one release rate of 0.01 kg/hr was classified as a false negative.

Table 10: SENSIA RedLook System utilizing the Mileva 33F OGI camera MATM TADI testing results

TP	FP	TN	FN	TP (%)	FP (%)	TN (%)	FN (%)	Max Release Rate Detected (kg/hr)	Minimum Release Rate Detected (kg/hr)
67	0	3	1	95	0	4	1	308.2	0.02

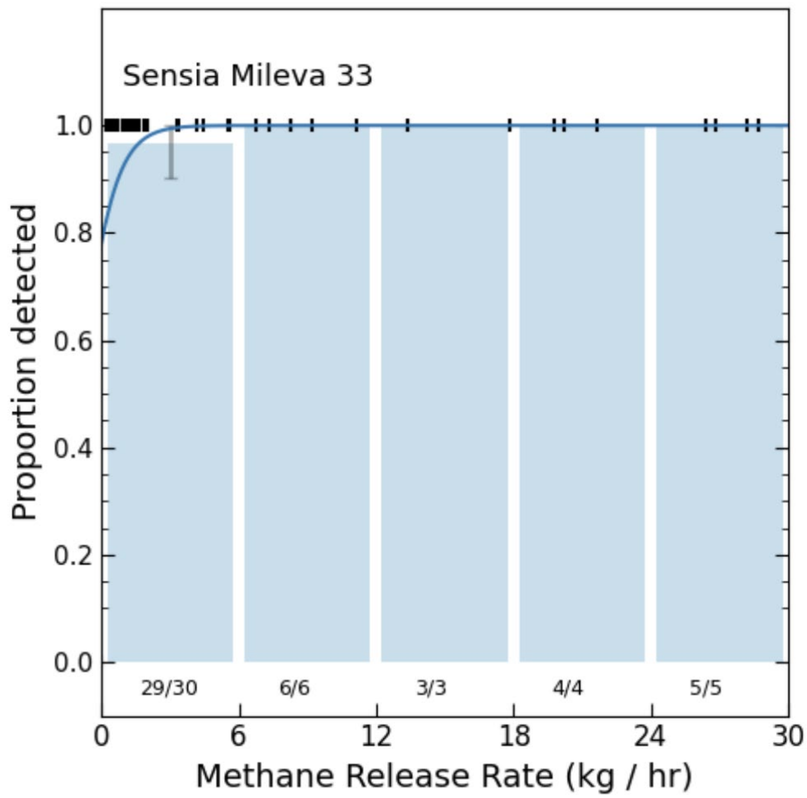

Figure 9: SENSIA RedLook System utilizing the Mileva 33F camera. Each release is marked by a vertical line at y = 0 if not detected and y = 1 if detected, ordered along the x-axis by release volume.

14. Pollution Prevention

[Reserved]

15. Data Management

15.1 Raw Video Collection

Radiometric information generated from the Mileva 33F OGI camera is saved in files with extension ".raw" and ".rlk" formats. The .raw video format does not undergo any data loss through compression and is a standardized raw image/video format that stores each video frame as a matrix showing the digital level value (14 bits) on each pixel of the camera detector array. This video format can be opened by both the RedLook Software and third-party applications. The .rlk video format is SENSIA's proprietary radiometric video format which includes all the information of the .raw files and additional metadata, including information about the Mileva 33F OGI camera serial number and hardware/software configuration and calibration file. The .rlk video format can only be opened within the RedLook Software.

15.2 Camera Diagnostics Log

The RedLook System continuously and autonomously tracks camera and system diagnostics. These diagnostic logs are written in a data format that requires SENSIA to perform the interpretation. In cases such as camera downtime, SENSIA can remotely investigate recorded log data to assess the cause of the downtime.

15.3 Compressed Video

15.3.1 The RedLook Software also saves videos in the compressed ".mp4" video format. These videos cannot be reopened or re-processed by the RedLook Software. The RedLook Software can produce compressed videos in two ways: alert videos and continuous recording footage. Both modes can be independently activated/deactivated and configured according to the end user needs; however, as per this method, alert videos are always created.

