

APPENDIX "G"

Performance Specifications for:

Continuous Emissions Monitoring of Total Hydrocarbons.

a. Applicability.

1. This method applies to the measurement of total hydrocarbons as a surrogate measure for the total gaseous organic concentration of the VOC control device outlet. The concentration is expressed in terms of propane.
2. The Department may approve the use of gas conditioning, including cooling to between 4.4° and 18°C (40° and 64°F), and condensate traps to reduce the moisture content of the sample gas if the owner/operator:
 - i. Successfully demonstrates to the Department that the use of such system is necessary for the specific application.
 - ii. Includes in the demonstration a quantification of the total hydrocarbon concentration (THC) lost to the gas conditioning system.

b. Principal. A gas sample is extracted from the source through a heated sample line and heated glass fiber filter to a flame ionization detector (FID), or other detector as approved by the Department. Results are reported as volume concentration equivalents of the propane.

c. Definitions. As used in this Section, all terms not defined herein shall have the meaning given them in the November 15, 1990 Clean Air Act Amendments (CAAA), or in Section 2 of this regulation.

"Calibration drift" means the difference in the measurement system response to a mid-level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

"Calibration error" means the difference between the gas concentration indicated by the measurement system and the known concentration of the calibration system.

"Calibration gas" means a known concentration of a gas in an appropriate diluent gas.

"Measurement system" means the total equipment required for the determination of the inlet and outlet gas concentrations, percent capture efficiency, and gas outlet emission rate. The system consists of the following major subsystems:

1. Sample interface--the portion of the system that is used for one or more of the

following:

- i. Sample acquisition.
 - ii. Sample transportation.
 - iii. Sample conditioning.
 - iv. Protection of the analyzer from the effects of the stack effluent.
2. Organic analyzer--the portion of the system that senses organic concentration and generates an output proportional to the gas concentration.
 3. Data recorder--the portion of the system that records a permanent record of the measurement values.
 4. Flow rate system
 - i. A gas volume meter meeting the requirements of Method 2A, Section 2.1 (40 CFR Part 60, **Appendix A**, July 1, 1992), or,
 - ii. A system approved by the Department.

"Response time" means the time interval from a step change in pollutant concentration at the inlet to the emission measurement system to the time at which 95 percent of the corresponding final value is reached as displayed on the recorder.

"Span value" means for most incinerators, a 50 parts per million (ppm) propane span. Different span values may be allowed with prior Department approval.

"Zero drift" means the difference in the measurement system response to a zero level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

- d. Apparatus. [Note: this method is often applied in highly explosive areas. Caution should be exercised in choice of equipment and installation.] An acceptable measurement system includes a sample interface system, a calibration valve, gas filter and a pump preceding the analyzer. THC measurement systems are designated HOT or COLD systems based on the operating temperatures of the system. In HOT systems, all components in contact with the sample gas (probe, calibration valve, filter, and sample lines) as well as all parts of the flame ionization analyzer between the sample inlet and the detector must be maintained between 150° to 175°C. This includes the sample pump if it is located on the inlet side of the FID. A condensate trap may be installed, if necessary, to prevent any condensate entering the detector. The essential components of the

measurement system are as follows:

1. Organic concentration analyzer. A Department-approved detector capable of meeting or exceeding the specifications in this method.
 2. Sample probe. Use either paragraph (d)(2)(i) or (ii) of this Section.
 - i. Stainless steel, or equivalent, three-hole rake type. Sample holes shall be 4 millimeters (mm) (0.2 inches [in.] in diameter or smaller and located at 16.7, 50, and 83.3 percent of the equivalent stack diameter.
 - ii. A single opening probe so that a gas sample is collected from the centrally located 10 percent area of the stack cross Section, and is representative of the emission.
 3. Sample line. Stainless steel or Teflon¹ tubing to transport the sample gas to the analyzer. The sample line from the heated probe shall be heated to between 150 and 175°C (302 and 347°F).
 4. Calibration valve assembly. Use either paragraph (d)(4)(i) or (ii) of this Section.
 - i. A heated three-way valve assembly to direct the zero and calibration gases to the analyzers.
 - ii. Other methods, such as quick-connect lines, to route calibration gas to the analyzers.
 5. Particulate filter. An in-stack or an out-of-stack glass fiber filter if exhaust gas particulate loading is significant. An out-of-stack filter must be heated.
 6. Recorder. A strip-chart recorder, analog computer, or digital recorder for recording measurement data. The minimum data recording shall be one measurement value per minute. Full scale of the data recorder shall be selected so that the emission limit is between 30 percent and 50 percent.
- e. Calibration gases and other gases.
1. Gases used for calibration, fuel, and combustion air shall be contained in

¹Mention of trade names or specific products does not constitute endorsement by the Department or the U.S. EPA.

compressed gas cylinders.

