



**Review and Analysis of Emissions Test Reports  
for Purposes of Reviewing the Natural Gas  
Production Flares Volatile Organic Compounds  
Emissions Factor Under Clean Air Act Section  
130**

*This page intentionally left blank.*

Review and Analysis of Emissions Test Reports for Purposes of Reviewing the Natural Gas  
Production Flares Volatile Organic Compounds Emissions Factor Under Clean Air Act Section  
130

U.S. Environmental Protection Agency  
Office of Air Quality Planning and Standards  
Sector Policies and Programs Division  
Research Triangle Park, North Carolina 27711

February 2018

## **Disclaimer**

The EPA's Sector Policies and Programs Division of the Office of Air Quality Planning and Standards, Office of Air and Radiation, reviewed and approved this report for publication. Mention of trade names, commercial products, or company names is not intended to constitute endorsement or recommendation for use.

# Table of Contents

|   | <u>Page</u> |
|---|-------------|
| Section 1 Summary .....   | 1           |
| Section 2 Background .....  | 4           |
| 2.1 Review of the Existing VOC Emissions Factor for Flares at Natural Gas Production Site ..... | 4           |
| 2.2 Overview of Emissions Test Data Review for THC Emissions Factors Development ..             | 6           |
| 2.3 Overview of New Emissions Factor Analysis and Development .....                             | 7           |
| Section 3 Emissions Factor Analysis for Elevated Flares .....                                   | 9           |
| Section 4 THC Emissions Factor Development for Enclosed Ground Flares .....                     | 10          |
| 4.1 Field-Tested Enclosed Ground Flares - THC .....   | 10          |
| 4.1.1 Gas Volume Basis .....  | 11          |
| 4.1.2 Heat Input Basis .....  | 13          |
| 4.2 Manufacturer-Tested Enclosed Ground Flares - THC .....                                      | 14          |
| 4.2.1 Gas Volume Basis .....  | 17          |
| 4.2.2 Heat Input Basis .....  | 19          |
| Section 5 Clarification of Heating Value Basis .....  | 21          |
| Section 6 Conclusions .....   | 22          |
| Section 7 References .....  | 23          |
| Appendix A Consent Decree   |             |
| Appendix B EPA’s “Test Quality Rating Tool” Template (ICR Template)                             |             |

## List of Tables

|   |    |
|---|----|
| Table S-1. Summary of New THC Emissions Factors Developed .....   | 3  |
| Table 4-1. Overview of the Emissions Factor for THC Expressed in Terms of Gas Volume from Field-Tested Enclosed Ground Flares .....         | 12 |
| Table 4-2. Description of SCC Included in Table 4-1 .....   | 12 |
| Table 4-3. Analysis of Emissions Test Reports for Field-Tested Units, Gas Volume Basis .....  | 12 |
| Table 4-4. Overview of the Emissions Factor for THC Expressed in Terms of Heat Input from Field-Tested Enclosed Ground Flares .....         | 13 |
| Table 4-5. Analysis of Emissions Test Reports for Field-Tested Units, Heat Input Basis .....  | 13 |
| Table 4-6. Overview of the Emissions Factors for THC Expressed in Terms of Gas Volume from Manufacturer-Tested Enclosed Ground Flares ..... | 17 |

|  |    |
|--|----|
| Table 4-7. Description of SCC Included in Table 4-6 .....  | 17 |
| Table 4-8. Analysis of Emissions Test Reports for Manufacturer-Tested Units, Gas<br>Volume Basis .....   | 18 |
| Table 4-9. Overview of the Emissions Factors for THC Expressed in Terms of Heat<br>Input from Manufacturer-Tested Enclosed Ground Flares ..... | 19 |
| Table 4-10. Analysis of Emissions Test Reports for Manufacturer-Tested Units, Heat<br>Input Basis .....  | 20 |

## Section 1 Summary

This report documents EPA's review and analysis of test reports for purposes of conducting the review and, if necessary, revision of the existing volatile organic compounds (VOC) emissions factor for flares at natural gas production sites pursuant to section 130 of the Clean Air Act (CAA). The EPA would revise the emissions factor if, based on a review of the available data, it concludes that revision is necessary. As explained in more detail below in this report, the available flare data pertain to total hydrocarbon (THC) emissions and do not provide sufficient information for estimating VOC emissions from the tested flares. As such, the available data give no indication that the existing VOC emissions factor for flares at natural gas production sites is somehow flawed or outdated and thus warrants revision; absent data indicating such, the EPA cannot conclude that revision is necessary. Therefore, based on its review of available flare data, the EPA concludes that it is not necessary to revise this existing flare VOC emissions factor.

While the EPA has not revised the existing VOC emissions factor for flares at natural gas production sites, it has used the available THC emissions data for enclosed ground flares to develop two new total hydrocarbons (THC) emissions factors for enclosed ground flares at natural gas production sites. Additionally, the EPA has developed four new THC emissions factors for enclosed ground flares at certain chemical manufacturing processes. The six emissions factors are finalized as an update to the *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*, (AP-42) (EPA, 1995).

On October 16, 2016, Air Alliance Houston, Community In-Power and Development Association, Inc. (CIDA), Louisiana Bucket Brigade, and Texas Environmental Justice Advocacy Services (TEJAS), (collectively, "Plaintiffs") filed a lawsuit against the U.S. Environmental Protection Agency (EPA) alleging that the EPA had failed to review and, if necessary, revise the emissions factor for VOC from elevated flares and enclosed ground flares at natural gas production sites at least once every three years as required in Section 130 of the Clean Air Act (CAA). *Air Alliance Houston, et al. v. McCarthy*, No. 1:16-cv-01998-RC (D.D.C.). On December 7, 2016, the Court entered a consent decree in this case. Under the terms of the consent decree, by June 5, 2017, the EPA was to review and either propose revisions to the VOC emissions factor for elevated and enclosed ground flares at natural gas production sites under CAA Section 130, or propose a determination under CAA Section 130 that revision of the emissions factor is not necessary and post the proposed revision or determination on the Agency's AP-42 website. The consent decree further requires that by February 5, 2018, the EPA issue a final revision or determination and post it on the Agency's AP-42 website. Appendix A of this document contains a copy of the consent decree.

The EPA evaluated test data available to the Agency for elevated and enclosed ground flares from natural gas production sites, as well as data from testing conducted by manufacturers under 40 CFR part 60 subparts OOOO and OOOOa and 40 CFR part 63 subpart HH and HHH. On June 5, 2017, the EPA proposed to determine that revision to the existing VOC emissions

factor for flares at production sites is not necessary; at the same time the EPA proposed three THC emissions factors for enclosed ground flares and updates to AP-42 Section 13.5 (Industrial Flares). The EPA requested public comments on its proposal, and the public comment period ended on August 18, 2017. EPA received a total of 3 comment letters. The EPA's Response-to-Comments document (ERG, 2018) contains the Agency's responses to issues raised in the public comments. After considering the public comments, the EPA is finalizing its proposed determination and six new emissions factors in AP-42 Section 13.5 (Industrial Flares), as shown in Table S-1.

**Table S-1. Summary of New THC<sup>a</sup> Emissions Factors Developed**

| Emissions Unit and Pollutant   | No. of Available Units with Emissions Test Data | Source Classification Codes (SCC)                        | AP-42 Emissions Factor   | Representativeness |
|--|---|--|--|--------------------|
| Enclosed Ground Flares at Natural Gas Production Sites   | 9   | 31000205<br>31000212<br>31000227                         | 332 pound (lb) THC (as propane)/million standard cubic feet (10 <sup>6</sup> scf) gas burned<br>or<br>0.335 lb THC (as propane)/million British thermal units (10 <sup>6</sup> Btu) heat input | Poorly             |
| Enclosed Ground Flares for Certain Chemical Manufacturing Processes, Flare Operating Under Low Percent Load. <sup>b</sup>  | 29  | 30119701<br>30119705<br>30119709<br>30119741<br>30190099 | 8.37 lb THC (as propane)/10 <sup>6</sup> scf gas burned<br>or<br>3.88e-3 lb THC (as propane)/10 <sup>6</sup> Btu heat input  | Moderately         |
| Enclosed Ground Flares for Certain Chemical Manufacturing Processes, Flare Operating Under High Percent Load. <sup>b</sup> | 30  | 30119701<br>30119705<br>30119709<br>30119741<br>30190099 | 2.56 lb THC (as propane)/10 <sup>6</sup> scf gas burned<br>or<br>1.20e-3 lb THC (as propane)/10 <sup>6</sup> Btu heat input  | Moderately         |

<sup>a</sup> The test method for THC for these emissions factors is EPA Method 25A.

<sup>b</sup> The dataset for these tests consisted of four different test conditions per unit: ramping back and forth between 0 and 30 percent of load; ramping back and forth between 30 percent and 70 percent of load; ramping back and forth between 70 percent and 100 percent of load; and a fixed-rate maximum load condition. Analyses determined that only the first condition was statistically different. Low percent load is represented by a unit operating at less than 30 percent of maximum load.

## Section 2 Background

For purposes of reviewing the existing natural gas production site flare VOC emissions factor, the EPA obtained field test reports containing operating parameter and emission rate data on enclosed ground flares at natural gas production sites. Additionally, the EPA received enclosed ground flare data from manufacturers conducting performance tests under 40 CFR part 60 subparts OOOO and OOOOa and 40 CFR part 63 subparts HH and HHH.<sup>1</sup> Finally, the EPA located one test report for elevated flares, but the gas flowrate information contained in the test report is claimed as confidential. The following documents the EPA's review and analysis of these available source test reports.

