



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

4/14/2025

Dr. Felix Hoehne  
Sensirion Connected Solutions AG  
Laubisrütistrasse 50  
8712 Stäfa, Switzerland

Dear Dr. Hoehne:

We are writing in response to your submission on behalf of Sensirion Connected Solutions AG (Sensirion), located in Chicago, Illinois, dated July 15, 2024, and supplemental information subsequently provided July 30, 2024, January 18, 2025, April 6, 2025 and April 10, 2025, in which you request the approval of an “Alternative Test Method for Methane Detection Technology” under the New Source Performance Standards for Crude Oil and Natural Gas Facilities for which construction, modification or reconstruction commenced after December 6, 2022 (40 CFR Part 60, 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 authority to consider and/or approve alternative test methods for methane detection technology.

As we understand, Sensirion, has developed a measurement solution, Nubo Sphere, which is a photoacoustic sensor. Sensirion uses a network of Nubo Spheres on a site to measure methane gas concentration. Sensirion also collects environmental data, including wind speed and direction, humidity, and temperature, on each site. Gas concentration and environmental data are used in models to convey that information into leak locations and quantities.

To support your submittal, you have provided the following documents associated with your submission, either submitted through [EPA’s publicly facing portal](#) or through EPA’s Confidential Business Information (CBI) Office when a CBI claim was made:

- Executive Summary documents submitted July 15, 2024: the documents is a publicly facing portal submission that describe submission information and provides a technical summary of the technology, summary of documents submitted and additional contextualizing information. See [§60.5398b\(d\)\(2\)](#) and [§60.5398b\(d\)\(3\)\(i\)-\(ii\)](#).

- Description of Technology document submitted on July 15, 2024, which is a publicly facing document that describes the relevant measurement technology including measurement theory, instrumentation, application, and known limitations. Sensirion also supplemented the publicly facing document with additional documentation claimed as Confidential Business Information (CBI) received on July 30, 2024, which includes further claimed proprietary information and data regarding how the technology works. See [§60.5398b\(d\)\(3\)\(iii\)](#) and [§60.5398b\(d\)\(3\)\(iv\)](#).
- A publicly facing document titled “Supporting Information,” submitted on July 15, 2024, lists documents containing validation data. A third-party validation data set was submitted as a publicly facing document on July 15, 2024. Additional data and reports, claimed as CBI, were received on July 30, 2024, January 23, 2025, and April 06, 2025. These materials, including a third-party validation study, serve as supporting evidence that Sensirion can appropriately detect methane emissions at the 1 kg/hr threshold, as applied in the field. See [§60.5398b\(d\)\(3\)\(vi\)\(A\)](#).
- A sampling protocol titled “Methane Alternative Test Method – SCS Nubo Sphere.” EPA received the final version on April 10, 2025, which includes all the required procedures and applicable quality assurance and control requirements, consistent with your operation of the 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 your submission to be complete.

Based on a review of the provided material, and recognizing that Sensirion Connected Solutions AG meets the criteria found in [§60.5398b\(d\)\(2\) to submit an alternative test method for consideration](#), we have determined that your Nubo Sphere sensor network meets the periodic screening requirements for 1, 2, 3, 5, 10, and 15 kg/hr detection thresholds. Additionally, we are approving your solution for use by an owner or operator, on an affected facility, subject to the caveats included in the protocol, for the alternative periodic screening process as described in [§60.5398b\(b\)](#).

Furthermore, the Nubo Sphere alternative test method may be used as an alternative to fugitive emissions monitoring under the 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 (40 CFR Part 60, 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 is making the relevant documents mentioned in this letter publicly available there (except for information which has been claimed as CBI). 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 subject to the monitoring of fugitive emissions components affected facilities, and inspection and monitoring of covers and closed vent systems subject to 40 CFR part 60, Subparts OOOOa and OOOOb, we will post this letter as **MATM-009** on the EPA website at <https://www.epa.gov/emc/oil-and-gas-alternative-test-methods> for use by interested parties.

This approval letter is not an implied or express endorsement by EPA of any specific companies or products, as EPA does not promote the products, services, or enterprises of non-federal entities. This letter may be freely distributed and used for non-commercial, scientific and educational purposes. The use of the official EPA Seal and Logo is intended for US Government purposes only and may only be reproduced and used with the express, written permission of EPA's Office of Public Affairs. Further, the EPA Seal or Logo may not be used in a way that implies an EPA endorsement.

If you should have any questions or require further information regarding this approval, please contact my staff at [MethaneATM@epa.gov](mailto:MethaneATM@epa.gov).

