



# Department of Environmental Quality



*To protect, conserve and enhance the quality of Wyoming's environment for the benefit of current and future generations.*

Matthew H. Mead, Governor

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**DATE:** December 14, 2012

**TO:** Oil & Gas Midstream Operators  
Air Stack Testing Companies

**FROM:** Steven A. Dietrich, P.E., Administrator *SAD*  
Air Quality Division

**SUBJECT:** Total VOC and Formaldehyde testing and reporting for compressor engines using EPA Reference Method 18 (GC), Method 25A (FID), Method 320 (FTIR), and Method 323

**COPY:** AQD Staff

*Please note that the following information provided in this document is for calculating and reporting actual "total VOC" and formaldehyde emissions to the AQD on annual major source inventories and triennial minor source inventories for engines. Since formaldehyde emissions are not included in the "total VOC" emissions methodology for using EPA Reference Method 25A (40 CFR Part 60, Appendix A) or when determining compliance with the NSPS (40 CFR Part 60, Subpart JJJJ), a different actual "total VOC" emissions methodology has been developed by the AQD for reporting actual "total VOC" emissions on inventories. Note that "total VOCs" and formaldehyde emissions must be reported to the AQD for inventory purposes.*

The U.S. Environmental Protection Agency (EPA) has approved the use of Federal Reference Methods 18 and 25A in 40 CFR Part 60, Appendix A, and Method 320 in 40 CFR Part 63, Appendix A, for determining emissions of volatile organic carbons (VOCs) from stacks. Additionally, Method 18 in 40 CFR Part 60, Appendix A, and Method 320 in 40 CFR Part 63, Appendix A can be used for determining speciated hydrocarbon emissions from these same sources. A review of stack tests and results reported in both major and minor source inventories leads to questions on how the test methods require emissions to be reported, and how the Air Quality Division (AQD) needs to have emissions reported for inventory purposes.



The calculation of VOC emissions from compressor engines will be done as specified in Chapter 6, Section 3 (f)(v). In order of decreasing accuracy, the calculation options are as follows:

1. The use of continuous emissions monitoring data;
2. The use of reference method testing (three 1-hr tests) for emissions tested during the reporting year;
3. The use of manufacturers' emissions estimation data (as used for permitting purposes);
4. The use of estimated emissions from EPA's AP-42 "Compilation of Air Pollutant Emission Factors" or other AQD approved source specific emission factors;
5. Alternatively, actual emissions may also be presumed to be allowable emissions determined by permit or standard unless there is evidence that actual emissions are in excess of the allowable emissions.

Method 25A can be used for determining the total gaseous organic concentration of the monitored stream using a flame ionization detector (FID). As stated in §1.2 of Method 25A, "this method is applicable for the determination of total gaseous organic concentration of vapors consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons). The concentration is expressed in terms of propane (or other appropriate organic calibration gas) or in terms of carbon." When reported as a pound per hour (lb/hr) emission rate using Method 25A, VOC emissions are in terms of lb/hr "as propane". The test method does not "see" the formaldehyde carbon chain, thus not including all VOCs in the test result.

For inventory purposes, the AQD requires actual emissions on all inventories in terms of "total" VOCs, and reports actual emissions to EPA in terms of "total" VOCs, and not VOCs "as propane". When using Method 25A, stack test results must first be converted from propane to a concentration "as carbon". As stated in §12.1 of Method 25A, the "as propane" result must be multiplied by three (3) as there are three (3) carbon atoms in propane to get a concentration "as carbon". In conjunction with Method 25A, Method 18 is used to determine the methane and ethane concentrations, and is also used to determine the formaldehyde concentration. Thus the methane and ethane concentrations from Method 18 are subtracted from the Method 25A concentration "as carbon", and the formaldehyde concentration from Method 18 is added to the Method 25A concentration, to determine the "total" VOC concentration. Please see the following Example 1:

Method 25A test results in a VOC emission rate of *0.5 lb/hr as propane*;  
Method 25A test results in a carbon emission rate of *(0.5 lb/hr) x 3 = 1.5 lb/hr*;  
Method 18 test results in a methane-ethane emission rate of *0.7 lb/hr*;  
Method 18 test results in a formaldehyde emission rate of *0.2 lb/hr*  
Therefore the "total" VOC emission rate is *1.5 lb/hr - 0.7 lb/hr + 0.2 lb/hr = 1.0 lb/hr*.

It should be noted that when testing is conducted to show compliance with the New Source Performance Standards (NSPS) for stationary non-emergency spark ignition (SI) internal combustion engines as determined by 40 CFR Part 60, Subpart JJJJ, the formaldehyde concentration is **not** included in the VOC concentration. Formaldehyde emissions can be

determined using Method 18 of 40 CFR Part 60, Appendix A, Methods 320 or 323 of 40 CFR Part 63, Appendix A, or any other ASTM approved method listed in 40 CFR Part 60, Subpart JJJJ or 40 CFR Part 63, Subpart ZZZZ. **For inventory reporting requirements, the formaldehyde emissions are required to be included in the “total” VOCs reported to the AQD.** Please see the following Example 2:

Method 25A test results in a VOC emission rate of *0.5 lb/hr as propane*;  
Method 25A test results in a carbon emission rate of *(0.5 lb/hr) x 3 = 1.5 lb/hr*;  
Method 18 test results in a methane-ethane emission rate of *0.7 lb/hr*;  
Method 323 test results for formaldehyde emission rate of *0.2 lb/hr*;  
Therefore the “total” VOC emission rate reported on an emissions inventory form to the AQD is *1.5 lb/hr – 0.7 lb/hr + 0.2 lb/hr = 1.0 lb/hr*.

Method 320 of 40 CFR Part 63, Appendix A, uses a Fourier transform infrared (FTIR) spectrometer to determine individual speciated hydrocarbon emissions. When using an FTIR, the concentration of each individual hydrocarbon VOC component as determined by the FTIR is simply added up to determine the total. As previously stated, when determining compliance with 40 CFR Part 60, Subpart JJJJ, the formaldehyde concentration is **not** included in the VOC concentration. In §60.4244(f) equation 3 of 40 CFR Part 60, Subpart JJJJ requires VOC emissions to be reported in g/Hp-hr based on a VOC concentration as propane.

**For inventory reporting requirements though, the formaldehyde emissions are required to be included in the “total” VOCs reported to the AQD.** Please see the following Example 3:

Method 320 test results for Subpart JJJJ in a VOC emission rate of *1.5 lb/hr*;  
Method 320 “total” VOCs =  $\sum(\text{speciated VOC hydrocarbon components}) = 2.0 \text{ lb/hr}$ ;  
Method 320 test results in a formaldehyde emission rate of *0.5 lb/hr*;  
Therefore the “total” VOC emission rate reported on an emissions inventory form to the AQD is *1.5 lb/hr + 0.5 lb/hr = 2.0 lb/hr*.

As stated in previous guidance from the AQD concerning actual emissions inventories for fee purposes at major sources, portable analyzer or reduced test lengths will not be accepted. For fee purposes, the average pounds per hour (lb/hr) results of three (3) valid, one-hour tests, and annual hours of operation will be used for calculating “total” VOC and formaldehyde emissions at major sources. In order to use the tested emission rates, the test must have been conducted within the calendar year of record. If a valid test is not available which was conducted during the calendar year, then refer to calculation options 3, 4 and 5 listed at the beginning of this document.

SAD/brb