The background file for AP-42 Section 13.5 contains the information discussed in this document, including the data summary and emissions factor development workbook, the Individual Test Rating (ITR) score sheets, and the test reports that EPA reviewed but did not use in developing the THC emissions factors. A link to the background file is found under the section's heading on the AP-42 website (<https://www3.epa.gov/ttn/chief/ap42/ch13/index.html>). The test reports EPA used in the development of the emissions factors are listed as references in AP-42 Section 13.5. These references can be accessed by clicking the reference's name in Section 13.5.<sup>2</sup>

### 2.1 Review of the Existing VOC Emissions Factor for Flares at Natural Gas Production Sites

An emissions factor for VOC from natural gas production flares (SCC 31000205) exists in the EPA's WebFIRE database; however, this factor (5.60 lb per million cubic feet of gas produced) is not included in AP-42. This factor was obtained from the 1990 *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants* (EPA, 1990). There is no background information in that document to indicate the source of the data or the methods used to derive the emissions factor. As such, the emissions factor has a "U" rating. For emissions factors developed prior to 2013, EPA assigned a letter rating (e.g., A, B, E) to designate the quality of the factors. A "U" designation indicates an unrated factor, meaning

---

<sup>1</sup> For the purposes of 40 CFR part 60 subparts OOOO and OOOOa and 40 CFR part 63 subparts HH and HHH, these units are not considered flares. The definition of flare in these subparts specifically excludes these units. See discussion in section 4.2.

<sup>2</sup> In addition to the reports located in the background file, there were two additional field tests that were reviewed but not used in the creation of the THC emissions factor for enclosed ground flares at natural gas production sites due to low destruction efficiency. However, the results for these units are contained in a single report with two other units that were used in the development of that emissions factor. As such, the entire report is listed as a reference in Section 13.5, and the report for these two units that were not used in the development of this factor is not in the background file.

that the factor is developed from source tests that have not been thoroughly evaluated, research papers, modeling data, or other sources that may lack supporting documentation. The data used to develop an unrated emission factor are not necessarily poor, but there is not enough information to rate the factor.

Available flare emissions data include data on THC emissions from both field-tested and manufacturer-tested enclosed ground flares.<sup>3</sup> For many types of sources, including enclosed ground flares, it is less common to measure VOC emissions than it is to measure emissions of specific compounds or THC. It is easier to measure THC emissions than VOC emissions because THC can be determined using EPA Method 25A, which counts the number of carbons in a gas sample to provide a determination of THC emissions. To measure VOC emissions, one of two approaches is generally taken: (1) THC emissions are measured with one method (e.g., EPA Method 25A) while methane and ethane emissions are measured with a second method (e.g., EPA Method 18) and subtracted from the THC emissions, or (2) emissions of individual compounds are measured with one or more test methods and then summed to obtain the VOC emissions. Depending on the gas stream being measured, the number of organic compounds present in the gas stream can be numerous, and it can be difficult to measure all of the compounds individually.<sup>4</sup>

Consistent with Section 130 of the CAA, the EPA would revise the existing emissions factor for flares at natural gas production sites if, based on a review of the available data, it concludes that revision is necessary. As mentioned above, the available enclosed ground flare data pertain to THC emissions data. They also do not provide sufficient information for estimating VOC emissions from the tested flares because the reports either did not contain methane and ethane emissions data or, where the report did include methane and ethane emissions data, the measured methane and ethane emissions were higher than the THC emissions, thus resulting in a negative value for VOC emissions. As such, these data do not shed light on the VOC emissions from the tested units and therefore give no indication that the existing VOC emissions factor warrants revision; absent data indicating such, the EPA cannot conclude that revision is necessary. Therefore, based on its review of available flare data, the EPA concludes that it is not necessary to revise this existing flare VOC emissions factor.

---

<sup>3</sup> As explained in Section 3, we located but did not use data on one manufacturer-tested elevated flare as the data have been claimed to contain confidential business information.

<sup>4</sup> This is especially true in the case of combustion sources, because the compounds in the emissions stream are different from the compounds in the inlet stream and there are many different organic compounds that may be emitted as byproducts of combustion. This is one reason why programs such as the manufacturer testing program under 40 CFR part 60 subparts OOOO and OOOOa and 40 CFR part 63 subparts HH and HHH require the measurement of THC instead of VOC.

## 2.2 Overview of Emissions Test Data Review for THC Emissions Factors Development

While the EPA has not revised the existing VOC emissions factor for flares at natural gas production sites, it has developed two new THC emissions factors for enclosed ground flares at natural gas production sites based on the THC emissions data for enclosed ground flares from field-tested units. These data are based on enclosed ground flares in the natural gas production sector burning various vent streams (e.g., tank vents, glycol dehydrator vents) during the time of the tests. For enclosed ground flares with the SCCs specified in Tables 4-1 and 4-4 in Section 4.1 of this document, the EPA recommends the use of the THC emissions factors developed with these data instead of the VOC emissions factor in WebFIRE, as background documentation for this new emissions factor is available and the factor is based on field data from similar units.

The facility and emissions information for each test report are compiled in a test data summary workbook called “EF Creation\_THC\_ONGflare\_2018February.xlsx”. For EPA to use emissions data from a test report in developing an emissions factor, two basic test data elements must be included in the report: (1) pounds per hour (lb/hr) emissions rate, or enough data to calculate the lb/hr emissions rate, and (2) a related process rate (e.g., volume of gas burned per hour (MMscf/hr) or heat input (MMBtu/hr)). The EPA reviewed each test report to confirm whether these critical fields were available. The EPA also reviewed each test report to determine flare operating characteristics (i.e., type of fuel burned, destruction and removal efficiency (DRE), and flare exit velocity).

For each emissions test report used in developing the emissions factors (i.e., reports that contain the two test data elements described above), EPA determined an ITR score by completing the “Test Quality Rating Tool” tab in the EPA’s WebFIRE Template and Test Quality Rating Tool (including instructions) spreadsheet (available on the ERT website at: <https://www.epa.gov/electronic-reporting-air-emissions/electronic-reporting-tool-ert>). Appendix B provides the “Test Quality Rating Tool” template for the ITR. The ITR is a quantitative measure of the quality of the data contained within a test report. The ITR score may range from 0 to 100 and gives a general indication of the level and quality of documentation available in the test report and the level of conformance with the requirements of the standard test methods used to measure the emissions. The “Test Quality Rating Tool” includes a series of questions related to “Supporting Documentation Provided” (columns A and B) and related to “Regulatory Agency Review” (columns G and H). Generally, the “Supporting Documentation Provided” columns are an indication of the completeness of the test report while the “Regulatory Agency Review” columns provide an indication of whether the test was conducted according to the requirements of the standard test methods used to measure the emissions.

For the “Supporting Documentation Provided” portion, the ITR worksheet includes 8 general questions, 8 questions for manual test methods, and 10 questions for instrumental test methods. Examples of the general questions include: whether the testing firm described deviations from the test method or provided a statement that deviations were not required; whether the test report provided a full description of the process and unit tested; and whether the test report provided an assessment of the validity, representativeness, achievement of data quality

objectives and usability of the data. For instrumental test methods, example questions include: whether the test report provided: a complete description of the sampling system; inclusion of response time tests; inclusion of calibration error tests; and inclusion of calibration drift tests. The “Regulatory Agency Review” portion of the ITR worksheet includes 14 general questions, 33 questions for manual test methods, and 15 questions for instrumental test methods. This portion of the worksheet includes questions on whether method quality assurance criteria were met, whether samples were handled appropriately, and the representativeness of the data collection.

For the test reports associated with the field-tested units, the EPA completed only for the “General” and “Instrumental Test Methods” sections of the ITR worksheet. In these reports, the only relevant data<sup>5</sup> that is collected by a manual test method are the EPA Methods 2 and 4 data for velocity and moisture. The “Manual Test Methods” portion of the worksheet is intended to determine the quality of data for a manual method measuring a pollutant or diluent. It does not fairly assess data quality for just velocity and moisture, because there is no corresponding lab data. As such, the majority of the questions do not apply, and the report is penalized for not having data that are not required. For the test reports associated with the manufacturer-tested units, EPA completed all sections of the worksheet. This is because the testing procedures for the manufacturer performance tests requires some of the necessary data to be collected by manual test methods, such as determining certain compounds by EPA Method 3C. These data are then used in the determination of the THC mass emissions rate.

ITR scores for the test reports in the analysis range from 20 to 78.<sup>6</sup> The ITR scores for the test reports reviewed are provided in a workbook called “WF\_ITR\_ONGFlares\_THC\_2018February.xlsx”.

## 2.3 Overview of New Emissions Factor Analysis and Development

The emissions factor development approach followed the EPA’s *Recommended Procedures for Development of Emissions Factors and Use of the WebFIRE Database* (EPA, 2013). The workbook “EF Creation\_THC\_ONGflare\_2018February.xlsm” provides the emissions factor development calculations for each emissions factor. The EPA followed the recommended procedures in the 2013 guidelines implicitly, including:

- procedures for assigning an ITR score for those test reports that are used in the emissions factor analysis;

---

<sup>5</sup> Some reports did have lab data for methane and ethane, but EPA did not use those data in the development of these emissions factors. Where EPA used methane data (see Section 4.1 of this document for more information on use of methane data), the tester obtained those data by instrumental test methods. Additionally, there is lab data for fuel samples, but the ITR “Manual Test Methods” questions are intended to be used for stack test methods, not fuel samples.

<sup>6</sup> While the ITR is an assessment of the quality of the report, a low rating does not necessarily mean that the report was not adequate for the intended purposes. The ITR also does not take into account conversations that may have occurred between the facility and the regulatory authority to resolve any issues.

- recommended statistical procedures for determining whether datasets are part of the same data population;
- statistical procedures for determining whether any data points are outliers (i.e., outlier checks); and
- procedures for determining whether data for a particular emissions unit should be included in the emissions factor.

This last step, determining whether to include data from each unit, involves comparing the Factor Quality Index (FQI) for different emissions units. The FQI is an indicator of the emissions factor's ability to estimate emissions for the entire national population, and it is related to both the ITR score and the number of units in the dataset. After the EPA completed the statistical procedures, the Agency ranked the dataset by ITR score (high to low) and developed an FQI for each unit in the candidate set. The FQI should decrease with each emissions unit. If the FQI increases, EPA considers only average test values above the point where the FQI increases in factor development.

Generally, the EPA combines emissions data from multiple tests conducted on a single emissions unit so that each emissions unit is equally weighted with other units. However, there are times when it may be necessary to subcategorize the emissions factor data from particular units because the emissions are dissimilar. The recommended emissions factor development procedures include a statistical procedure for determining whether emissions data are from the same data population or whether emissions data should be subcategorized based on a characteristic of the emissions unit (e.g., operating load). This analysis requires three or more emissions units from each potential subcategory. For testing performed by the manufacturers, each unit was tested under four different operating conditions. Instead of combining all of the emissions data for each unit, the EPA performed a statistical analysis to determine whether the data should be subcategorized. This is further discussed in Section 4.2 of this document.

