OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NC 27711

October 2, 2025

Dr. Stefan Bokaemper
Kuva Systems
1035 Cambridge St
Suite 10A
Cambridge, MA 02141

Dear Dr. Bokaemper:

We are writing in response to your submission on behalf of Kuva Systems, located in Cambridge, Massachusetts, dated January 22, 2025. In that request you seek approval of an "Alternative Test Method for Methane Detection Technology" under the 40 CFR part 60, Subpart OOOOb – Performance Standards for Crude Oil and Natural Gas Facilities for Which Construction, Modification or Reconstruction Commenced after December 6, 2022 (Subpart OOOOb). We are considering this request under 40 CFR 60.5398b(d), based on the information you have submitted (as described below). The EPA's Office of Air Quality Planning and Standards has been delegated certain authorities under this provision, including the authority to consider and/or approve alternative test methods for methane detection technology.

As EPA understands, Kuva Systems has developed a measurement solution, a short-wave infrared (SWIR) camera, which deploys on a fixed mast/tower, collocated with an anemometer and a power source. The methane lidar camera is mounted on the mast/tower within 100 meters of all potential leak sources, at a height that ensures it has line of sight with respect to most equipment. When in use, the Kuva GCI360 camera utilizes a SWIR sensor and RGB camera to detect and locate methane leaks. When a methane plume is identified, a methane mass emission rate can be calculated from a simple mass balance approach. All detected methane emissions, regardless of quantification, trigger a false-positive screening where a human with specialized training reviews the images to verify the detection. A verified detection is followed by a validation screening, which is identical to the initial periodic screening, for all fields of view where methane was detected. If the validation screening also results in a methane detection, an

alert is generated requiring follow up action. Kuva Systems shares the results of the periodic screening with the owner or operator immediately upon completion. The requirements for an owner response to this information is then stated in 40 CFR 60.5398b(b).

To support Kuva's submittal, Kuva has provided information through EPA's publicly facing portal or through EPA's Confidential Business Information (CBI) Office when a CBI claim was made:

- "Executive Summary" document (January 22, 2025): technical summary description of the technology, a list of all documents submitted as part of the application, and a list of documents that serve as supporting documentation, including testing results, a technical paper, and an approval document from the Colorado AIMM program. This document also indicates that Kuva Systems is requesting approval under the periodic screening approach at the 15 kg/hr threshold. See §60.5398b(d)(2) and §60.5398b(d)(3)(iv).

- "Description of Technology" document (January 22, 2025): in-depth discussion of the theory behind the measurement technology. This document includes a discussion of data collection and processing, probability of detection determination, method limitations, and reporting practices are also included. Kuva Systems also supplemented the publicly facing document with additional documentation claimed as Confidential Business Information (CBI) received on January 29, 2025, which includes further claimed proprietary information and data regarding how the technology works. See §60.5398b(d)(3)(iii) and §60.5398b(d)(3)(iv).

- Publicly facing supporting Information (January 22, 2025): letter detailing Kuva Systems' participation in blind release testing at the Texas Tech University Oilfield Technology Center (OTC), peer reviewed journal article detailing the performance of the Kuva Systems package during a METEC study, and approval letter from the Colorado Department of Public Health and the Environment that gives approval for the Kuva Systems package to be used as part of the AIMM program in the state of Colorado. These materials serve as supporting evidence that Kuva Systems can appropriately detect methane emissions at the 15 kg/hr threshold under the conditions defined in the alternative test method, as applied in the field. See §60.5398b(d)(3)(vi)(A).

- A sampling protocol (i.e. alternative test method) titled "Periodic screening method for Kuva GCI360" (January 22, 2025, revised September 10, 2025): all required procedures and applicable quality assurance and control requirements, consistent with the operation of the methane detection solution, and consistent with the requirements in §60.5398b(d)(3)(vi)(C).