Sincerely,

Steffan M. Johnson, Group Leader  
Measurement Technology Group

cc:

Greg Fried, OECA/AED  
Elizabeth Leturgey, OECA/OC  
Ned Shappley, OAQPS/AQAD  
Karen Wesson, OAQPS/AQAD  
Regional Testing Contacts

Attachments (2)

Sensirion Alternative Test Method (MATM-009).pdf

Memo to Docket - Acceptance Justification: Sensirion Connected Solutions AG (Technology)

## MEMORANDUM

TO: EPA-HQ-OAR-2024-0619

FROM: Paul Van Rooy, EPA

DATE: April 15, 2025

Subject: **Acceptance Justification: Sensirion Connected Solutions AG (Technology)**

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This memorandum summarizes EPA's consideration of the technical basis of Sensirion Connected Solutions AG (Sensirion), approach for their periodic measurement solution, called the Nubo Sphere, documented in ALTTECH-27, 28, 29, 30, 31, and 32. Sensirion initially submitted on July 15, 2024, 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 April 15, 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.

According to the company's Description of Technology document, the Nubo Sphere is a network of point-sensor devices fixed on a site designed to detect, locate, and quantify methane emissions in real time. Nubo Sphere uses a photoacoustic methane sensing technique to quantify methane concentrations. Sensirion has clearly defined all known interferences and the operating wind for the Nubo Sphere. Sensirion provided details on how their technology overcomes known interferences. Sensirion supported their operating window with long-term stress testing, lab-based humidity and temperature tests, and field data, all claimed as CBI. An ultrasonic anemometer is used to measure windspeed and direction. Leaks are located and quantified using a human-supervised inversion algorithm. Sensirion provided data on the repeatability of the human-supervised inversion algorithm, claimed as CBI. The detailed description of the components included in this document meet the requirements included in *§60.5398b(d)(3)(iii)*.

Sensirion provided sufficient details in their description of measurement technology documents detailing how the Nubo Sphere is used to determine a methane mass emission rate. Briefly, the Nubo Sphere photoacoustic methane sensor is used to quantify methane concentration. Laser-based photoacoustic methane sensors require adjustment for temperature and humidity. Local temperature and humidity are measured using sensors and the methane concentration is adjusted using an algorithm claimed as CBI. The measured Nubo Sphere concentration also requires minor long-term drift

compensation. Sensirion provided EPA several documents, claimed as CBI, detailing sensor performance, detection sensitivity, and operations conditions, to support the use of these environmental and long-term drift compensations. When the Nubo Sphere detects a methane concentration of 0.6 ppm (instrument noise) above background, the human-supervised inversion algorithm is triggered to locate and quantify the methane leaks. The human-supervised inversion algorithm uses the locations of all potential sources along with wind data to estimate the leak origin. Sensirion incorporates several quality assurance and quality control (QA/QC) checks for all environmental sensors to ensure accuracy and reasonableness of these sensors to ensure the accuracy of for their use in quantification of methane. EPA reviewed the calibration and QA/QC processes and concludes that they are sufficient to meet the requirement in *§60.5398b(d)(3)(vi)(B)*.

Consistent with the requirements in *§60.5398b(d)(3)(vi)*, Sensirion provided EPA with multiple third-party validation reports as well as field data to demonstrate their system could achieve their target sensitivity levels of 1kg/hr, 2 kg/hr, 3kg/hr, 5kg/hr, 10 kg/hr, and 15kg/hr. Sensirion provided data from a blinded controlled release study conducted at the METEC test site as part of the ADED 2024 campaign which suggested a 90% probability of detection of less than 1 kg/hr (data claimed as CBI). 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. Sensirion also submitted results from an additional third-party controlled release study to the public-facing portal. The controlled release study was focused on small methane releases but was not conducted at a facility with surface equipment designed to simulate upstream and midstream natural gas operations. Results of this study suggest a detection limit of 17 g/hr. EPA thoroughly reviewed these reports and find them sufficient verification of the sensitivity of their technology as required in *§60.5398b(d)(3)(vi)(A)*.

Sensirion's final alternative test method, developed by the company and revised based on comments from the EPA, reasonably matches how data was collected during the third-party validation report. The method is sufficient for use for compliance in the oil and gas sector, and includes all the information as required in *§40 CFR 60.5398b(d)(3)(vi)(C)*. The method includes critical practices such as the siting of the individual sensors, installation, ongoing validation of full site coverage, and metrics for re-siting evaluations. The method includes sufficient information to allow a user to understand the data collection through data reporting phase. The method also includes sufficient QA/QC of the methane

sensors, temperature and humidity sensors, and anemometer to ensure when valid data is being collected and when potential corrective actions are needed. Additionally, Sensirion includes several reasonableness check which would allow trained Sensirion personnel to continually evaluate the processes and make any necessary changes in equipment. 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 Sensirion's processes.