Some of the data from EPA Method 25A included test run averages reported as a negative or zero value. Because the 2013 recommended procedures for emissions factor development do not specify how this data should be handled, and because it is not possible for emissions rates to be negative, the EPA excluded this data from emissions factor development in this project.

### **Section 3**

## **Emissions Factor Analysis for Elevated Flares**

Elevated flares do not lend themselves to conventional emissions testing methods, due to the fact that the plume is not emitted through a stack. It is difficult, dangerous, and costly to conduct extractive sampling on these plumes, as the tester must be elevated in a mobile testing platform in order to follow the plume as it shifts direction. More recently, testing of some elevated flares at refineries and chemical plants has been accomplished using passive Fourier transform infrared spectroscopy (pFTIR) and differential infrared absorption LIDAR [light detection and ranging] (DIAL). Both of these techniques must be performed by highly trained and specialized operators, and as such, measurement of elevated flares with these techniques is uncommon and infrequently required.

The EPA is aware of one flare manufacturer for natural gas production sites that has conducted pFTIR testing on an elevated flare. During a site visit, this manufacturer, a non-regulatory entity, provided the EPA data, which the manufacturer has claimed as confidential business information (CBI). Because it is not possible to mask CBI data with only one report, the EPA contacted the flare manufacturer to request a version of the report that does not contain information that it considers to be CBI for use in this emissions factor development effort. The manufacturer declined.

In light of the above, and absent other available data on elevated flares, the EPA has not developed a new elevated flare VOC emissions factor. However, the existing VOC emissions factor remains available in assisting industry and states in estimating VOC emissions from elevated flares at natural gas production sites.

## **Section 4**

### **THC Emissions Factor Development for Enclosed Ground Flares**

The EPA has developed THC emissions factors for enclosed ground flared based on data for field and manufacturer-tested enclosed ground flares. The emissions data review and the emissions factor development for each emissions factor are described below

While there is a current unrated VOC emissions factor in WebFIRE for flares from natural gas production sites, the background data for that factor does not indicate if the factor applies to enclosed ground flares or just elevated flares, nor does it detail the method used to develop the factor. Further, because the measurement of VOC and THC vary, the data are not often directly comparable. As such, the existing emissions factor from WebFIRE is not included in the development of the new emissions factors described below.

#### **4.1 Field-Tested Enclosed Ground Flares - THC**

In this review and analysis, an enclosed ground flare refers to a thermal oxidation system using a flame with an enclosure.<sup>7</sup> Enclosed grounds flares are a commonly used control device at natural gas production sites. However, for the purposes of 40 CFR part 60 subparts OOOO and OOOOa and 40 CFR part 63 subparts HH and HHH, these units are not considered flares, as that term is defined in those subparts. The definition of flare in these subparts specifically excludes these units.<sup>8</sup> In the Oil and Gas sector, these units are more commonly referred to as “enclosed combustors”. Enclosed combustors can be used to control the emissions from numerous sources at natural gas production sites, including glycol dehydrators, condensate storage tanks, pumps, and compressors.

The EPA reviewed data from test reports associated with 13 field-tested units for the development of the enclosed ground flare THC emissions factors for natural gas production sites. Each test report was analyzed and summarized, and for those test reports included in the emissions factor analysis, given an ITR score. The emissions data (pounds of THC per hour [lb THC/hr]) from these test reports are based on measurements taken with EPA Method 25A. Upon reviewing the data, only 9 field-tested units had useable data and were included in the development of an emissions factor. Certain test reports were excluded from the emissions factor analysis because the demonstrated destruction efficiency was below 95 percent. Certain test reports were excluded from the emissions factor analysis because there was not enough information in the reports to determine the processes that were being controlled by the enclosed ground flares.<sup>9</sup> One test report was excluded from the emissions factor analysis because there

---

<sup>7</sup> See Consent Decree, page 2.

<sup>8</sup> In these subparts, a flare is defined as a thermal oxidation system using an open flame (without enclosure).

<sup>9</sup> These reports did not include enough information to determine whether the enclosed ground flares were at natural gas production sites. The reports also lacked information on the type of fuel that the flares were burning.

was no process data included in the report. For the test reports used, some runs were eliminated from the dataset because the average value of the run was zero or negative. Additionally, while all of the reports included calculated emission rates of THC in lb/hr, the raw Method 25A data was bias corrected in these calculations. Method 25A does not specifically allow data to be bias corrected; therefore, the emission rates were recalculated using the raw Method 25A results, and available flowrate and stack moisture data. Lastly, some reports included results for methane and total non-methane hydrocarbons (TNMHC) (as propane) in lieu of THC results. For these reports, the methane data was divided by three to put it on an “as propane” basis and added to the TNMHC results to obtain the THC (as propane) emissions rate.

In addition to this field-tested data, the EPA reviewed and analyzed test reports submitted by manufacturers of enclosed combustors pursuant to 40 CFR part 60 subparts OOOO and OOOOa and 40 CFR part 63 subparts HH and HHH. As explained in more detail in Section 4.2 of this document, our statistical analysis determined that the emissions profile for these manufacturer-tested units is not likely to be representative of the THC emissions from an enclosed combustor burning field gas. Therefore, the EPA used only the data from the field-tested units in developing the enclosed ground flare THC emissions factors for natural gas production sites.

#### ***4.1.1 Gas Volume Basis***

Table 4-1 provides an overview of the THC emissions factor expressed in terms of gas volume burned (lb THC/10<sup>6</sup> scf) developed using data from field-tested enclosed ground flares. Test reports for nine units had useable data and were included in the development of an emissions factor. These units had inlet gas volume flowrate as the available process data. These useable emissions test reports are provided in Table 4-3. A list of available test report information is provided in workbook “EF Creation\_THC\_ONGflare\_2018February.xlsm”.

The EPA’s recommended emissions factor development procedures were followed for the THC data. Test data from nine emissions units were combined for the emissions factor development. The statistical analysis for determining outliers in the dataset was conducted, and no data was found to be an outlier. As previously discussed, one of the last steps in developing an emissions factor is a comparison of the FQI for test results. In the development of the emissions factor for THC from enclosed ground flares based on field data, the FQI evaluation did not exclude any test data from the dataset.

The workbook “EFCreation\_THC\_ONGflare\_2018February.xlsm” provides the emissions factor analysis, which characterizes the emissions factor as Poorly Representative. Table 4-1 lists the SCCs applied to this factor and Table 4-2 provides a more detailed description of each SCC.

**Table 4-1. Overview of the Emissions Factor for THC Expressed in Terms of Gas Volume from Field-Tested Enclosed Ground Flares**

| No. of Units Included in Analysis | Test Method    | AP-42 Emissions Factor                                     | Representativeness | SCC                              |
|-----------------------------------|----------------|--|--------------------|----------------------------------|
| 9                                 | EPA Method 25A | 332 lb THC (as propane)/<br>10 <sup>6</sup> scf gas burned | Poorly             | 31000205<br>31000212<br>31000227 |

**Table 4-2. Description of SCC Included in Table 4-1**

| SCC      | Level 1 Description  | Level 2 Description    | Level 3 Description    | Level 4 Description                    |
|----------|----------------------|------------------------|------------------------|--|
| 31000205 | Industrial Processes | Oil and Gas Production | Natural Gas Production | Flares                                 |
| 31000212 | Industrial Processes | Oil and Gas Production | Natural Gas Production | Condensate Storage Tank                |
| 31000227 | Industrial Processes | Oil and Gas Production | Natural Gas Production | Glycol Dehydrator Reboiler Still Stack |

**Table 4-3. Analysis of Emissions Test Reports for Field-Tested Units, Gas Volume Basis**

| Facility Name   | Test Method    | Average Test Result                         | ITR |
|---|----------------|---|-----|
| Enterprise Products: Jackrabbit Compressor Station        | EPA Method 25A | 601 lb THC/10 <sup>6</sup> scf gas burned   | 47  |
| Cimarron Energy: Greeley Gas Processing Plant, 24" Unit   | EPA Method 25A | 67.3 lb THC/10 <sup>6</sup> scf gas burned  | 34  |
| Cimarron Energy: Greeley Gas Processing Plant, 48" Unit   | EPA Method 25A | 87.4 lb THC/10 <sup>6</sup> scf gas burned  | 34  |
| Cimarron Energy: Greeley Gas Processing Plant, 30" Unit   | EPA Method 25A | 51.5 lb THC/10 <sup>6</sup> scf gas burned  | 37  |
| ETC Canyon Pipeline, LLC: Debeque Gas Plant               | EPA Method 25A | 403 lb THC/10 <sup>6</sup> scf gas burned   | 32  |
| ETC Canyon Pipeline, LLC: Rifle Bolton                    | EPA Method 25A | 1,475 lb THC/10 <sup>6</sup> scf gas burned | 32  |
| Questar Gas Management: Wonsits Valley Compressor Station | EPA Method 25A | 26.4 lb THC/10 <sup>6</sup> scf gas burned  | 43  |
| Cimarron Energy: Parshall                                 | EPA Method 25A | 243 lb THC/10 <sup>6</sup> scf gas burned   | 42  |
| Shell Exploration and Production Co.: Pinedale            | EPA Method 25A | 35.2 lb THC/10 <sup>6</sup> scf gas burned  | 37  |

#### 4.1.2 Heat Input Basis

Table 4-4 provides an overview of the THC emissions factor expressed in terms of gas heat input (lb THC/10<sup>6</sup> Btu) developed using data from field-tested enclosed ground flares. Six test reports had useable data and were included in the development of an emissions factor. These units had gas heat input rate as the available process data. These useable emissions test reports are provided in Table 4-5. A list of available test report information is provided in workbook “EF Creation\_THC\_ONGflare\_2018February.xlsm”.

The EPA’s recommended emissions factor development procedures were followed for the THC data. Test data from six emissions units were combined for the emissions factor development. The statistical analysis for determining outliers in the dataset was conducted, and no data was found to be an outlier. As previously discussed, one of the last steps in developing an emissions factor is a comparison of the FQI for test results. In the development of the emissions factor for THC from enclosed ground flares based on field data, the FQI evaluation did not exclude any test data from the dataset.

