TRUSTED PROVEN QUALITY

Review of EPA Method 21 as relates to the SEM5000 Portable Methane Detector

Method 21 - Determination of Methane Leaks

6.0 Equipment and Supplies

A methane monitoring instrument meeting the following specifications is required:

6.1 The methane instrument detector shall respond to the compounds being processed. Detector types that may meet this requirement include, but are not limited to, catalytic oxidation, flame ionization, infrared absorption, and photoionization.

The **SEM5000** responds to the compounds being processed thanks to an embedded infrared absorption spectrometer. The method implemented is called TDLAS, (Tunable Diode Laser Absorption Spectroscopy). It delivers a signal proportional to the gas (methane) concentration.
This method does not affect the gas sample and is selective to the target gas, (methane). The specific reaction to methane cancels the cross sensitivity to other normally occurring gases in a known atmosphere, like a biogas process or natural gas network.

6.2 The instrument shall be capable of measuring the leak definition concentration specified in the regulation.

The **SEM5000** is able to measure concentrations of methane in the range of 0.5ppm to 100% of volume. This complete range of concentrations is covered by the instrument thanks to three methods of calculation which are operational in real time. The instrument manages and activates automatically the adequate range of concentration.

6.3 The scale of the instrument meter shall be readable to ±2.5 percent of the specified leak definition concentration.

The resolution of **SEM5000** is 0.1ppm, less than 2.5 percent of the specified leak definition concentration.

6.4 The instrument shall be equipped with an electrically driven pump to ensure that a sample is provided to the detector at a constant flow rate. The nominal sample flow rate, as measured at the sample probe tip, shall be 0.10 to 3.0 l/min (0.004 to 0.1 ft3 /min) when the probe is fitted with a glass wool plug or filter that may be used to prevent plugging of the instrument.

The **SEM5000** is equipped with an electrically driven suction pump and has a nominal flow rate in the range of 0.6 to 1 l/min.
The flowrate is controlled by pressure difference.
An alarm is activated in case of blocked flow.

6.5 The instrument shall be equipped with a probe or probe extension or sampling not to exceed 6.4 mm (1/4in) in outside diameter, with a single end opening for admission of sample.

The **SEM5000** features a quick-connect gas inlet coupling with locking mechanism.
The diameter of the sample probe is 4mm.
In SEM survey configuration, the telescopic probe is used and has a single opening for admission of the sample.

6.6 The instrument shall be intrinsically safe for operation in explosive atmospheres as defined by the National Electrical Code by the National Fire Prevention Association or other applicable regulatory code for operation in any explosive atmospheres that may be encountered in its use. The instrument shall, at a minimum, be intrinsically safe for Class 1, Division 1 conditions, and/or Class 2, Division 1 conditions, as appropriate, as defined by the example code. The instrument shall not be operated with any safety device, such as an exhaust flame arrestor, removed.

The **SEM5000** is ATEX certified to be intrinsically safe for use in Class 1, Zone 1 areas.
ATEX Marking: II2 G Ex ib op is IIB T3 Gb $-30 \leq Ta \leq +50°C$
ATEX certification number: INERIS 18ATEX0029X
The instrument does not require any additional safety devices.

7.1 Two gas mixtures are required for instrument calibration and performance evaluation:
7.1.1 Zero gas. Air, less than 10 parts per million by volume (ppmv) VOC.
7.1.2 Calibration gas. For each organic species that is to be measured during individual source surveys, obtain or prepare a known standard in air at a concentration approximately equal to the applicable leak definition specified in the regulation.

The **SEM5000** requires daily field calibration prior to the start of the survey. Calibration requires the use of two known gas mixtures: Zero air and methane (CH4) in a concentration of 500ppmv.

8.1.1 Response factor. A response factor must be determined for each compound that is to be measured, either by testing or from reference sources. The response factor tests are required before placing the analyzer into service, but do not have to be repeated at subsequent intervals.
8.1.1.1 Calibrate the instrument with the reference compound as specified in the applicable regulation. Introduce the calibration gas mixture to the analyzer and record the observed meter reading. Introduce zero gas until a stable reading is obtained. Make a total of three measurements alternating between the calibration gas and zero gas. Calculate the response factor for each repetition and the average response factor.
8.1.1.2 The instrument factors for emission to be measured, (methane), shall be less than 10 seconds unless otherwise specified in the applicable regulation. When no instrument is available that meets this specification when calibrated with the reference gas specified in the applicable regulation, the available instrument may be calibrated with the gas to be measured, (methane), so long as the instrument then has a response factor of less than 10 seconds.

Calibration of the **SEM5000** consists of three alternating measurements between two calibration gases, methane and zero gas. The **SEM5000** records and calculates the response factor for each measurement as well as the average response factor of the tests. All calibration information is recorded and used to auto-fill Calibration Procedure and Background reports in the SEMsoft software package.
The **SEM5000** response factor to methane, (CH4), is 1.

8.1.2 Calibration Precision. The calibration precision test must be completed prior to placing the analyzer into service and at subsequent 3-month intervals or at the next use, whichever is later.
8.1.2.1 Make a total of three measurements by alternately using zero gas and the specified calibration gas. Record the meter readings. Calculate the average algebraic difference between the meter readings and the known value. Divide this average difference by the known calibration value and multiply by 100 to express the resulting calibration precision as a percentage.
8.1.2.2 The calibration precision shall be equal to or less than 10 percent of the calibration gas value.

Calibration of the **SEM5000** consists of three alternating measurements between two calibration gases, methane and zero gas. The **SEM5000** records the readings, calculates the average difference between the meter readings and the known value and divides the average difference by the known calibration value and multiplies by 100 to express the resulting calibration precision as a percentage. These calculations are recorded and used to auto-fill Calibration Precision report in the SEMsoft software package.
SEM5000 calibration precision is equal to 10 percent of the calibration gas value.

8.1.3 Response Time. The response time test is required before placing the instrument into service. If a modification to the sample pumping system or flow configuration is made that would change the response time, a new test is required before further use.
8.1.3.1 Introduce zero gas into the instrument sample probe. When the meter reading has stabilized, switch quickly to the specified calibration gas. After switching, measure the time required to attain 90 percent of the final stable reading. Perform this test sequence three times and record the results. Calculate the average response time.
8.1.3.2 The instrument response time shall be equal to or less than 30 seconds. The instrument pump, dilution probe (if any), sample probe, and probe filter that will be used during testing shall all be in place during the response time determination.

Calibration of the **SEM5000** consists of three alternating measurements between two calibration gases, methane and zero gas. The **SEM5000** records the measure of the time required to attain 90 percent of the final stable reading and calculates the average response time of the three tests. These measurements and calculations are recorded and used to auto-fill the Instrument Response Time record in the SEMsoft software package.
When equipped with the sample probe, the **SEM5000** response time to attain ninety percent of the final stable reading is less than 30 seconds.