Finally, Sensirion requested their solution be approved broadly across all basins in the continental United States. The justification for the broadly applicable request is based on 14 case studies claimed as CBI and discusses in presentations during meetings with the EPA. These case studies were conducted at sites in the California, Canada, the Barnett basin, and the Bakken basin. The case studies covered a variety of site complexities and surrounding geographies. In each of these case studies, Sensirion demonstrates their system's ability to pick up different leak rates and sizes from different types of equipment failures and leaks, as well as demonstrating the system's response once repairs are made. Sensirion also conducted rigorous long-term lab testing to understand the environmental limitations of the technology. Those data were submitted as CBI. Sensirion's case studies are sufficient evidence that their measurement system has performed effectively in different geographical and environmental conditions. Based on EPA's review of Sensirion's case studies, EPA concludes that Sensirion has sufficient evidence that their measurement system has performed effectively in different geographical and environmental conditions. For this reason, EPA agrees that that Sensirion's solution can be used broadly and has not included any basin restriction in the alternative test method approval letter.

### Meeting Summary between EPA Measurement Technology Group and Sensirion

Date	Venue	Participants	Topics
2024-10-30	EPA offices	Felix Hoehne, Paul Van Rooy, Ned Shappley	Initial discussion regarding what we expect to see in the ATM and what EPA expects to see as evidence / field validation.
2024-11-21	Teams Call	Felix Hoehne, Javier Bilbao, Paul Van Rooy, Walter Lin	<p>Agenda:</p> <p>1) Open up to any questions Sensirion has for EPA regarding ATM feedback</p> <p>2) Defining your envelope of operations: What are the environmental factors that interfere with or impact your ability to achieve 90% probability of detection at your desired detection threshold? With those in mind, define your operating window for us. Show us the data that supporting your operating window is adequate.</p> <p>3) Defining your siting requirements: Walk us through how you site your technology on a facility. How do you make initial siting decisions? What goes into that decision? After you set up your sensors, how do you verify your siting is adequate? What metrics are you looking at? What are the bounds on those metrics? How long does it take you to verify your siting is adequate? What are you tracking to ensure your siting is adequate on a regular basis? What would trigger a re-siting of your sensors?</p>
2025-01-23	Teams Call	Felix Hoehne, Javier Bilbao, Paul Van Rooy, Walter Lin	<p>Agenda:</p> <p>Main discussion items:</p> <ul style="list-style-type: none"> <li>- Context regarding the changes to the ATM</li> <li>- discuss questions regarding the new ATM template</li> </ul>
2025-02-27	Teams Call	Felix Hoehne, Javier Bilbao, Paul Van Rooy, Walter Lin, Karen Marsh	<p>Agenda:</p> <ul style="list-style-type: none"> <li>-Go over any questions or comments from Sensirion</li> <li>-Sensirion to show data that supports the full range of their operating window</li> <li>-Offsets/drift/compensation (comments in ATM)</li> </ul>

			-Now that we have had a chance to dig in a bit more, let's walk through the field data plots quickly. What are they telling us. When would an alert occur?
2025-03-05	Team Call	Felix Hoehne, Paul Van Rooy, Walter Lin, Karen Marsh	<p>Follow up on last weeks meeting Regarding updates to ATM made by Sensirion.</p> <p>Discussion included:</p> <ul style="list-style-type: none"> <li>-Updates to siting procedure</li> <li>-Updates to QAQC parameters</li> <li>-Cal check and wind data requirements</li> <li>-Tasks to complete prior to next meeting.</li> </ul> <p>Sensirion plans to send additional data to support method envelop of operation and drift corrections.</p>
2025-03-10	In person	Felix Hoehne, Paul Van Rooy, Ned Shappley,	In person meeting to discuss Sensirion ATM application. Meeting focussed on periodic screening procedure and siting procedure.
2025-03-13	Teams Call	Felix Hoehne, Paul Van Rooy	Discuss additional materials needed from Sensirion in order to fully validate method. Those materials include results from an additional blind study, lab testing showing full range of humidity, data on compensation, and wind comparisons (NWS met stations vs Sensirion met). Discuss necessary additions to the method – QAQC checks for wind and humidity, optional calibration check procedure.
2025-03-19	Teams Call	Felix Hoehne, Karen Marsh, Walter Lin, Paul Van Rooy	Sensirion to discuss method additions since last meeting. Sensirion shares final validation data sets. EPA discusses next steps
2025-03-27	Teams Call	Felix Hoehne, Karen Marsh, Walter Lin, Paul Van Rooy	Working meeting to discuss final revisions of the method and next steps.