The workbook “EF Creation\_THC\_ONGflare\_2018February.xlsm” provides the emissions factor analysis, which characterizes the emissions factor as Poorly Representative.

**Table 4-4. Overview of the Emissions Factor for THC Expressed in Terms of Heat Input from Field-Tested Enclosed Ground Flares**

| No. of Units Included in Analysis | Test Method    | AP-42 Emissions Factor                                   | Representativeness | SCC <sup>a</sup>                 |
|-----------------------------------|----------------|--|--------------------|----------------------------------|
| 6                                 | EPA Method 25A | 0.335 lb THC (as propane)/10 <sup>6</sup> Btu heat input | Poorly             | 31000205<br>31000212<br>31000227 |

<sup>a</sup> A detailed description of these SCCs is included in Table 4-2.

**Table 4-5. Analysis of Emissions Test Reports for Field-Tested Units, Heat Input Basis**

| Facility Name   | Test Method    | Average Test Result                         | ITR |
|---|----------------|---|-----|
| Cimarron Energy: Greeley Gas Processing Plant, 24” Unit | EPA Method 25A | 0.029 lb THC/10 <sup>6</sup> Btu heat input | 34  |
| Cimarron Energy: Greeley Gas Processing Plant, 48” Unit | EPA Method 25A | 0.045 lb THC/10 <sup>6</sup> Btu heat input | 34  |
| Cimarron Energy: Greeley Gas Processing Plant, 30” Unit | EPA Method 25A | 0.026 lb THC/10 <sup>6</sup> Btu heat input | 37  |
| ETC Canyon Pipeline, LLC: Debeque Gas Plant             | EPA Method 25A | 0.329 lb THC/10 <sup>6</sup> Btu heat input | 32  |
| ETC Canyon Pipeline, LLC: Rifle Bolton                  | EPA Method 25A | 1.47 lb THC/10 <sup>6</sup> Btu heat input  | 32  |
| Cimarron Energy: Parshall                               | EPA Method 25A | 0.106 lb THC/10 <sup>6</sup> Btu heat input | 42  |

## 4.2 Manufacturer-Tested Enclosed Ground Flares - THC

The regulations in 40 CFR part 60 subparts OOOO and OOOOa and 40 CFR part 63 subparts HH and HHH (hereinafter collective referred to as the “Oil and Gas sector rules”) provide owners and operators an exemption from performance testing if they purchase a unit that has been tested by the manufacturer and the test demonstrates that the unit meets specific requirements specified in these regulations.<sup>10</sup> The criteria require that the unit achieve at least 95 percent destruction efficiency, average emissions of equal to or less than 10 parts per million by volume (ppmv) wet THC (as propane), average emissions of equal to or less than 10 ppmv dry carbon monoxide (CO), and no visible emissions while burning pure propylene under four test conditions, with three test runs per condition. In the first condition, the unit is held steady at 90-100 percent of the maximum design rate. In the second condition, the unit is ramped up and down between 70 and 100 percent of the maximum design rate. In the third condition, the unit is ramped up and down between 30 and 70 percent of the maximum design rate. In the fourth condition, the unit is ramped up and down between 0 (or the minimum possible inlet flowrate) and 30 percent of the maximum design rate.

As of December 1, 2017<sup>11</sup>, 30 units<sup>12</sup> were listed with a “Yes” in the “Control Device Demonstrates Performance Requirements” column on the list maintained on the Oil and Gas sector implementation page.<sup>13,14</sup> Each of the test reports for these 30 units was reviewed, analyzed, summarized, and given an ITR score. Based on the emissions test report review and analysis, all the test reports for the 30 units had useable data and were included in the emissions factor development process. The workbook “EF Creation\_THC\_ONGflare\_2018February.xlsx” provides a complete list of the available test report information. The emissions data (lb THC/hr) in these test reports are based on measurements taken with EPA Method 25A. Certain test runs were eliminated from the dataset because the average value of the run was zero or negative. In most cases, the test report did not

---

<sup>10</sup> In these subparts, these units are not considered flares. The definition of flare in these subparts specifically excludes these units. In these subparts, a flare is defined as a thermal oxidation system using an open flame (without enclosure).

<sup>11</sup> Since December 1, 2017, two additional units have been listed with a “Yes” in the “Control Device Demonstrates Performance Requirements” column. The EPA only included units that were listed as of December 1 in order to provide enough time to perform the necessary data analysis and documentation for the emissions factors. Units listed after December 1 will be included in any future reviews of the emissions factors.

<sup>12</sup> There were actually 34 units listed with a “Yes” in the “Control Device Demonstrates Performance Requirements” column, but four of these units are the same as other units sold under a different name. This is indicated in footnotes to Tables 4-8 and 4-10.

<sup>13</sup> <https://www.epa.gov/stationary-sources-air-pollution/performance-testing-combustion-control-devices-manufacturers> (EPA, 2012)

<sup>14</sup> “Yes” means that the manufacturer has demonstrated that the specific model of control device listed achieves the combustion control device performance requirements in NSPS subparts OOOO and OOOOa and NESHAP subparts HH and HHH through performance testing conducted as specified in these subparts. “Yes” does not constitute an endorsement by the EPA.

include the lb/hr emission rate, and the EPA used the raw Method 25A, stack flowrate, and moisture data to calculate the lb/hr emission rate.

The EPA's recommended emissions factor development procedures were followed for the THC data associated with these manufacturer-tested units. Because testing was performed under four different conditions, and it was uncertain what effect the conditions may have on THC emissions, we conducted a statistical analysis to determine if these data all belong to the same population. The statistical analysis showed that the data from the 0-to-30 percent ramping condition do not belong to the same dataset as the rest of the conditions. Therefore, we divided the data into two datasets. We also compared these two datasets to the field-tested units discussed in Section 4.1 of this document. The statistical analysis showed that the data from the field-tested units do not belong to either of these datasets. Therefore, we used the test reports associated with the manufacturer-tested units to create four emissions factors: two for low-load operating conditions (one expressed in terms of gas volume burned and another in terms of heat input) and two for normal to high-load operating conditions (one expressed in terms of gas volume burned and another in terms of heat input).<sup>15</sup> We also conducted a statistical analysis to determine outliers for each dataset, and found no data to be an outlier.

As discussed in Section 2.3 of this document, the last step in developing an emissions factor is a comparison of the FQI for different units. When the FQI increases, only average test values above the point where the FQI increases should be considered in the factor development. In the development of the emissions factor for THC from manufacturer-tested enclosed ground flares, the FQI evaluation excluded test data from two units from the dataset (these two reports have the lowest ITR scores).

Finally, although we developed these factors using units tested for purposes of demonstrating compliance with the Oil and Gas sector rules, we did not apply SCCs for natural gas production to these emissions factors. In the Oil and Gas sector rules, propene (propylene) must be used as the fuel during manufacturer performance testing<sup>16</sup> even though it is not often seen in natural gas production because propylene is harder to burn than methane and other compounds expected to be sent to the enclosed combustor in the field. Therefore, while burning propylene, it is expected to be more challenging for the units to meet the rules' required destruction efficiency of at least 95 percent than if the unit were burning the fuel that would be sent to the it in the field. However, the fact that the unit can meet the required destruction efficiency, while useful in proving compliance with the rule, provides no information on the type or quantity of compounds that would be expected to be emitted from a unit burning field gas, as propylene is not generally a component of field gas. As such, the emissions data from the manufacturer-tested units do not provide data that are appropriate for developing emissions

---

<sup>15</sup> Data from only 29 test reports were used in the emissions factor development process for the low-load operating condition. One test report was excluded because all of the test runs for that unit at the low load operating condition were either negative values or zero. All 30 test reports were used in the emissions factor development process for the normal to high-load operating condition.

<sup>16</sup> See 40 CFR 60.5413(d)(2), 40 CFR 60.5413a(d)(2), 40 CFR 63.772(h)(2), and 40 CFR 63.1282(g)(2).

factors for enclosed ground flares operating on natural gas production sites. The difference in emissions profiles is demonstrated by the fact that the field-tested units and the manufacturer-tested units are statistically not in the same dataset. Therefore, we did not apply the SCCs for natural gas production to these units. We applied the same chemical manufacturing SCCs that are applied to the original flare factors in AP-42 Table 13.5-1. The EPA developed those factors based on flares burning an 80-20 mix of propylene and propane, which is similar to the propylene burned by the enclosed ground flares during the manufacturer tests.

However, the fact that we did not apply natural gas production SCCs to these factors due to the difference in emissions profiles between the manufacturer-tested units and enclosed combustors burning field gas does not mean that the manufacturer-tested enclosed ground flares should not be used to control emissions from natural gas production for purposes of complying the Oil and Gas sector rules. These units have demonstrated high destruction efficiencies in a controlled setting, well over 99 percent, well above the 95 percent reduction required in the Oil and Gas sector rules.

#### 4.2.1 Gas Volume Basis

Table 4-6 provides an overview of the THC emissions factors expressed in terms of gas volume burned (lb THC/10<sup>6</sup> scf) developed using data from manufacturer-tested enclosed ground flares. Table 4-8 provides the useable emissions test reports. We based the low-load emissions factor on the emissions test data from 29 test reports and the normal to high-load emissions factor on the emissions test data from 30 test reports. Both factors are characterized as Moderately Representative. The source classification codes applied to this factor are listed in Table 4-6 and further described in Table 4-7.

**Table 4-6. Overview of the Emissions Factors for THC Expressed in Terms of Gas Volume from Manufacturer-Tested Enclosed Ground Flares**

| No. of Units Included in Analysis | Operating Condition           | Test Method    | AP-42 Emissions Factor                                  | Representativeness | SCC                              |
|-----------------------------------|-------------------------------|----------------|---|--------------------|----------------------------------|
| 30 <sup>a</sup>                   | Normal to High Percent Load   | EPA Method 25A | 2.56 lb THC (as propane)/10 <sup>6</sup> scf gas burned | Moderately         | 30190099<br>30119701<br>30119705 |
| 29 <sup>a</sup>                   | Low Percent Load <sup>b</sup> | EPA Method 25A | 8.37 lb THC (as propane)/10 <sup>6</sup> scf gas burned | Moderately         | 30119709<br>30119741             |

<sup>a</sup> Two units were excluded from each dataset based on the FQI evaluation. This number represents the number of units in the emissions factor analyses.