EPA conducted an initial review of the submitted material. Based on this review and receipt of additional information, and consistent with the requirements in §60.5398b(d)(1)(i), EPA determined Kuva Systems' submission to be complete on January 29, 2025.

Based on a review of the provided material and recognizing that Kuva Systems meets the criteria found in §60.5398b(d)(2) to submit an alternative test method for consideration, EPA has determined that the SWIR Camera package meets the periodic screening requirements for the 15 kg/hr threshold. EPA is approving the solution for use by an owner or operator, at an affected facility, for the alternative periodic screening process as described in §60.5398b(b).

Furthermore, the alternative methane test method may be used as an alternative to fugitive emissions monitoring under 40 CFR part 60, Subpart OOOOa - New Source Performance Standards for Crude Oil and Natural Gas Facilities for which construction, modification or reconstruction commenced after September 18, 2015, and on or before December 6, 2022 (Subpart OOOOa) provided the owner or operator using the solution complies with §60.5398b, including the notification, recordkeeping, and reporting requirements outlined in §60.5424b.

EPA has created a docket EPA-HQ-OAR-2024-0619 and will make the relevant documents mentioned in this letter publicly available there. Additional material developed by EPA to justify these decisions is also attached to this letter.

Because the alternative method may be used by owners and operators of affected facilities subject to the monitoring of fugitive emissions components, and inspection and monitoring of covers and closed vent systems subject to Subparts OOOOa and OOOOb, we will post this letter as MATM-016 on the EPA website at https://www.epa.gov/emc/oil-and-gas-alternative-testmethods for use by interested parties.

If you should have any questions or require further information regarding this approval, please contact EPA staff at MethaneATM@epa.gov.

Sincerely,

STEFFAN JOHNSON

Digitally signed by STEFFAN JOHNSON
Date: 2025.10.02 07:02:46 -04'00'

Steffan M. Johnson, Group Leader
Measurement Technology Group

cc: Greg Fried, OECA/AED
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Regional Testing Contacts

Attachments (2)

Kuva Systems Alternative Test Method (MATM-016).pdf

Acceptance Justification: SWIR Camera

MEMORANDUM

TO: EPA-HQ-OAR-2024-0619

FROM: Dave Nash, EPA; Paul Van Rooy, EPA

DATE: October 2, 2025

Subject: **Acceptance Justification: Kuva Systems SWIR Camera (Technology)**

This memorandum summarizes EPA's consideration of the technical basis of Kuva's approach for their periodic measurement solution, called the Kuva GCI360 shortwave infrared (SWIR) camera, documented in ALTTECH-87. Kuva submitted the application on 22 January 2025, as part of the Advanced Methane Detection Alternative Test Method program (40 CFR 60.5398b(d)). EPA's consideration of this technology as a periodic measurement solution under this program. and its application to this program, is further described in EPA's approval letter dated October 2, 2025. This Memorandum also includes a summary of meetings between the company and EPA staff related to the company's request for approval of this technology.

Background Information

Kuva Systems, now a part of Sensirion Connected Solutions, is a methane emissions monitoring technology company with locations in the United States. According to Kuva Systems, this product has been deployed across several oil and gas production facilities in US basins including the Eagle Ford Basin, Permian Basin, Anadarko Basin, Williston Basin, DJ Basin, Appalachian Basin, and Uinta Basin. The Kuva GCl360 has also been deployed in the Canadian provinces of Alberta, British Columbia, and Saskatchewan. In addition to field deployments, Kuva also participated in three blind controlled release studies: 1) the Advancing Development of Emissions Detection (ADED) Tests performed at the Methane Emissions Technology Evaluation Center (METEC) by Colorado State University from April 2021 to October 2021; 2) a Stanford University blind test program from October 2022 to November 2022; and 3) a Texas Tech University blind test performed at the Oilfield Technology Center in the spring of 2024. For purposes of their submission to EPA, Kuva requested their technology be broadly applicable across the sector in the periodic screening program at sensitivities of 15 kg/hr. Based on the

information provided in their submittal to EPA, referenced above, Kuva was eligible to apply as required under §60.5398b(d)(2). Additionally, the submittal was clear as to the applicability of the request and provided the EPA the information included in §60.5398b(d)(3)(i-ii).

