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Mr. Wayne Rivera
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Re: Compliance Sampling Plan
Testing of Three Train 1 Turbines
Following Hot Section Changeout
Element Project No. EHO007986P

Dear Mr. Rivera:

Element Materials Technology Houston LLC (Element) is pleased to submit our compliance sampling plan for performing air emissions testing services at the Corpus Christi Liquefaction LLC facility located in Gregory, Texas. It is our understanding that testing will be performed on three (3) turbine exhaust stacks subsequent to hot section change-outs. The three (3) turbines are located in Train 1 and are specifically identified as EPN's TRB2, TRB4, and TRB6. Special Condition 22 of the permit requires a re-test following the change-out of a hot section. The test program will be performed as follows:

* **TCEQ Permit 105710 and PSDTX1306M1(TCEQ Permit)**

  - Test in accordance with the requirements contained in Texas Commission on Environmental Quality (TCEQ) Permit No. 105710 and PSDTX1306M1, dated November 4, 2020 (TCEQ Permit). The test program will include a re-test of three (3), natural gas-fired combustion turbines.

  - The TCEQ Permit Special Condition 20.B requires the turbines to be tested for nitrogen oxides (NOx), oxygen (O_2), carbon

monoxide (CO), volatile organic hydrocarbons (VOCs – defined as non-methane, non-ethane hydrocarbons quantified as propane), and sulfur dioxide (SO_2). For the determination of SO_2, Special Condition 20 allows for fuel sampling and analysis procedures to be performed in lieu of stack sampling for this pollutant. The turbines must be tested at or above 90% of maximum load, as stipulated in Special Condition 20.C.

PROCEDURES

The test program will include the following methods:

PARAMETER	TEST METHOD
O_2	EPA Method 3A
Moisture	EPA Method 4 (modified)
SO_2	Fuel sampling and analysis to be provided by CCL
NOx	EPA Method 7E
CO	EPA Method 10
"Total" VOC	EPA Method 25A (off-site methane/ethane by Method 18, if needed)
lb/mmBtu	EPA Method 19
lb/hr	Stoichiometric calculations

Compliance will be determined using triplicate sixty (60) minute sample runs for all parameters. A description of the test methods follows:

- **NOx, CO, and O_2:** The NOx, CO, and O_2 test on the turbines will utilize continuous analyzer techniques. NOx emissions will be measured with a chemiluminescent analyzer. CO will use a nondispersive infrared gas filter correlation (NDIR-GFC) analyzer. O_2 will use a paramagnetic analyzer. The sample system will consist of a stainless steel probe system (heated to prevent condensation), a three way calibration valve assembly, heat traced Teflon sample line, a chilled conditioning system, Teflon transport line, a stainless steel and Teflon diaphragm pump, the aforementioned analyzers and data acquisition system (DAS). The NOx, CO, and O_2 instruments will be calibrated with EPA Protocol gas standards. Prior to use, the instruments will undergo a three (3) point calibration error test (linearity). The NOx instrument will also undergo a NOx converter efficiency test

with each trailer setup. The number of points will be determined by the stratification test (using the procedures contained in Method 7E as referenced in Method 3A). Prior to sampling, the probe will be conditioned at the first sample point (and any time the probe is removed from the stack) for at least two times the response time. Element plans on using typical span ranges (50 to 100 ppmv NOx; 100 to 500 ppmv CO; 25% O_2).

- **THC/VOC:** The total hydrocarbons (THC)/VOC test on the turbine outlets will utilize a continuous analyzer technique. The sample points will be the same as utilized above. The sample system will consist of a stainless steel sample probe, a three way calibration valve assembly, heat traced Teflon sample line, Teflon transport line, a stainless steel and Teflon diaphragm pump, manifold apparatus, and a continuous flame ionization analyzer (THC analyzer) following EPA Method 25A requirements and quantifying the organics as propane. Element will obtain integrated Tedlar bags, followed by off site EPA Method 18 (by Enthalpy Analytical, LLC) analysis, for methane and ethane in order to determine TCEQ defined VOC (non-methane, non-ethane hydrocarbons as propane). The THC/VOC sample will be obtained on a "hot-wet" basis (i.e. will bypass the chilled conditioning system). The entire sampling system prior to the analyzer will be heated to a range of 225 to 300°F. The THC analyzer will determine "total" hydrocarbons and will be calibrated with EPA Protocol propane standards. The flue gas moisture will be used to convert the THC/VOC concentration data to a dry basis. Element anticipates operating on the 100 ppmv THC scale. The Tedlar bag samples will be considered a dry based sample. The bags will be obtained either using an SKC lung sampler technique or in Element's trailer system using the EPA Method 18 direct pumping procedure. Please note if the THC on the Method 25A analyzer demonstrates compliance, the methane/ethane analyses may not be performed.