15.3.2 Alarm event videos provide visual evidence of the triggered detection event. Alarm event videos include video footage of the detection event and include instants preceding the event. These videos are used for the review of Alarm events and reporting purposes and can be generated manually or automatically. The RedLook Software also offers a video recovery tool to allow the end user to search past detection events and filter by date or alarm type.

15.4 Data Storage

15.4.1 Within the RedLook Software, the raw videos and associated metadata are saved into separate folders on the control computer, where a new folder is automatically generated for every 900 frames. Like the raw videos, the RedLook Software saves the compressed video recordings into separated 2-minute-long videos and stores them onto the control computer. If an autonomous tour is used, these 2-minute-long videos correspond to the 2-minute dwell time at each tour stop monitoring view.

15.4.2 The RedLook Software must store raw and compressed video footage collected valid camera observation periods for a minimum of 5 years. In cases where extended storage capacity is necessary, the hard disk drive (HDD) capacity of the control computer can be scaled accordingly to accommodate larger volumes of video data without impacting system performance.

15.4.3 All metadata generated by the RedLook Software is saved into a local PostgreSQL database. This database contains the following metadata:

- Identification information of Mileva 33F OGI cameras: Includes serial numbers as well as latitudes and longitudes obtained during operation.
- Tour stop information: All information associated with the tour stop configurations used during operation of each Mileva 33F OGI camera.

- ROIs: All identifying information associated with the selected ROIs during the commissioning stage.
- Alarms identification information: All identifying information associated with each alarm events.

15.5 Data Delivery to End users

During the periodic screening window, all alarm events are sent to the end user via the control room computer RedLook software and via email. Upon completion of the periodic screening window, the end user generates a detection report from the control computer. The detection report is a summary of any alarm events encountered during the periodic screening window. The end user can also use the RedLook software to search for any historic alarm events which are logged in the RedLook software on the control computer. Additional requirements for repair, recordkeeping, and reporting apply to the owner/operator and must be included in the company-defined monitoring plan required by 40 CFR 60.5398b(b)(2).

16. References

[Reserved]

Appendices

I. Appendix A: Siting Procedure

Planning

The SENSIA RedLook System MATM siting procedure is structured according to the following sequential phases all carried out by SENSIA:

1. Facility documentation review: The SENSIA RedLook System MATM must be configured according to the specific characteristics of the facility to be monitored. End users provide avaialble documentation to SENSIA in the form of GPS coordinates, satellite images, site layouts, 3D model(s) of the site, and photographs of the site and components to be monitored. Using this information, SENSIA will make informed decisions to ensure the method is optimally adapted to the existing site infrastructure, provides complete coverage of all equipment requiring monitoring, and meets the required performance criteria.

2. Camera layout and configuration: This phase sees optimization of Mileva 33F OGI counts, locations and heights. All these elements are considered in tandem to ensure full monitoring coverage via optimal viewing angles. The following key factors are considered.

    a. Camera line of sight verification: Each camera shall be installed with a clear, unobstructed line of sight to all assigned monitoring areas. No physical obstructions shall be present within the established monitoring view that could interfere with monitoring performance. The monitoring view(s) defined during system siting shall constitute the baseline monitoring view for that camera. Prior to each periodic screening window, the end user will verify via the live camera feed that site conditions, equipment placement, or operational activities have not significantly altered the baseline monitoring view, mainly through new equipment or structures, vehicles, etc. These deviations from the baseline monitoring view shall be corrected prior to continued use of the system for compliance purposes.

    b. Camera installation height: Cameras shall be installed at elevated positions, a minimum of 10 m above the ground, to ensure adequate coverage of monitored components and a downward viewing angle. Installation height shall be sufficient to maintain a clear line of sight, appropriate background contrast, and effective source-localization capability. Cameras shall not be installed in orientations that allow direct or indirect pointing toward the sun at any time, as this may compromise sensor integrity and system operability.

    c. Pan-and-tilt Use: Pan-and-tilt devices autonomously move the OGI camera through a tour of the facility in which the camera dwells on pre-defined monitoring views for 15-minute periods.

