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

23 September 2025

Mr. John Tang
SLB
5950 N Course Dr.
Houston, Texas USA 77072

Dear Mr. Tang:

We are writing in response to your submission on behalf of SLB, located in Houston, TX, initially submitted on March 14, 2025 under ChampionX, LLC and was resubmitted under the company, SLB on August 28, 2025. In that request SLB seeks 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). EPA is considering this request under 40 CFR 60.5398b(d), based on the information SLB has submitted (as described below). 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, SLB has developed a measurement solution, a Systematic Observation of Facility Intermittent Emissions (herein referred to as SOOFIE) emissions monitoring system, which deploys a network of SOOFIE devices, that measure methane concentration using a metal-oxide semiconductor (MOS) sensor, in addition to environmental variables like temperature, pressure, and relative humidity. For each emission event, methane concentration and wind values are used to identify the most likely leak source and perform event-based quantification using a hybrid quantification approach that applies a physics-based atmospheric model to a machine learning algorithm. SLB generates an alert if the periodic screening emission rate is above the applicable alerting threshold. The requirements for owner/operator response to this information is then stated in 40 CFR 60.5398b(b).

To support the submittal, SLB has provided the following documents associated with the submission. This information was submitted through EPA's publicly facing portal or through EPA's Confidential Business Information (CBI) Office when a CBI claim was made.

- "Executive Summary" document, initially submitted on March 14, 2025 and updated on August 28, 2025, providing a summary description of the technology, updates to the application due to ChampionX's acquisition by SLB, a list of all documents submitted as part of the application, and a list of CBI documents that serve as supporting documentation. This document also indicates that SLB is requesting approval under the periodic screening approach at the 5, 10, and 15 kg/hr thresholds. See §60.5398b(d)(2) and §60.5398b(d)(3)(iv).

- "Description of Technology" document, initially submitted on March 14, 2025 and updated on August 28, 2025, providing an in- depth discussion of the theory behind the measurement technology including siting tool workflow and evaluation, known limitations, mass emissions rate calculation, method validation and performance, data management, and reporting practices. SLB also supplemented the publicly facing document with additional documentation as CBI, received initially on March 14, 2025 and updated on August 28, 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).

- A "Visual Workflow" document, initially submitted on March 14, 2025 and updated on August 28, 2025, indicating how data are collected, processed, maintained, and provided to the owner/operator. See §60.5398b(d)(3)(v).

- Publicly facing supporting information, initially submitted on March 14, 2025 and updated on August 28, 2025, including the installation and user guide of the SOOFIE device and a brochure with technical specifications of the SOOFIE device. Additional data and reports, claimed as CBI, were received initially on March 14, 2025 and updated on August 28, 2025 that serve as supporting evidence that SLB can appropriately detect methane emissions at the 5, 10, and 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 "SLB SOOFIE Alternative Test Method.pdf", initially submitted on March 14, 2025. EPA received the final version on August 28, 2025, which includes all the required procedures and applicable quality

assurance and control requirements, consistent with the 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 the submission to be complete on April 29, 2025.

*Recognizing that SLB meets the criteria found in §60.5398b(d)(2) to submit an alternative test method for consideration, and based on a review of the completed materials, EPA has determined that the SOOFIE emissions monitoring system meets the periodic screening requirements for the 5, 10, and 15 kg/hr threshold with facility-level spatial resolution***.** 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), subject to the caveats included in the protocol, for the alternative periodic screening process as described in §60.5398b(b).

Furthermore, the alternative 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/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.

EPA will post this letter as MATM-013 on the EPA website at: https://www.epa.gov/emc/oil-and-gas-alternative-test-methods for use by interested parties. This will allow SLB's alternative method to be used by other owners and operators of facilities subject to the monitoring of fugitive emissions components, covers, and closed vent systems subject to Subparts OOOOa and OOOOb.

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.

Sincerely,

STEFFAN JOHNSON

Digitally signed by STEFFAN JOHNSON
Date: 2025.09.23 14:34:28 -04'00'

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)

SLB SOOFIE Alternative Test Method.pdf

Acceptance Justification: SOOFIE Emissions Monitoring System

MEMORANDUM

TO: EPA-HQ-OAR-2024-0619

FROM: Carlos J. Valle Díaz, EPA; Ned Shappley, EPA

DATE: September 23, 2025

Subject: **Acceptance Justification: SOOFIE Emissions Monitoring System**

This memorandum summarizes EPA's technical consideration of SLB's approach for their periodic measurement solution, the Systematic Observation of Facility Intermittent Emissions (SOOFIE) emissions monitoring system, originally documented in ALTTECH-96, 97, 98, 99, and 100. ChampionX originally submitted these applications on 14 March 2025. The application was resubmitted 28 August 2025 as ALTTECH-128, 129, and 130 when ChampionX was acquired by SLB 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 September 23, 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