- **Flue Gas Moisture:** Triplicate sixty (60) minute runs will be performed on the turbine outlets to determine the flue gas moisture. The sampling train will consist of a stainless steel probe, a heated Teflon line and a series of chilled impingers. The first and second impingers will each contain 100 mL of deionized water, the third impinger will be dry and the fourth impinger will contain a known weight of silica gel. The moisture sample will be obtained at a constant rate from a point at least one (1) meter inside each stack or at the midpoint. Following each run, the impinger contents will be recovered volumetrically and gravimetrically. The moisture content will be used to convert the THC analyzer data from a wet to a dry basis on the turbines.

- **Emission Calculations:** Element proposes using a calculation technique to convert pollutant concentration data to an emission rate on a lb/mmBtu and lb/hr basis on the turbines. EPA Method 19, coupled with fuel flow and fuel composition will be used. The mass emissions calculations will require the determination of the fuel F factor and gross calorific value (GCV) (either utilizing EPA published data for natural gas or the fuel composition from the analysis of a single sample collected and analyzed by the facility or data provided by the supplier) and the fuel flow rates (monitored and recorded by the facility). The equations to be used are shown as follows:

$$E\ lb/mmBtu = C_d \times F_d \times \left[\frac{20.9}{20.9 - \%O_{2d}}\right] \qquad Equation\ 19\text{-}1$$

$$Pollutant\ lb/hr = E \times GCV\ fuel \times flow\ rate \times 1 \times 10^{6}$$

Where:

E = pollutant emission rate in lb/mmBtu, corrected to 0% O_2
C_d = pollutant concentration in lb/dscf
F_d = fuel F factor, dscf/mmBtu (determined using equation 19-13 from the fuel analysis or published data from EPA for natural gas)
% O_{2d} = stack oxygen, dry basis, from Element emissions test
GCV = fuel gross calorific value, Btu/lb or Btu/scf (calculated from the fuel analysis or published data for natural gas.)
fuel flow rate = lb/hr or scf/hr fuel flow (operating data provided by

the facility)

DESCRIPTION OF EQUIPMENT

The following instrumental/equipment are expected to be use by Element:

Parameter	Make and Model (or equivalent)	Detection Principle	Expected Span Range*
O_2	Servomex 1440 Series	Paramagnetic/NDIR	25%
NOx	ThermoEnvironmental Model 42i Series	Chemiluminescence	100 ppmv
CO	ThermoEnvironmental Model 48i Series	NDIR-GFC	100 ppmv
THC	JUM Model 3-500	Flame ionization detector	100 ppmv
Methane, Ethane	Tedlar bag with off-site analysis	GC-FID	NA
* Subject to change dependent upon actual concentrations.			

PROPOSED ALTERATIONS/CLARIFICATIONS TO TESTING

The following are the proposed alterations/clarifications to testing as outlined in the Procedures section above. Please note these alterations are identical to those utilized on other compliance test programs throughout Texas and many are contained in other TCEQ Rules (i.e. TCEQ Rule 117) and therefore may not be an alteration.

- The use of typical analyzer span ranges (100 ppm NOx and CO, 25% O_2) and therefore the criteria of being on an instrument span range in which the measured NOx, CO and O_2 emissions are between 20 to 100% of the calibration span may not be achieved. Also, if emission “spikes” are present, the span range will need to be adjusted to capture them. Element will select the appropriate span range.

- The use of a stoichiometric calculation procedure to determine emission rates on the Turbines.

- Please note that as of the preparation of this test plan, there are no audit samples available.

TEST SCHEDULING AND REPORT

Scheduling for this work should be coordinated through Element's Air Emissions Services Division, the TCEQ Regional Office and Corpus Christi Liquefaction, LLC.

Preliminary outlet concentration data (ppmvd NOx, CO, THC and % O_2) will be available in the field. Methane and ethane data (if applicable) will be available approximately ten business days after receipt into the analytical laboratory.

Upon completion of testing, personnel will return to their office to complete the evaluation of test data. The final test reports will meet the TCEQ Permit Special Condition 20.F submittal deadline of 60 days after completion of field testing. Both hard copies and electronic pdf copies will be provided. The test reports will contain:

1. Letter of Transmittal
2. Test Objective
3. Description of Test Procedures
4. Discussion
5. Summary
6. Tabulated Summary of Sampling Results
7. Diagram of Test Location
8. Field and Laboratory Data Sheets, including Calculation Sheets
9. Applicable Calibration Sheets

CONTACT PERSONS

The contact persons for this project are as follows:

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Sincerely,

ELEMENT MATERIALS TECHNOLOGY HOUSTON LLC

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Air Emissions Services Division

PWY:pwy