    d. Detection range verification: SENSIA will verify that all cameras are installed and configured to operate within the maximum detection range of 100 m. Cameras operating outside validated detection limits shall not be used for compliance monitoring until configuration adjustments are made.

e. Number of cameras: The number of cameras deployed at a facility shall be sufficient to ensure effective monitoring of all components requiring monitoring under this method. Camera count and placement shall collectively provide complete coverage of the defined monitoring areas while meeting line-of-sight, detection range, and periodic screening requirements through the use of optimal viewing angles. The selected configuration shall demonstrate that all required components are observable within the established monitoring schedule.

All configuration parameters are addressed simultaneously and iteratively, until an optimal solution is reached for the specific site. Due to the nature of this process, there will not be a single, definitive solution for each case but multiple possible configurations. The following figure illustrates how SENSIA, based on the information provided by the client (layouts and 3D model), selects the optimal camera position to monitor the area of interest.

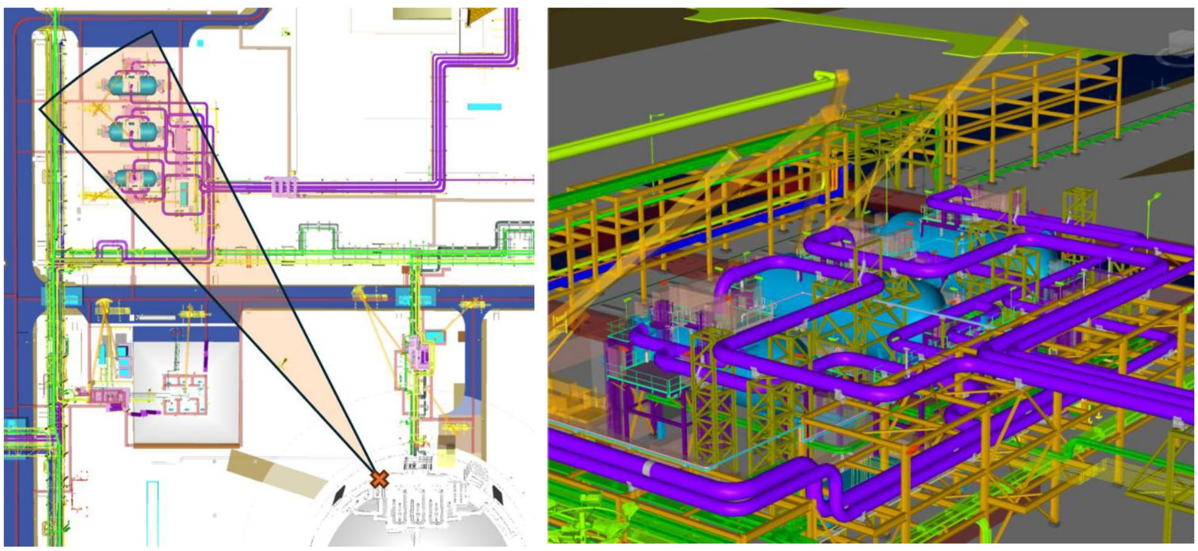

Figure 10. Overview of the siting carried out using an end user provided 3D site model

3. Site survey: SENSIA will validate the proposed system configuration on site, in coordination with the end user, to determine/confirm the final camera installation points and ensure that the preliminary design is accurate and feasible. During this verification, qualified SENSIA personnel will inspect each location and its corresponding monitoring view(s), using portable OGI cameras when necessary to validate the selection in situ. This process ensures that the chosen camera locations are optimal and that the final system configuration delivers the expected performance.

II. Appendix B: Example Site Monitoring Plan

This site monitoring plan outlines the response actions that the owner/operator must perform in response to the results of the periodic screening window from the use of the SENSIA RedLook System MATM. All procedures for periodic screening must be followed as described in Alternative Test Method: SENSIA RedLook System Methane Alternative Test Method (MATM)

1. Response Requirements for use of SENSIA RedLook System Methane Alternative Test Method (MATM).

   SENSIA will autonomously deliver the results of the periodic screening window to the owner/operator within 5 days of completion of the periodic screening window. These results include the elements in Table 11.