<sup>b</sup> Low percent load is represented by a unit operating at less than 30% of maximum load.

**Table 4-7. Description of SCC Included in Table 4-6**

| SCC      | Level 1 Description  | Level 2 Description    | Level 3 Description                              | Level 4 Description           |
|----------|----------------------|------------------------|--|-------------------------------|
| 30190099 | Industrial Processes | Chemical Manufacturing | Fuel Fired Equipment                             | User Specified                |
| 30119701 | Industrial Processes | Chemical Manufacturing | Butylene, Ethylene, Propylene, Olefin Production | Ethylene: General             |
| 30119705 | Industrial Processes | Chemical Manufacturing | Butylene, Ethylene, Propylene, Olefin Production | Propylene: General            |
| 30119709 | Industrial Processes | Chemical Manufacturing | Butylene, Ethylene, Propylene, Olefin Production | Propylene: Fugitive Emissions |
| 30119741 | Industrial Processes | Chemical Manufacturing | Butylene, Ethylene, Propylene, Olefin Production | Ethylene: Flue Gas Vent       |

**Table 4-8. Analysis of Emissions Test Reports for Manufacturer-Tested Units, Gas Volume Basis**

| Manufacturer Name                              | Unit Name                | Test Method    | Average Test Result in lb THC/10 <sup>6</sup> scf gas burned |                     | ITR |
|--|--------------------------|----------------|--|---------------------|-----|
|  |                          |                | Low Load   | Normal to High Load |     |
| ABUTECA <sup>a</sup>                           | ABUTECA 20               | EPA Method 25A | 1.41   | 3.46                | 45  |
| ABUTECA <sup>a</sup>                           | ABUTECA 20               | EPA Method 25A | 1.86   | 2.70                | 45  |
| Alphabet Energy                                | Alphabet PGC             | EPA Method 25A | 30.4   | 10.9                | 76  |
| Big Iron Oilfield Service                      | BNECU PI36               | EPA Method 25A | 7.15   | 2.28                | 49  |
| Big Iron Oilfield Service                      | BNECU PI48 <sup>b</sup>  | EPA Method 25A | -  | 1.61                | 49  |
| Black Gold Rush                                | BGR-18                   | EPA Method 25A | 10.8   | 5.10                | 77  |
| Cimarron <sup>c</sup>                          | CEI 1-24                 | EPA Method 25A | 67.2   | 4.42                | 57  |
| Cimarron <sup>c</sup>                          | CEI 1-30                 | EPA Method 25A | 12.1   | 1.75                | 57  |
| Cimarron <sup>c</sup>                          | CEI 1-48                 | EPA Method 25A | 2.13   | 1.06                | 57  |
| Cimarron <sup>c</sup>                          | CEI 1-60                 | EPA Method 25A | 5.78   | 0.906               | 56  |
| Cimarron <sup>c</sup>                          | 48" HV ECD               | EPA Method 25A | 2.01   | 0.231               | 57  |
| COMM Engineering                               | COMM OOOO Combustor 200  | EPA Method 25A | 12.0   | 3.74                | 50  |
| COMM Engineering                               | Model 2                  | EPA Method 25A | 1.70   | 1.16                | 76  |
| COMM Engineering                               | Model 3                  | EPA Method 25A | 1.26   | 0.203               | 78  |
| COMM Engineering                               | Model 4                  | EPA Method 25A | 2.00   | 0.763               | 78  |
| Coyote North                                   | COMB 48"                 | EPA Method 25A | 3.45   | 2.11                | 66  |
| Hy-Bon/EDI <sup>d</sup>                        | CH2.5                    | EPA Method 25A | 3.82   | 2.31                | 75  |
| Hy-Bon/EDI <sup>d</sup>                        | CH10.0                   | EPA Method 25A | 5.58   | 3.02                | 76  |
| JLCC Combustion                                | FC 20                    | EPA Method 25A | 3.09   | 1.75                | 52  |
| John Zink                                      | ZTOF040X30PF             | EPA Method 25A | 0.948  | 0.601               | 74  |
| Kimark   | KSF 1-48                 | EPA Method 25A | 1.64   | 0.229               | 76  |
| Leed Fabrication                               | 36" Combustor (EC36)     | EPA Method 25A | 14.5   | 2.45                | 57  |
| Leed Fabrication <sup>e</sup>                  | 48" Combustor (EC48)     | EPA Method 25A | 78.0   | 10.1                | 30  |
| Questor Technology                             | Q100                     | EPA Method 25A | 1.31   | 1.97                | 56  |
| Questor Technology                             | Q250                     | EPA Method 25A | 7.07   | 4.55                | 56  |
| REM Technology (Spartan Controls) <sup>e</sup> | SlipStream GTS-12        | EPA Method 25A | 1.19   | 1.59                | 20  |
| SFI Oil & Gas Production Systems               | SCD-36                   | EPA Method 25A | 3.06   | 3.41                | 76  |
| SFI Oil & Gas Production Systems               | SCD-48                   | EPA Method 25A | 11.4   | 3.32                | 77  |
| SFI Oil & Gas Production Systems               | SCD-60                   | EPA Method 25A | 4.51   | 1.99                | 58  |
| Zeeco, Inc.                                    | EGF-48-30 (aka EGF-4-30) | EPA Method 25A | 7.83   | 3.66                | 58  |

<sup>a</sup> Also known as NOV MEVC 20 and MEVC 100.

<sup>b</sup> All test runs were negative values or zero, and this unit was removed from the dataset for the low load condition.

<sup>c</sup> In the draft proposal, the EPA inadvertently used an older version of these test reports. The corrected, updated versions were used in determining the final emissions factors.

<sup>d</sup> Also known as GCO ECD 1600 and GCO ECD 2000.

<sup>e</sup> These emissions units were excluded from the dataset for both emissions factors based on the FQI evaluation.

#### 4.2.2 Heat Input Basis

Table 4-9 provides an overview of the THC emissions factors expressed in terms of heat input (lb THC/10<sup>6</sup> Btu) developed using data from manufacturer-tested enclosed ground flares. Table 4-10 provides the useable emissions test reports. We based the low-load emissions factor on the emissions test data from 29 test reports and the normal to high-load emissions factor on the emissions test data from 30 test reports. Both factors are characterized as Moderately Representative.

**Table 4-9. Overview of the Emissions Factors for THC Expressed in Terms of Heat Input from Manufacturer-Tested Enclosed Ground Flares**

| No. of Units Included in Analysis | Operating Condition           | Test Method    | AP-42 Emissions Factor                                      | Representativeness | SCC <sup>c</sup>                 |
|-----------------------------------|-------------------------------|----------------|---|--------------------|----------------------------------|
| 30 <sup>a</sup>                   | Normal to High Percent Load   | EPA Method 25A | 1.20e-3 lb THC (as propane)/ 10 <sup>6</sup> Btu heat input | Moderately         | 30190099<br>30119701<br>30119705 |
| 29 <sup>a</sup>                   | Low Percent Load <sup>b</sup> | EPA Method 25A | 3.88e-3 lb THC (as propane)/ 10 <sup>6</sup> Btu heat input | Moderately         | 30119709<br>30119741             |

<sup>a</sup> Two units were excluded from each dataset based on the FQI evaluation. This number represents the number of units in the emissions factor analyses.

<sup>b</sup> Low percent load is represented by a unit operating at less than 30% of maximum load.

<sup>c</sup> A detailed description of these SCCs is included in Table 4-7.

**Table 4-10. Analysis of Emissions Test Reports for Manufacturer-Tested Units, Heat Input Basis**

| Manufacturer Name                              | Unit Name                | Test Method    | Average Test Result in lb THC/10 <sup>6</sup> Btu Heat Input |                     | ITR |
|--|--------------------------|----------------|--|---------------------|-----|
|  |                          |                | Low Load   | Normal to High Load |     |
| ABUTECA <sup>a</sup>                           | ABUTECA 20               | EPA Method 25A | 6.50E-04   | 1.59E-03            | 45  |
| ABUTECA <sup>a</sup>                           | ABUTECA 20               | EPA Method 25A | 8.60E-04   | 1.25E-03            | 45  |
| Alphabet Energy                                | Alphabet PGC             | EPA Method 25A | 1.40E-02   | 4.99E-03            | 76  |
| Big Iron Oilfield Service                      | BNECU PI36               | EPA Method 25A | 3.29E-03   | 1.05E-03            | 49  |
| Big Iron Oilfield Service                      | BNECU PI48 <sup>b</sup>  | EPA Method 25A | -  | 7.58E-04            | 49  |
| Black Gold Rush                                | BGR-18                   | EPA Method 25A | 5.01E-03   | 2.37E-03            | 77  |
| Cimarron                                       | CEI 1-24                 | EPA Method 25A | 3.09E-02   | 2.05E-03            | 57  |
| Cimarron                                       | CEI 1-30                 | EPA Method 25A | 5.57E-03   | 8.16E-04            | 57  |
| Cimarron                                       | CEI 1-48                 | EPA Method 25A | 9.80E-04   | 4.85E-04            | 57  |
| Cimarron                                       | CEI 1-60                 | EPA Method 25A | 2.67E-03   | 4.22E-04            | 56  |
| Cimarron                                       | 48" HV ECD               | EPA Method 25A | 9.25E-04   | 1.07E-04            | 57  |
| COMM Engineering                               | COMM OOOO Combustor 200  | EPA Method 25A | 5.65E-03   | 1.94E-03            | 50  |
| COMM Engineering                               | Model 2                  | EPA Method 25A | 1.00E-03   | 5.65E-04            | 76  |
| COMM Engineering                               | Model 3                  | EPA Method 25A | 6.54E-04   | 1.00E-04            | 78  |
| COMM Engineering                               | Model 4                  | EPA Method 25A | 9.56E-04   | 3.75E-04            | 78  |
| Coyote North                                   | COMB 48"                 | EPA Method 25A | 1.58E-03   | 9.82E-04            | 66  |
| Hy-Bon/EDI <sup>c</sup>                        | CH2.5                    | EPA Method 25A | 1.86E-03   | 1.13E-03            | 75  |
| Hy-Bon/EDI <sup>c</sup>                        | CH10.0                   | EPA Method 25A | 2.60E-03   | 1.41E-03            | 76  |
| JLCC Combustion                                | FC 20                    | EPA Method 25A | 1.41E-03   | 8.14E-04            | 52  |
| John Zink                                      | ZTOF040X30PF             | EPA Method 25A | 4.37E-04   | 2.78E-04            | 74  |
| Kimark   | KSF 1-48                 | EPA Method 25A | 7.64E-04   | 1.07E-04            | 76  |
| Leed Fabrication                               | 36" Combustor (EC36)     | EPA Method 25A | 6.67E-03   | 1.13E-03            | 57  |
| Leed Fabrication <sup>d</sup>                  | 48" Combustor (EC48)     | EPA Method 25A | 3.61E-02   | 4.79E-03            | 30  |
| Questor Technology                             | Q100                     | EPA Method 25A | 6.12E-04   | 9.39E-04            | 56  |
| Questor Technology                             | Q250                     | EPA Method 25A | 3.28E-03   | 2.12E-03            | 56  |
| REM Technology (Spartan Controls) <sup>d</sup> | SlipStream GTS-12        | EPA Method 25A | 5.58E-04   | 7.42E-04            | 20  |
| SFI Oil & Gas Production Systems               | SCD-36                   | EPA Method 25A | 1.41E-03   | 1.57E-03            | 76  |
| SFI Oil & Gas Production Systems               | SCD-48                   | EPA Method 25A | 5.21E-03   | 1.53E-03            | 77  |
| SFI Oil & Gas Production Systems               | SCD-60                   | EPA Method 25A | 2.07E-03   | 9.21E-04            | 58  |
| Zeeco, Inc.                                    | EGF-48-30 (aka EGF-4-30) | EPA Method 25A | 3.59E-03   | 1.69E-03            | 58  |