SLB is a global multinational oilfield service company with principal executive offices in in Houston, Texas focused on services for the energy sectors, including the midstream and upstream oil and gas production sectors. One of these services is though the development and commercialization of solution for measuring fugitive methane emissions, such as the Systematic Observation of Facility Intermittent Emissions (herein referred to as SOOFIE). SOOFIE devices have been deployed across the U.S. and internationally in diverse geographies and facility types. In addition to field deployments, SLB (at that point, ChampionX) also participated in the 2024 Advancing Development of Emissions Detection (ADED) Tests performed at the Methane

Emissions Technology Evaluation Center (METEC) by Colorado State University. For purposes of their submission to EPA, SLB requested their technology be broadly applicable across the sector in the periodic screening program at sensitivities of 5, 10, and 15 kg/hr. Based on the information provided in their submittal to EPA, referenced above, they were 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), SLB's Description of Technology Document details their measurement technology. This document describes the scientific theory and working principles of SLB's SOOFIE emissions monitoring system, a network of point sensors designed to detect, localize, and quantify methane emissions at oil and gas facilities. Each SOOFIE device is equipped with a metal-oxide semiconductor (MOS) sensor to detect changes in electrical resistance driven by surface adsorption and desorption phenomena. As detailed in the Description of Technology, SLB's SOOFIE emissions monitoring system uses signal processing algorithms that normalize and calibrate voltage responses to derive methane-specific concentration (ppm) and emission rates (kg/hr).

In ambient conditions, oxygen molecules adsorb onto the surface of the metal-oxide material, forming a depletion layer that increases the MOS sensor's electrical resistance. When methane interacts with the sensor, it displaces the adsorbed oxygen, altering the surface charge distribution and thereby reducing the electrical resistance. To quantify methane, an empirical model calculates methane concentration using MOS sensor outputs along with environmental parameters such as temperature, relative humidity, and specific humidity.

To identify the start and end of methane emission events, all methane concentration measurements collected across the SOOFIE sensor network are processed through a proprietary AI-based event detection algorithm. This algorithm evaluates temporal and concentration-based patterns in the data to classify each reading as either part of, or outside, a methane emission

event. The data is pre-processed by a series of steps that include retaining only data with a minimum change of 0.5 ppm in methane concentration to eliminate noise, ensuring data fall within the defined operating parameters of the system, and including only data downwind of a probable source at the time of measurement to exclude off-site emissions. Each event must contain at last three valid 5-minute average data points to meet the minimum temporal coverage requirement to estimate methane emission rates using SLB's proprietary quantification algorithm – a hybrid model combining machine learning techniques with a Gaussian plume dispersion framework.

To locate the methane leaks, SLB utilizes a proprietary algorithm that incorporates site-specific information with wind data, for example wind speed and variability, to provide the recommended quantity of SOOFIE devices (≥ three), as well as their suggested placement to ensure maximum spatial coverage prior to initial site setup. As detailed in the Description of Technology, SLB provides the general workflow of their siting tool with additional supporting information submitted as CBI. When applicable, the algorithm can be re-run to incorporate recent wind data and ensure spatial coverage requirements are met to obtain at least 90% probability of detection (POD) across the site. A result from this practice could involve adding additional sensor placements to the site.

Potential limitations and techniques to mitigate those limitations are clearly outlined in the Description of Technology. For example, SOOFIE devices are not intrinsically safe and do not carry any certifications for use when an explosive atmosphere may be present, however, SOOFIE devices are placed at a distance of at least 1.5 times the source height away from each probable emissions source. In addition, the optimal number and location of the SOOFIE devices are determined using their proprietary algorithm. Lastly, the internal components of the SOOFIE devices operate under a specified range of environmental conditions, like wind speed, relative humidity, temperature, pressure at ground level, and oxygen content in ambient air of ~ 21%, and certain wind conditions need to be achieved for successful transport of methane to the SOOFIE device and ensure 90% POD is maintained. SLB's Description of Technology defines the envelope of operation of the SOOFIE emissions monitoring system that meets the periodic

screening requirements for the 5, 10, and 15 kg/hr threshold with facility-level spatial resolution. SLB 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)(v) and §60.5398b(d)(3)(vi)(A).

Method Sensitivity and Spatial Resolution

SLB demonstrated a solution sensitivity (90% Probability of Detection) below the 5 kg/hr alerting threshold, based on 2024 ADED test conducted at METEC at Colorado State University. 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. The series of tests were conducted from February 2024 through April 2024 where tests ranged in duration from 0.3 to 8 hours, with 1-5 simultaneous sources in an emission event. Total methane emissions rates per source ranged from 0.08 to 6.71 kg/hr, and total facility emissions ranged from 0.2 to 9.4 kg/hr. SLB discussed, in detail, two additional testing campaigns as supporting information for their method's validation and performance.