2. Preparation of calibration gases shall be done according to the procedure in Protocol No. 1, listed in the reference in paragraph (l)(2) of this Section.
 3. The recommended shelf life for each calibration gas cylinder over which the concentration does not change more than ± 2 percent from the certified value shall be obtained from the cylinder manufacturer.
 4. The following calibration and other gases shall be used:
 - i. Fuel. A 40 percent hydrogen and 60 percent helium or 40 percent hydrogen and 60 percent nitrogen gas mixture to avoid an oxygen synergism effect that reportedly occurs when oxygen concentration varies significantly from a mean value.
 - ii. Zero gas. High purity air with less than 0.1 parts per million by volume (ppmv) of organic material methane or carbon equivalent or less than 0.1 percent of the span value, whichever is greater.
 - iii. Low-level calibration gas. Propane calibration gas (in air or nitrogen) with a concentration equivalent to 20 to 30 percent of the applicable span value.
 - iv. Mid-level calibration gas. Propane calibration gas with a concentration equivalent to 45 to 55 percent of the applicable span value.
 - v. High-level calibration gas. Propane calibration gas with a concentration equivalent to 80 to 90 percent of the applicable span value.
- f. Measurement system performance specifications.
1. Zero drift shall be less than ± 3 percent of the span value.
 2. Calibration drift shall be less than ± 3 percent of the span value.
 3. Calibration error shall be less than ± 5 percent of the calibration gas value.
- g. Pretest preparations.
1. Selection of sampling site.

- i. The location of the sampling site shall be determined from the applicable Section of this regulation or purpose of the test (i.e., exhaust stack, inlet line, etc).
 - ii. The sample port shall be located at least 1.5 meters (4.9 feet) or 2 equivalent diameters upstream of the gas discharge to the atmosphere.
2. Location of sample probe. The sample probe must be installed so that the probe is centrally located in the stack, pipe or duct and is sealed tightly at the stack port connection.
3. Measurement systems preparation. Prior to the emission test, the measurement system must be assembled following the manufacturer's written instructions in preparing the sample interface and the organic analyzer. The system must be operable.
4. Calibration error test.
 - i. Immediately prior to the test series (within 2 hours of the start of the test), zero gas and high-level calibration gas shall be introduced at the calibration valve assembly.
 - ii. The analyzer output shall be adjusted to the appropriate levels, if necessary.
 - iii. The predicted response for the low-level and mid-level gases shall be calculated based on a linear response line between the zero and high-level responses.
 - iv. Low-level and mid-level calibration gases shall be introduced successively to the measurement system.
 - v. The analyzer responses for low-level and mid-level calibration gases shall be recorded, and the differences between the measurement system responses and the predicted responses shall be determined. These differences must be less than ± 5 percent of the respective calibration gas value. If not, the measurement system shall be deemed not acceptable and must be replaced or repaired prior to testing. No adjustments to the measurement system shall be conducted after the calibration and before the drift determination found in paragraph (h)(2) of this Section.

- vi. If adjustments are necessary before the completion of the test series, the drift checks shall be performed prior to the required adjustments, and the calibration following the adjustments shall be repeated.
- vii. If multiple electronic ranges are to be used, each additional range must be checked with a mid-level calibration gas to verify the multiplication factor.

5. Sampling System Bias Check

- i. Perform the sampling system bias check by introducing calibration gases at the calibration valve installed at the outlet of the sampling probe. A zero gas and either the mid-range or high-range gas, whichever most closely approximates the effluent concentrations, shall be used for this check, as follows:
- ii. Introduce the upscale calibration gas and record the gas concentration displayed by the analyzer on a form approved by the Department. Then introduce zero gas, and record the gas concentration displayed by the analyzer. During the sampling system bias check, operate the system at the normal sampling rate, and make no adjustments to the measurement system other than those necessary to achieve proper calibration gas flow rates at the analyzer. Alternately introduce the zero and upscale gases until a stable response is achieved. The tester shall determine the measurement system response time by observing the times required to achieve a stable response for both the zero and upscale gases. Note the longer of the two times as the response time.
- iii. The sampling system bias check shall be considered invalid if the difference between the gas concentrations displayed by the measurement system for the analyzer calibration error check exceeds ± 5 percent of the span for either the zero or upscale calibration gas. If an invalid calibration is exhibited, take corrective action, and repeat the sampling system bias check until acceptable performance is achieved. If adjustment to the analyzer is required, first repeat the analyzer calibration error check, then

repeat the sampling system bias check.