<sup>a</sup> Also known as NOV MEVC 20 and MEVC 100.

<sup>b</sup> All test runs were negative values or zero, and this unit was removed from the dataset for the low load condition.

<sup>c</sup> Also known as GCO ECD 1600 and GCO ECD 2000.

<sup>d</sup> These emissions units were excluded from the dataset for both emissions factors based on the FQI evaluation.

## **Section 5**

### **Clarification of Heating Value Basis**

In addition to adding new emissions factors to AP-42 Section 13.5, the EPA is adding footnotes to Tables 13.5-1 through 13.5-3 to clarify the heating value basis that was used to develop each factor. This clarification only applies to factors that are based on heating value, i.e., lb/10<sup>6</sup> Btu.

The heating value of a fuel is the energy released during combustion, generally expressed as energy per mass of fuel (e.g., Btu/lb) or energy per volume of fuel (e.g., Btu/scf). Heating value can be presented in two different forms. The higher heating value (also known as the gross heating value or upper heating value) takes into account the latent heat of vaporization of water in the combustion products. The lower heating value (also known as the net heating value or lower heating value) subtracts the heat of vaporization of water vapor from the higher heating value; it accounts for no recovery of the latent heat of vaporization of any water in the fuel or water produced from combustion. The difference between the two heating values is more pronounced as the content of hydrogen in the fuel increases, because hydrogen combines with oxygen to create water during the combustion process.

It is necessary to clarify the heating value basis of the emissions factors in Section 13.5 in order for users to more accurately estimate emissions. For example, the higher heating value of propylene is 2336 Btu/scf and the lower heating value is 2185 Btu/scf. This means that for each 100 scf/hr of propylene burned, the higher heating value will estimate 0.0151 lb/hr more emissions than the lower heating value. For a large flare, this difference would be more prominent and could produce estimates that differ by hundreds or even thousands of pounds per year. To resolve this issue, we are footnoting Tables 13.5-1 through 13.5-3 with the heating value basis that was used when the factors were developed.

Additionally, based on comments received after proposal, we are adding clarifying footnotes to Tables 13.5-1 through 13.5-3 to indicate that the emissions factors represent the emissions exiting a flare, not the uncontrolled emissions entering the flare from the associated process unit.

## **Section 6**

### **Conclusions**

The following final actions are based on a review of available test reports associated with flares at natural gas production sites.

1. Based on its review of available data, the EPA has concluded that it is not necessary to revise the existing VOC emissions factor in WebFIRE for flares at natural gas production sites.
2. The EPA has developed two THC emissions factors from field-tested units burning field gas and is applying natural gas production SCCs to these factors. The EPA recommends the use of these THC emissions factors instead of the VOC emissions factor in WebFIRE for estimating VOC emissions from enclosed ground flares at natural gas production sites.
3. The existing VOC emissions factor in WebFIRE remains available for estimating emissions from elevated flares at natural gas production sites.
4. The EPA has developed four factors from manufacturer-tested units burning pure propylene. The factors are based on the percent load of the inlet gas burned, with two factors applying to low-load conditions and the other two factors applying to normal to high-load conditions. The EPA is applying chemical manufacturing SCCs to these factors.
5. The EPA has included these six new THC emissions factors as an update to AP-42 Section 13.5.
6. The EPA is clarifying the heating value basis for the emissions factors in AP-42 Tables 13.5-1 through 13.5-3 in order to allow users to generate more accurate emissions estimates and clarifying that the emissions factors in the tables represent the emissions at the exit of a flare, not the uncontrolled VOC or THC emissions routed to the flare.

Section 7  
References

*Air Alliance Houston, et al. v. McCarthy*, No. 1:16-cv-01998-RC (D.D.C.).

EPA (U.S. Environmental Protection Agency). 1990. *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants*. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. EPA 450/4-90-003. March 1990.

EPA (U.S. Environmental Protection Agency). 1995. *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*. AP-42, Fifth Edition, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. January 1995. Available at: <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors>

EPA (U.S. Environmental Protection Agency). 2012. *Performance Testing for Combustion Control Devices Manufacturers' Performance Test New Source Performance Standards (NSPS) OOOO, OOOOa and Maximum Achievable Control Technology HH/HHH*. Last Updated December 14, 2017. Available at: <https://www.epa.gov/stationary-sources-air-pollution/performance-testing-combustion-control-devices-manufacturers>

EPA (U.S. Environmental Protection Agency). 2013. *Recommended Procedures for Development of Emissions Factors and Use of the WebFIRE Database*. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. August 2013 (Draft Final). Available at: <https://www.epa.gov/air-emissions-factors-and-quantification/procedures-development-emissions-factors-stationary-sources>

ERG (Eastern Research Group). 2018. *Summary of EPA Responses to Public Comments Received on the Proposed Emissions Factors for Enclosed Ground Flares at Natural Gas Production Sites and Chemical Manufacturing Processes*. February 1, 2018. Available at: [https://www3.epa.gov/ttn/chief/consentdecree/ONGflare/response\\_to\\_comments.pdf](https://www3.epa.gov/ttn/chief/consentdecree/ONGflare/response_to_comments.pdf)

## **Appendix A**

### **CONSENT DECREE**

UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF COLUMBIA

|  |   |                              |
|--|---|------------------------------|
| _____                                      | ) |                              |
| AIR ALLIANCE HOUSTON, <i>et al.</i> ,      | ) |                              |
|  | ) |                              |
|  | ) | Case No. 1:16-cv-01998 (RC)  |
| Plaintiffs,                                | ) |                              |
|  | ) |                              |
| v.   | ) |                              |
|  | ) |                              |
| GINA McCARTHY, Administrator, United       | ) | <b><u>CONSENT DECREE</u></b> |
| States Environmental Protection Agency, in | ) |                              |
| her official capacity,                     | ) |                              |
|  | ) |                              |
| Defendant.                                 | ) |                              |
|  | ) |                              |
| _____                                      | ) |                              |

WHEREAS, on October 16, 2016, Plaintiffs, Air Alliance Houston, Community In-Power and Development Association, Inc., Louisiana Bucket Brigade, and Texas Environmental Justice Advocacy Services, filed their Complaint alleging that Gina McCarthy, in her official capacity as Administrator of the United States Environmental Protection Agency (“EPA”), failed to perform nondiscretionary duties under Clean Air Act (“CAA”) Section 130, 42 U.S.C. § 7430. Specifically, Plaintiffs allege that EPA failed to review and, if necessary, revise the emissions factor for volatile organic compounds (“VOCs”) from elevated flares and enclosed ground flares at natural gas production sites in the source category entitled “Crude Oil and Natural Gas Production, Transmission and Distribution” (ONG source category) at least once every three years. 42 U.S.C. § 7430;

WHEREAS, for purposes of this Consent Decree, an “elevated flare” is defined to be a thermal oxidation system using an open flame without an enclosure;

WHEREAS, for purposes of this Consent Decree, an “enclosed ground flare” is defined to be a thermal oxidation system using a flame with an enclosure;

WHEREAS, for purposes of this Consent Decree, “natural gas production sites” are defined as the wells and all related processes used in the extraction, production, recovery, lifting, stabilization, separation or treating of natural gas (including condensate). “Natural gas production sites” include not only the pads where the wells are located, but also include stand-alone sites where natural gas (including condensate and produced water) from several wells may be separated, stored and treated.”