SLB provided information on the reanalysis of the SOOFIE emissions monitoring system METEC data to determine their 90% POD. EPA found the reanalysis appropriate to support the periodic test method as it was written. For each release, it was confirmed that the methane plume dispersed over at least one SOOFIE device in the sensor network. Any emissions events where wind speed was outside the envelope of operation were removed from the calculations. SLB demonstrated facility-level resolution based on 2024 ADED tests as well as field data. A 90% POD threshold was identified at approximately 0.6 kg/hr, which is below the reference detection limit of 5 kg/hr. Additional examples demonstrating facility-level detections are included in SLB's Description of Technology document.

Consistent with the requirements in §60.5398b(d)(3)(vi)(A), SLB's data has provided sufficient evidence to support their requested SOOFIE emissions monitoring system detection thresholds. Additionally, data provided by SLB showing the SOOFIE emissions monitoring system could identify the approximates source of emissions within the local boundaries of the site, satisfied the facility-level spatial resolution requirements in §60.5398b(d)(3)(vii).

Testing Protocol

The alternative test method, developed by SLB and refined based on feedback from EPA, reasonably matches EPA's understanding of how data will be collected. The application of the SOOFIE emissions monitoring system in their method is consistent with the operation of the system in the validation report. 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 B of the method designed to ensure 100% site coverage and identifies any potential interferences, like wind conditions that would be outside the envelope of operation which could affect the technology's probability of detection, while also developing substantial QA/QC around these limitations to ensure valid data is being collected and highlight when potential corrective actions are needed. The method also details the amount of valid data needed to verify either the presence or the absence of an emission and is written to include sufficient recordkeeping of their procedures that would allow a third-party, for example a state regulatory authority, to audit the SLB's processes.

Applicability

SLB requested the SOOFIE emissions monitoring system be approved broadly across the oil and gas sector in the continental United States based on successful deployment in several basins including the Anadarko Basin, Appalachian Basin, Denver Basin, Fort Worth Basin, Greater Green River Basin, Permian Basin, Powder River Basin, San Joaquin Basin, Santa Maria-Ventura-Los Angeles Basin, TX-LA-MS Salt Basin, Western Gulf Basin, and Williston Basin. The SOOFIE

emissions monitoring system have also been internationally deployed in Canada, South American, Europe, Asia, Oceania, and the Middle East. The detection principle of the SOOFIE emissions monitoring system is not dependent on topography. Any meteorological differences between basins that may cause challenges (e.g., high wind speed and wind direction variability) 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 SLB

Date	Venue	Participants	Topics
2025-04-22	Teams meeting	Carlos J. Valle Díaz, Michael Stovern, Trevor Cross, Sagar Gaur, Khalid Soofi, Johanna Eidmann, Hayden Myers, and Antuaneth Rodriquez	Intro meeting and clarification of first set of questions from the review team based on their submitted application.
2025-04-29	Teams meeting	Carlos J. Valle Díaz, Michael Stovern, Trevor Cross, Sagar Gaur, Khalid Soofi, Johanna Eidmann, Hayden Myers, and Antuaneth Rodriquez	Completed discussing remaining unanswered questions from the previous meeting and agreed to begin iterating over the ATM reviewing process.
2025-05-14	Teams meeting	Carlos J. Valle Díaz, Michael Stovern, Ned Shappley, and John Tang	John was introduced as the new point of contact moving forward. He was updated on the status of the review process.
2025-05-21	Teams meeting	Carlos J. Valle Díaz, Michael Stovern, John Tang, Sagar Gaur, Khalid Soofi, Johanna Eidmann, Hayden Myers, and Antuaneth Rodriquez	Discussed questions related to their detection and alerting scheme and envelope of operation of their technology.
2025-06-10	Teams meeting	Carlos J. Valle Díaz, Ned Shappley, Johanna Eidmann, Sagar Gaur, Khalid Soofi, MaryBeth Clifford, and Antuaneth Rodriquez	Continued discussion of ATM feedback.
2025-08-05	Teams meeting	Carlos J. Valle Díaz, Ned Shappley,	Continued discussion of ATM feedback and

Date	Venue	Participants	Topics
		Johanna Eidmann, Sagar Gaur, Khalid Soofi, MaryBeth Clifford, and Antuaneth Rodriquez	revisions. Discussed calibration requirements.
2025-08-21	Teams meeting	Carlos J. Valle Díaz, Ned Shappley, John Tang, Johanna Eidmann, Sagar Gaur, Khalid Soofi, and Drew Pomerantz	Discuss final edits to the method and how to move forward to finalize the approval.