6. Response time test.

- i. Zero gas shall be introduced into the measurement system at the calibration valve assembly.
- ii. When the system output has stabilized, the owner or operator shall switch quickly to the high-level calibration gas.
- iii. The time shall be recorded from the concentration change to the measurement system response equivalent to 95 percent of the step change.
- iv. The test shall be repeated three times and the results averaged.

h. Emission measurement test procedure.

1. Organic measurement.

- i. Sampling shall begin at the start of the test period.
- ii. Time and any required process information shall be recorded, as appropriate.
- iii. Periods of process interruption or cyclic operation shall be noted on the recording chart.

2. Drift determination.

- i. Immediately following the completion of the test period and hourly during the test period, the zero and mid-level calibration gases shall be introduced, one at a time, to the measurement system at the calibration valve assembly. No adjustments to the measurement system shall be made until after both the zero and calibration drift checks are made.
- ii. The analyzer response shall be recorded.
- iii. If the drift values exceed the specified limits, the test results shall be invalidated preceding the check, and the test shall be repeated following corrections to the measurement system.

- iv. Alternatively, the test measurement system may be recalibrated as in paragraph (g)(4) of this Section and the results reported using both sets of calibration data (i.e., data determined prior to the test period and data determined following the test period).
- i. Organic concentration calculations. The average organic concentration shall be determined in terms of ppmv propane by the integration of the output recording over the period specified in the applicable Section of this regulation.
- j. Quality assurance.
 - 1. The owner or operator shall assure proper calibration, maintenance, and operation of the continuous emissions monitoring system on a continual basis.
 - 2. The owner or operator shall establish a quality assurance program to evaluate and monitor performance on a continual basis. The following checks shall be done routinely:
 - i. A daily calibration check for each monitor. The calibration shall be adjusted if the check indicates the instrument's calibration drift exceeds the specification established in paragraph (f) of this Section.
 - ii. A daily system audit that includes the following:
 - A. A review of the calibration check data.
 - B. An inspection of the recording system.
 - C. An inspection of the control panel warning lights.
 - D. An inspection of the sample transport/interface system (e.g., flowmeters, filters), as appropriate.
 - iii. A quarterly calibration error test at the span midpoint.
 - iv. The entire performance specification test repeated every second year.
- k. Reporting of total hydrocarbon levels.
 - 1. The total hydrocarbon concentration (THC) levels from the initial compliance certification test shall be reported as ppm propane for inlet and outlet

concentrations and as a percent reduction across the control device.

2. THC levels shall be expressed in milligrams per second (mg/sec) (pounds per second [lb/sec]).
3. This conversion shall be accomplished using the following equation:

$$\text{THC,mg/sec} = (\text{THC ppm propane}) \times (\text{stack gas flow}) \times 5.2 \times 10^{-2}$$

where:

THC ppm propane	=	The total hydrocarbon concentration as actually measured by this method in ppm propane at the inlet or outlet.
Stack gas flow	=	Measured in dry standard cubic feet per second as determined by the flowmeter system or Methods 2 and 4.
5.2×10^{-2}	=	Constant to account for the conversion of units.

1. References.

1. Measurement of Volatile Organic Compounds--Guideline Series. U. S. Environmental Protection Agency, Research Triangle Park, North Carolina. Publication No. EPA-450/2-78-041. June 1978. p. 46-54.
2. Traceability Protocol for Establishing True Concentrations of Gases Used for Calibration and Audits of Continuous Source Emission Monitors (Protocol No. 1). U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory. Research Triangle Park, North Carolina. June 1973.
3. Gasoline Vapor Emission Laboratory Evaluation--Part 2. U. S. Environmental Protection Agency. Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina. EMB Report No. 75-GAS-6. August 1975.
4. **Appendix D:** Performance Specifications for Continuous Emissions Monitoring of Total Hydrocarbons in Hazardous Waste Incinerators, Boilers and Industrial Furnaces. Federal Register. 54:206 pp. 43743-43745. October 26, 1989.