WHEREAS, the relief requested in the Complaint includes, among other things, an order from this Court to establish a date certain by which EPA must complete a review of the VOC emissions factor for elevated flares and enclosed ground flares at natural gas production sites in the ONG source category, and either revise this factor or make a final determination that revision is not appropriate as required by CAA Section 130, 42 U.S.C. § 7430;

WHEREAS, the only segment in the ONG source category for which EPA has and maintains an existing VOC emissions factor for flares is at the natural gas production sites, and EPA includes this VOC emission factor in its WebFIRE database (SCC 31000205) (hereafter referred to as the “Natural Gas VOC emissions factor”);

WHEREAS, EPA has not conducted a review of the Natural Gas VOC emissions factor or revised this factor under CAA Section 130, 42 U.S.C. § 7430 in over three years;

WHEREAS, before filing the Complaint in this action, Plaintiffs served notice on EPA as required by the CAA to inform EPA of Plaintiffs’ intent to initiate the present action;

WHEREAS, Plaintiffs and EPA (collectively “the Parties”) have agreed to a settlement of this action without admission of any issue of fact or law, except as expressly provided herein;

WHEREAS, the Parties, by entering into this Consent Decree, do not waive or limit any claim, remedy, or defense, on any grounds, related to any final EPA action;

WHEREAS, the Parties consider this Consent Decree to be an adequate and equitable resolution of all the claims in this matter and therefore wish to effectuate a settlement;

WHEREAS, it is in the interest of the public, Plaintiffs, EPA, and judicial economy to resolve this matter without protracted litigation;

WHEREAS, the Parties agree that this Court has jurisdiction over this matter pursuant to the citizen suit provision in CAA section 304(a)(2), 42 U.S.C. § 7604(a)(2), and that venue is proper in the United States District Court for the District of Columbia pursuant to 28 U.S.C. § 1391(e);

WHEREAS, the Court, by entering this Consent Decree, finds that the Consent Decree is fair, reasonable, in the public interest, and consistent with the Clean Air Act;

NOW THEREFORE, before the taking of testimony, without trial or determination of any issues of fact or law, and upon the consent of the Parties, it is hereby ordered, adjudged and decreed that:

1. This Court has jurisdiction over the claims set forth in the Complaint and may order the relief contained in the Consent Decree. Venue is proper in the United States District Court for the District of Columbia.

2. For the Natural Gas VOC emissions factor for elevated flares and enclosed ground flares at the natural gas production sites in the ONG source category, the EPA Administrator shall:

- a. no later than June 5, 2017, review and either propose revisions to the Natural Gas VOC emissions factor under CAA section 130, 42 U.S.C. § 7430, or propose a

determination that revision of the Natural Gas VOC emissions factor is not necessary under CAA section 130.

- b. no later than February 5, 2018, issue final revisions to the Natural Gas VOC emissions factor under CAA section 130, or issue a final determination that revision of the Natural Gas VOC emissions factor is not necessary under CAA section 130.

3. EPA shall post the proposed revision or determination and the final revision or determination, as described in paragraph 2 of this Consent Decree, on its AP-42 website (located at <http://www.epa.gov/ttn/chief/ap42/>) on the dates described in paragraph 2. In addition, EPA shall provide a copy of each such action to Plaintiffs' counsel indicated in Paragraph 15 within seven days of posting.

4. Once EPA has completed all of the actions set forth above and after the final actions required by paragraphs 2 and 3 have been completed, EPA may move to have this Consent Decree terminated, and the action dismissed. Plaintiffs shall have 30 days in which to respond to such motion.

5. The deadlines established by this Consent Decree may be modified (a) by written stipulation of EPA and Plaintiffs with notice to the Court, or (b) by the Court on motion of EPA for good cause shown pursuant to the Federal Rules of Civil Procedure, and upon consideration of any response by Plaintiff(s). Any other provision of this Consent Decree also may be modified by the Court following motion of an undersigned party for good cause shown pursuant to the Federal Rules of Civil Procedure and upon consideration of any response by a non-moving party.

6. If a lapse in appropriations for EPA occurs within ninety (90) days prior to the deadlines in Paragraph 2 of this Consent Decree, those deadlines will be extended automatically one day for each day of the lapse in appropriations. Nothing in this paragraph shall preclude EPA from seeking an additional extension through modification of this Consent Decree pursuant to Paragraph 5.

7. In the event of a dispute between the Parties concerning the interpretation or implementation of any aspect of this Consent Decree, the disputing party shall provide the other parties with a written notice outlining the nature of the dispute and requesting informal negotiations. The Parties shall meet and confer in order to attempt to resolve the dispute. If the Parties are unable to resolve the dispute within 14 days after receipt of the notice, a party may petition the Court to resolve the dispute.

8. This Court shall retain jurisdiction over this matter to enforce the terms of this Consent Decree and to consider any requests from Plaintiffs for costs of litigation, including attorney fees.

9. Nothing in the terms of this Consent Decree shall be construed (a) to confer upon this Court jurisdiction to review any final rule or determination issued by EPA pursuant to this Consent Decree, (b) to confer upon this Court jurisdiction to review any issues that are within the exclusive jurisdiction of the United States Courts of Appeals under CAA section 307(b)(1), 42 U.S.C. § 7607(b)(1), or (c) to waive any claims, remedies, or defenses that the Parties may have under CAA section 307(b)(1), 42 U.S.C. § 7607(b)(1).

10. Nothing in this Consent Decree shall be construed to limit or modify any discretion accorded EPA by the Clean Air Act or by general principles of administrative law in taking the actions which are the subject of this Consent Decree, including the discretion to alter,

amend, or revise any final actions promulgated pursuant to this Consent Decree. EPA's obligation to perform each action specified in this Consent Decree does not constitute a limitation or modification of EPA's discretion within the meaning of this paragraph.

11. Except as expressly provided herein, nothing in this Consent Decree shall be construed as an admission of any issue of fact or law. By entering into this Consent Decree, EPA and Plaintiffs do not waive or limit any claim, remedy, or defense, on any grounds, related to any final action EPA takes with respect to the actions addressed in this Consent Decree.

12. The Parties agree the Clean Air Act provides for the recovery of the costs of litigation (including attorneys' fees) incurred in this matter pursuant to section 304(d) of the CAA, 42 U.S.C. § 7604(d). The deadline for filing a motion for costs of litigation (including attorney fees) for activities performed prior to entry of the Consent Decree is hereby extended until ninety (90) days after this Consent Decree is entered by the Court. During this period, the Parties shall seek to resolve informally any claim for costs of litigation (including attorney fees), and if they cannot, Plaintiffs will file a motion for costs of litigation (including attorney fees) or a stipulation or motion to extend the deadline to file such a motion. EPA reserves the right to oppose any such request.

13. Plaintiffs reserve the right to seek additional costs of litigation, including attorney fees, incurred subsequent to entry of this Consent Decree and arising from Plaintiffs' need to enforce or defend against efforts to modify its terms or the underlying schedule outlined herein, or for any other unforeseen continuation of this action. EPA reserves the right to oppose any such request.

14. It is hereby expressly understood and agreed that this Consent Decree was jointly drafted by Plaintiffs and EPA. Accordingly, the Parties hereby agree that any and all rules of

construction to the effect that ambiguity is construed against the drafting party shall be inapplicable in any dispute concerning the terms, meaning, or interpretation of this Consent Decree.

15. The Parties agree and acknowledge that before this Consent Decree is entered by the Court, EPA must provide notice of this Consent Decree in the Federal Register and an opportunity for public comment pursuant to CAA section 113(g), 42 U.S.C. § 7413(g). After this Consent Decree has undergone notice and comment, the Administrator and/or the Attorney General, as appropriate, shall promptly consider any written comments received in determining whether to withdraw or withhold their consent to the Consent Decree, in accordance with CAA section 113(g). If the Administrator and the Attorney General do not elect to withdraw or withhold consent, EPA shall promptly file a motion that requests that the Court enter this Consent Decree.

16. Any notices required or provided for by this Consent Decree shall be in writing, via electronic mail or certified mail, and sent to each of the following counsel (or to any new address of the Parties' counsel as filed and listed in the docket of the above-captioned matter, at a future date):

- a. For Plaintiffs Air Alliance Houston, Community In-Power and Development Association, Inc., Louisiana Bucket Brigade, and Texas Environmental Justice Advocacy Services:

Sparsh Khandeshi  
Environmental Integrity Project  
1000 Vermont Avenue, Suite 1100  
Washington, D.C. 20005  
[skhandeshi@environmentalintegrity.org](mailto:skhandeshi@environmentalintegrity.org)  
Tel: 202-263-4446

Eric Schaeffer  
Environmental Integrity Project

1000 Vermont Avenue, Suite 1100  
Washington, D.C. 20005  
[eschaeffer@environmentalintegrity.org](mailto:eschaeffer@environmentalintegrity.org)  
Tel: 202-263-4440

b. For Defendant EPA:

Michele L. Walter  
United States Department of Justice  
Environment & Natural Resources Division  
999 18<sup>th</sup> St.  
Suite 370 – South Terrace  
Denver, Colorado 80202  
[michele.walter@usdoj.gov](mailto:michele.walter@usdoj.gov)  
Tel: 303-844-1345

17. EPA and Plaintiffs recognize and acknowledge that the obligations imposed upon EPA under this Consent Decree can only be undertaken using appropriated funds legally available for such purpose. No provision of this Consent Decree shall be interpreted as or constitute a commitment or requirement that the United States obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341, or any other applicable provision of law.

18. If for any reason the Court should decline to approve this Consent Decree in the form presented, this agreement is voidable at the sole discretion of either party and the terms of the proposed Consent Decree may not be used as evidence in any litigation between the Parties.

19. The undersigned representatives of Defendant EPA and Plaintiffs Air Alliance Houston, Community In-Power and Development Association, Inc., Louisiana Bucket Brigade, and Texas Environmental Justice Advocacy Services certify that they are fully authorized by the party they represent to consent to the Court's entry of the terms and conditions of this Consent Decree.

COUNSEL FOR PLAINTIFFS:

Dated: December 1, 2016

*/s/ Sparsh Khandeshi*  
Sparsh Khandeshi  
Environmental Integrity Project  
1000 Vermont Avenue, Suite 1100  
Washington, D.C. 20005  
[skhandeshi@environmentalintegrity.org](mailto:skhandeshi@environmentalintegrity.org)  
Tel: 202-263-4446

Eric Schaeffer  
Environmental Integrity Project  
1000 Vermont Avenue, Suite 1100  
Washington, D.C. 20005  
[eschaeffer@environmentalintegrity.org](mailto:eschaeffer@environmentalintegrity.org)  
Tel: 202-263-4440

*Counsel for Plaintiffs Air Alliance Houston,  
Community In-Power and Development  
Association, Inc., Louisiana Bucket Brigade, and  
Texas Environmental Justice Advocacy Services*

COUNSEL FOR DEFENDANT:

Dated: December 1, 2016

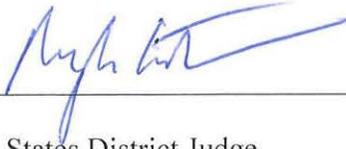
*/s/ Michele L. Walter*

JOHN C. CRUDEN  
Assistant Attorney General  
Environment & Natural Resources Division

MICHELE L. WALTER, D.C. Bar No. 487329  
United States Department of Justice  
Environment & Natural Resources Division  
999 18<sup>th</sup> St.  
Suite 370 – South Terrace  
Denver, Colorado 80202  
Tel: 303-844-1345  
E-mail: [michele.walter@usdoj.gov](mailto:michele.walter@usdoj.gov)

*Counsel for Defendant EPA*

SO ORDERED on this 7<sup>th</sup> day of December, 2016.