Technology Description

Consistent with the requirements in §60.5398b(d)(3)(iii-iv), Kuva Systems' Description of Technology Document details their measurement technology. This document describes the scientific theory behind, and working principles of, the Kuva Systems short wave infrared (SWIR) camera, which is used to screen for leaks at oil and gas sites that require leak detection and repair. The description of technology detailed how the Kuva Systems SWIR Camera is used to detect, quantify, and locate a methane leak. Potential limitations of the technology are also discussed.

Kuva's period screening test method does not require quantification of methane emissions, and instead creates an emissions event alert for any methane detection. Since emissions are measured very near the source, the model does not rely on plume dispersion modeling. The SWIR camera quantifies path-integrated methane concentration (ppm-m) using a passive approach—the GCI360 camera detects SWIR light from the sun that passes through methane plumes, if they exist. To convert path-integrated methane concentration to a mass emission rate, Kuva follows a mass balancing protocol, where methane is quantified based on the path-integrated density measured for each pixel in the gas plume.

To identify, locate, and image a methane plume, the GCI 360 scans the environment of interest, and a SWIR-overlain visible image is taken of each field of view in the site-wide sweep. Processed images are screened for false positives, validated, and subsequently transmitted to the operator for each field of view.

Potential limitations and techniques to mitigate those limitations are clearly outlined in the Description of Technology. For example, obstructed views can be overcome by mounting a camera above all equipment. Operators can also avoid infrared light being absorbed by avoiding positioning testing equipment by standing water (note that the camera can operate in snow and

other freezing conditions, as long as there is collected water on top of snow). . Heavy precipitation, night conditions, thick cloud cover, and shadows can result in poor sensitivity, however QAQC metrics are in place to avoid testing during these times. Finally, the sensitivity of the camera is dependent on both the wind speed as well as the distance between the camera and ground surface. To ensure 90% probability of detection, , Kuva developed a Detection Capability Score calculation that takes into account wind speed, wind direction, and noise. A Detection Capability Score of 0.5 or greater for any field of view is required for collection of valid data.

Kuva Systems also detailed their workflow from initial measurements to end products that are passed on to the owner or operator. This documentation is consistent with the regulatory requirements in §60.5398b(d)(3)(vi)(A) and §60.5398b(d)(3)(v).

Method Sensitivity and Spatial Resolution

Kuva Systems demonstrated a solution sensitivity (90% Probability of Detection) below the 15 kg/hr alerting threshold at a distance of 100 meters, based on studies at METEC, Stanford University, and Texas Tech University. Kuva Systems took part in the 2021 ADED testing conducted at METEC. The METEC facility was designed to mimic and simulate a wide range of emission scenarios associated with upstream and midstream natural gas operations. The facility was built using surface equipment donated from oil and gas operators. A controlled release system allowed metering and control of gas releases at realistic sources such as vents, flanges, fittings, valves, and pressure relief devices found throughout equipment. Emissions rates ranged from 0.4 to 6400 g/hr with leak durations between .16 to 8.3 hours. Average wind speeds ranged from approximately 1 to 10 m/s. The Stanford University study, conducted in October to November 2022, was focused on addressing emissions from unlit flares. Emissions were released from elevated locations spanning 0.037 to 2800 kg/hr. Finally, Kuva participated in a controlled release study at the Texas Tech University Oilfield Technology Center in spring of 2024. The Oilfield Technology Center features non-operational upstream equipment that was donated by operators for educational purposes. This study consisted of 100 blind releases at

14.8 kg/hr with the Kuva Systems SWIR camera stationed at a distance of 100 m away from the release site.