Table 11 Response requirements for use of SENSIA RedLook System MATM

Variable	Units	Description
Periodic Screening Result	Yes/No	An Indicator of detected emissions at any monitoring view.
Periodic Screening Emissions Rate Estimate	Kg/hr	A numerical value of the estimated emission rate encountered under a given monitoring view.
Screening Threshold Value	Kg/hr	Numerical value of the screening threshold per table 1 or 2 of 40 CFR Part 60, subpart OOOOb, based on the frequency of screening surveys in 40 CFR 60.5397b(g)(1)(i) - (v).
90% PoD	Kg/hr	Numerical value of the 90% Probability of Detection value representative of the periodic screening window.

Variable	Units	Description
Component Identification	Photograph	Digital image of the individual components identified as emitting, including a visualization of the plume associated with the alert. Photographs are included in the alarm events and detection reports associated with an emission for each emission.
Screening Start Date / Time	Date/Time	Start date and time of the periodic screening window.
Screening End Date / Time	Date/Time	End date and time of the periodic screening window.
Periodic Screening Event Duration	Days, Hours, Minutes	Total duration from start to end of the periodic screening window.
Fugitive Emission Screening Duration	Hours, Minutes	Cumulative duration of valid measurements.

If an alarm is generated during the periodic screening window, the end user must initiate a follow-up inspection/investigation to make repairs. A detection at the component-level triggers a follow-up inspection by the owner/operator as required in 40 CFR 60.5398b(b)(5)(iv), as follows:

1. The owner/operator conducts a monitoring survey of all fugitive emissions components located within 1m radius of the location of the periodic screening detection using either OGI or EPA Method 21 and following the procedures in the owner/operator company-defined monitoring plan.

2. If the detection occurred in a portion of the site containing a storage vessel of a closed vent system, the owner/operator must inspect all covers and closed vent systems connected to all storage vessels that are within a 0.5m radius of the location of the periodic screening detection by inspecting the whole system connected to the portion of the system in the radius of the alarm. Covers and closed vent systems must have a visual inspection to identify defects and must be inspected with OGI or Method 21.

Additional requirements for repair, recordkeeping, and reporting apply to the owner/operator and must be included in the company-defined monitoring plan required by 40 CFR 60.5398b(b)(2).

III. Appendix C: SENSIA RedLook Certificate Program - OGI Continuous Monitoring

The SENSIA RedLook Certificate Program - OGI Continuous Monitoring is the training program required for all personnel who operate the SENSIA RedLook System MATM. Certification through this program is a prerequisite for any personnel conducting commissioning, operation, or maintenance of the system. The program is administered by SENSIA and covers both theoretical and practical components of system operation. Training details are as follows:

1. The training program is two hours in duration and is structured into the following three sequential phases: (a) Theoretical Training, which covers the fundamental concepts of infrared technology, including technical principles, camera operation, and data interpretation; (b) Hands-On Practice, which provides practical instruction in operating OGI cameras, configuring the RedLook software, and managing data and alarm outputs; and (c) a Certification Exam, which evaluates participants' knowledge and practical skills prior to certification.

2. The theoretical and practical curriculum covers the following topics: (a) fundamentals of infrared technology, including the electromagnetic spectrum, conservation of energy, blackbody radiation, and emissivity; (b) infrared remote sensing, including main parameters of infrared cameras, OGI fundamentals, the basis of infrared spectroscopy, and variables for successful gas detection; (c) introduction to RedLook software functionalities, including regions of interest (ROIs), presets, tours, gas detection and quantification, and data and alarm management; (d) RedLook operation at site, including the main window, camera visualization, data window, alarms management, alarms and data recovery and reporting, and Modbus TCP slave configuration; (e) camera maintenance, including routine maintenance and troubleshooting procedures; and (f) hands-on practice in RedLook operation.

Training sessions are conducted by one SENSIA-certified instructor and are limited to a maximum of four attendants per session to ensure adequate instruction and assessment of each participant.