  
\_\_\_\_\_  
United States District Judge

**Appendix B**

**EPA'S "TEST QUALITY RATING TOOL" TEMPLATE  
(ITR TEMPLATE)**

August 2013

|    | A   | B               | G  | H               | N                    |
|----|---|-----------------|--|-----------------|----------------------|
| 1  | Name of Facility where the test was performed   |                 |  |                 |                      |
| 2  | Name of Company performing stationary source test   |                 |  |                 |                      |
| 3  | SCC of tested unit or units   |                 |  |                 |                      |
| 4  | Name of assessor and name of employer.  |                 |  |                 |                      |
| 5  | Name of regulatory assessor and regulatory agency name.   |                 |  |                 |                      |
| 6  |   |                 |  |                 |                      |
| 7  | <b>Emissions Factor Development Quality Indicator Value Rating 0</b>  |                 |  |                 |                      |
| 8  |   |                 |  |                 |                      |
| 9  |   |                 |  |                 |                      |
| 10 | <b>Supporting Documentation Provided</b>  | <i>Response</i> | <b>Regulatory Agency Review</b>  | <i>Response</i> | <b>Justification</b> |
| 11 | <b>General</b>  |                 |  |                 |                      |
| 12 | As described in ASTM D7036-12 Standard Practice for Competence of Air Emission Testing Bodies, does the testing firm meet the criteria as an AETB or is the person in charge of the field team a QI for the type of testing conducted? A certificate from an independent organization (e.g., Stack Testing Accreditation Council (STAC), California Air Resources Board (CARB), National Environmental Laboratory Accreditation Program (NELAP)) or self declaration provides documentation of competence as an AETB. |                 | As described in ASTM D7036-12 Standard Practice for Competence of Air Emission Testing Bodies, does the testing firm meet the criteria as an AETB or is the person in charge of the field team a QI for the type of testing conducted? A certificate from an independent organization (e.g., STAC, CARB, NELAP) or self declaration provides documentation of competence as an AETB. |                 |                      |
| 13 |   |                 | Was a representative of the regulatory agency on site during the test?   |                 |                      |
| 14 | Is a description and drawing of test location provided?   |                 | Is a description and drawing of test location provided?  |                 |                      |
| 15 | Has a description of deviations from published test methods been provided, or is there a statement that deviations were not required to obtain data representative of typical facility operation?   |                 | Is there documentation that the source or the test company sought and obtained approval for deviations from the published test method prior to conducting the test or that the tester's assertion that deviations were not required to obtain data representative of operations that are typical for the facility?   |                 |                      |
| 16 |   |                 | Were all test method deviations acceptable?  |                 |                      |
| 17 | Is a full description of the process and the unit being tested (including installed controls) provided?   |                 | Is a full description of the process and the unit being tested (including installed controls) provided?  |                 |                      |
| 18 | Has a detailed discussion of source operating conditions, air pollution control device operations and the representativeness of measurements made during the test been provided?  |                 | Has a detailed discussion of source operating conditions, air pollution control device operations and the representativeness of measurements made during the test been provided?   |                 |                      |
| 19 | Were the operating parameters for the tested process unit and associated controls described and reported?   |                 | Is there documentation that the required process monitors have been calibrated and that the calibration is acceptable?   |                 |                      |
| 20 |   |                 | Was the process capacity documented?   |                 |                      |
| 21 |   |                 | Was the process operating within an appropriate range for the test program objectives?   |                 |                      |
| 22 |   |                 | Were process data concurrent with testing?   |                 |                      |
| 23 |   |                 | Were data included in the report for all parameters for which limits will be set?  |                 |                      |
| 24 | Is there an assessment of the validity, representativeness, achievement of DQO's and usability of the data?   |                 | Did the report discuss the representativeness of the facility operations, control device operation, and the measurements of the target pollutants, and were any changes from published test methods or process and control device monitoring protocols identified?   |                 |                      |
| 25 | Have field notes addressing issues that may influence data quality been provided?   |                 | Were all sampling issues handled such that data quality was not adversely affected?  |                 |                      |
| 26 | <b>Manual Test Methods</b>  |                 |  |                 |                      |
| 27 | <b>Have the following been included in the report:</b>  |                 |  |                 |                      |
| 28 | Dry gas meter (DGM) calibrations, pitot tube and nozzle inspections?  |                 | Was the DGM pre-test calibration within the criteria specified by the test method?   |                 |                      |
| 29 |   |                 | Was the DGM post-test calibration within the criteria specified by the test method?  |                 |                      |
| 30 |   |                 | Were thermocouple calibrations within method criteria?   |                 |                      |
| 31 |   |                 | Was the pitot tube inspection acceptable?  |                 |                      |
| 32 |   |                 | Were nozzle inspections acceptable?  |                 |                      |
| 33 |   |                 | Were flow meter calibrations acceptable?   |                 |                      |
| 34 | Was the Method 1 sample point evaluation included in the report?  |                 | Were the appropriate number and location of sampling points used?  |                 |                      |
| 35 | Were the cyclonic flow checks included in the report?   |                 | Did the cyclonic flow evaluation show the presence of an acceptable average gas flow angle?  |                 |                      |
| 36 | Were the raw sampling data and test sheets included in the report?  |                 | Were all data required by the method recorded?   |                 |                      |
| 37 |   |                 | Were required leak checks performed and did the checks meet method requirements?   |                 |                      |
| 38 |   |                 | Was the required minimum sample volume collected?  |                 |                      |
| 39 |   |                 | Did probe, filter, and impinger exit temperatures meet method criteria (as applicable)?  |                 |                      |
| 40 |   |                 | Did isokinetic sampling rates meet method criteria?  |                 |                      |

|    | A   | B | G  | H | N |
|----|---|---|--|---|---|
| 41 |   |   | Was the sampling time at each point greater than 2 minutes and the same for each point?  |   |   |
| 42 | Did the report include a description and flow diagram of the recovery procedures?         |   | Was the recovery process consistent with the method?   |   |   |
| 43 |   |   | Were all required blanks collected in the field?   |   |   |
| 44 |   |   | Where performed, were blank corrections handled per method requirements?   |   |   |
| 45 |   |   | Were sample volumes clearly marked on the jar or measured and recorded?  |   |   |
| 46 | Was the laboratory certified/accredited to perform these analyses?                        |   | Was the laboratory certified/accredited to perform these analyses?   |   |   |
| 47 | Did the report include a complete laboratory report and flow diagram of sample analysis?  |   | Did the laboratory note the sample volume upon receipt?  |   |   |
| 48 |   |   | If sample loss occurred, was the compensation method used documented and approved for the method?  |   |   |
| 49 |   |   | Were the physical characteristics of the samples (e.g., color, volume, integrity, pH, temperature) recorded and consistent with the method?        |   |   |
| 50 |   |   | Were sample hold times within method requirements?   |   |   |
| 51 |   |   | Does the laboratory report document the analytical procedures and techniques?  |   |   |
| 52 |   |   | Were all laboratory QA requirements documented?  |   |   |
| 53 |   |   | Were analytical standards required by the method documented?   |   |   |
| 54 |   |   | Were required laboratory duplicates within acceptable limits?  |   |   |
| 55 |   |   | Were required spike recoveries within method requirements?   |   |   |
| 56 |   |   | Were method-specified analytical blanks analyzed?  |   |   |
| 57 |   |   | If problems occurred during analysis, is there sufficient documentation to conclude that the problems did not adversely affect the sample results? |   |   |
| 58 |   |   | Was the analytical detection limit specified in the test report?   |   |   |
| 59 |   |   | Is the reported detection limit adequate for the purposes of the test program?   |   |   |
| 60 | Were the chain-of-custody forms included in the report?                                   |   | Do the chain-of-custody forms indicate acceptable management of collected samples between collection and analysis?                                 |   |   |
| 61 |   |   |  |   |   |
| 62 | <b>Have the following been included in the report:</b>                                    |   |  |   |   |
| 63 | Did the report include a complete description of the instrumental method sampling system? |   | Was a complete description of the sampling system provided?  |   |   |
| 64 | Did the report include calibration gas certifications?                                    |   | Were calibration standards used prior to the end of the expiration date?   |   |   |
| 65 |   |   | Did calibration standards meet method criteria?  |   |   |
| 66 | Did report include interference tests?  |   | Did interference checks meet method requirements?  |   |   |
| 67 | Were the response time tests included in the report?                                      |   | Was a response time test performed?  |   |   |
| 68 | Were the calibration error tests included in the report?                                  |   | Did calibration error tests meet method requirements?  |   |   |
| 69 | Did the report include drift tests?   |   | Were drift tests performed after each run and did they meet method requirements?   |   |   |
| 70 | Did the report include system bias tests?   |   | Did system bias checks meet method requirements?   |   |   |
| 71 | Were the converter efficiency tests included in the report?                               |   | Was the NOX converter test acceptable?   |   |   |
| 72 | Did the report include stratification checks?   |   | Was a stratification assessment performed?   |   |   |
| 73 | Did the report include the raw data for the instrumental method?                          |   | Was the duration of each sample run within method criteria?  |   |   |
| 74 |   |   | Was an appropriate traverse performed during sample collection, or was the probe placed at an appropriate center point (if allowed by the method)? |   |   |
| 75 |   |   | Were sample times at each point uniform and did they meet the method requirements?   |   |   |
| 76 |   |   | Were sample lines heated sufficiently to prevent potential adverse data quality issues?  |   |   |
| 77 |   |   | Was all data required by the method recorded?  |   |   |
| 88 |   |   |  |   |   |
| 89 |   |   |  |   |   |
| 90 |   |   |  |   |   |
| 91 |   |   |  |   |   |
| 92 |   |   |  |   |   |
| 93 |   |   |  |   |   |

Total  
Manual Test 0  
Instrumental Test 0