Kuva provided information on the data analysis to determine their 90% probability of detection threshold. EPA found the data and analysis appropriate to support the periodic test method as it was written. Kuva Systems discussed, in detail, the SWIR Camera sensitivity dependence on windspeed, camera distance, and SWIR illumination. Kuva Systems also discussed potential hydrocarbon interferences. The way in which Kuva Systems determines appropriate monitoring conditions is defined in the alternative test method.

Consistent with the requirements in §60.5398b(d)(3)(vi)(A), Kuva's data have provided sufficient evidence to support their requested SWIR Camera detection threshold. Additionally, data provided by Kuva Systems showing the SWIR Camera could identify the approximates source of emissions within 2 meters of a release point, satisfied the area-level spatial resolution requirements in §60.5398b(d)(3)(vii).

Testing Protocol

The alternative test method, developed by Kuva Systems and refined based on feedback from EPA, reasonably matches EPA's understanding how data will be collected. The application of the SWIR camera in their method is consistent with the operation of the system in the validation report. Briefly, five valid images of each field of view are initially collected as a part of this periodic screening method. If any image in a field of view contains a methane detection, a manual false-positive screening is conducted. If the detection is found to be true (false-positive screening passed), an additional validation screening is conducted the following day and an additional five valid images are collected for the field(s) of view containing the methane detection. Alerts are generated when any image collected during the validation screening contain a methane detection.

The alternative test method includes all the information as required in §40 CFR 60.5398b(d)(3)(vi)(B) and (C) and appears to be adequate for use for in the alternative monitoring standards identified in §40 CFR 60.5398b(b). The method includes a defined siting

protocol in Appendix I of the method designed to ensure 100% site coverage. It also identifies any potential interferences (e.g., weather conditions, hydrocarbons) that would be outside the envelope of operation which could affect the technology's probability of detection. The methodincludes substantial QA/QC around the defined limitations to ensure valid data is being collected and determine when potential corrective actions are needed, and details the amount of valid data needed to verify either the presence or the absence of an emission. Finally, the method is written to include sufficient recordkeeping of their procedures that would allow a third-party (e.g., state regulatory authority) to audit the Kuva Systems methane detection solution's processes.

Applicability

Kuva Systems requested the SWIR camera be approved broadly across all basins in the continental United States based on successful deployment in several basins including Eagle Ford Basin, Permian Basin, Anadarko Basin, Williston Basin, DJ Basin, Appalachian Basin, and Uinta Basin. The Kuva GCl360 has also been deployed in the Canadian provinces of Alberta, British Columbia, and Saskatchewan. The detection principle of the SWIR camera is not dependent on topography. Any meteorological or land cover differences between basins that may cause problems are identified during siting and ongoing QAQC checks defined in the method. For these reasons, EPA agrees with the broad approval request.

Meeting Summary between EPA Measurement Technology Group and Kuva Systems

Date	Venue	Participants	Topics
2025-04-08	Teams meeting	Dave Nash, Michael Stovern	Discussion of initial review
2025-04-16	Teams meeting	Dave Nash, Michael Stovern	Discussion of and aggregation of initial comments to send to Kuva Systems
2025-04-16	Teams meeting	Dave Nash, Michael Stovern, Stefan Bokaemper, Jason Bylsma	Discuss initial EPA comments with Kuva Systems team
2025-08-06	Teams meeting	Dave Nash, Paul Van Rooy	Status check on Kuva, bringing Paul up to speed
2025-08-27	Teams meeting	Dave Nash, Paul Van Rooy, Stefan Bokaemper, Jason Bylsma, Felix Hoehne, Thomas McArthur	Continued discussion of ATM feedback
2025-09-03	Zoom meeting	Dave Nash, Paul Van Rooy, Stefan Bokaemper, Jason Bylsma, Thomas McArthur, Felix Hoehne	Continued discussion of ATM feedback and revisions. Discuss calibration requirements.