
# Site Specific Test Plan

Trail Ridge Energy, LLC
Trail Ridge Landfill
5110 US Highway 301 S
Jacksonville, Florida 32202

Source to be Tested: Engine 2 (EU-005)
Proposed Test Date: March 16, 2020

AST Project No. 2020-0164

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Prepared By
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**Regulatory Information**

| | |
|---|---|
| *Permit No.* | Florida Department of Environmental Protection (FDEP) Title V Air Permit 0310358-015-AV |
| *Facility ID No.* | 0310358 |
| *Regulatory Citation* | 40 CFR 60, Subpart JJJJ |

**Source Information**

| *Source Name* | *Source ID* | *Make/Model* | *Target Parameters* |
|---|---|---|---|
| Engine 2 | EU-005 | Caterpillar G3520C | NOx, CO, NMVOC, $H_2CO$, VEE |
| Treated LFG Gas | -- | -- | Sulfur |

**Contact Information**

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## TABLE OF CONTENTS



## LIST OF TABLES

## 1.0 Introduction

Alliance Source Testing, LLC (AST) was retained by Trail Ridge Energy, LLC (TRE) to conduct compliance testing at the Trail Ridge Landfill located Duval County, Florida facility. The facility operates under Florida Department of Environmental Protection (FDEP) Title V Air Permit 0310358-015-AV, Facility ID No. 0310358. Testing will be conducted to determine the concentration and emission rates of nitrogen oxides (NOx), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC), and formaldehyde ($H_2CO$) from the exhausts of one (1) generator engine. Visible Emissions Evaluations (VEEs) will also be conducted concurrent with the testing. Testing will be conducted to demonstrate compliance with the facility permit and 40 CFR 60 Subpart JJJJ. In addition to the emissions testing, the treated landfill gas (LFG) will be analyzed for sulfur content.

This site-specific test plan (SSTP) has been prepared to address the notification and testing requirements of the FDEP permit and the New Source Performance Standards (NSPS).

### 1.1 Process/Control System Descriptions

Trail Ridge Energy, LLC operates six (6) CAT Model No. G3520C engines (identified as Emission Unit Nos.: 004-009). These engines are fueled with landfill gas, which is generated at the Trail Ridge Landfill, to power base load electricity generator operations. The FDEP Air Operation Permit requires the facility to perform annual testing on a different engine each year. All six engines have previously been tested for compliance. The last engines tested (in 2019) was EU-004 (Engine#1); and EU-005 (Engine#2) since it is subject to the testing requirements of 40 CFR 60 Subpart JJJJ.

### 1.2 Project Team

Personnel planned to be involved in this project are identified in the following table.

**Table 1-1**
**Project Team**

| | |
|---|---|
| **TRE Personnel** | Emily Zambuto |
| **Regulatory Agency** | FDEP |
| **AST Personnel** | Andy Roth<br>other field personnel assigned at time of testing event |

## 2.0 Summary of Test Program

To satisfy the requirements of the FDEP permit and the NSPS, the facility will conduct a performance test program to determine the compliance status of the generator engines.

## 2.1 General Description

All testing will be performed in accordance with specifications stipulated in U.S. EPA Reference Test Methods 1, 3A, 4, 7E, 9, 10, 320, ALT-096 and 205. Table 2-1 presents an outline and tentative schedule for the emissions testing program. The following is a summary of the test objectives.

- Testing will be performed to demonstrate compliance with the with the FDEP Permit and NSPS, Subpart JJJJ.
- Emissions testing will be conducted on the exhaust of the engine.
- Performance testing will be conducted at the highest achievable load for each source at current site conditions. This is considered worst case for the unit.
- Each of the three (3) test runs will be 60 minutes in duration as required by 40CFR60, Subpart JJJJ
- Treated LFG samples will be taken and analyzed for and sulfur content using ASTM Method D-5504.

## 2.2 Process/Control System Parameters to be Monitored and Recorded

Plant personnel will collect operational and parametric data at least once every 15 minutes during the testing. The following list identifies the measurements, observations and records that will be collected during the testing program:

- Average kW output (to determine Engine load, bHP)
  Engine horsepower output cannot be directly measured. However, it can be calculated based on a linear relationship with recorded generator output using the generator set efficiency:
  Engine power (bhp) = generator output (kW) / (0.7457 kW/hp) / generator efficiency (96%)
  Using this equation, a generator output of 1,600 kW corresponds to an engine power output of approximately 2,233 hp.
- Engine Fuel Use
- Air-to-Fuel Ratio
- Inlet Gas Quality, Methane %

## 2.3 Proposed Test Schedule

Table 2-1 presents an outline and tentative schedule for the emissions testing program.

**Table 2-1**
**Program Outline and Tentative Test Schedule**

| Testing Location | Parameter | US EPA Method | No. of Runs | Run Duration | Est. Onsite Time |
|---|---|---|---|---|---|
| DAY 1 – March 15, 2020 | | | | | |
| Equipment Setup & Pretest QA/QC Checks | | | | | 8 hr |
| DAY 2 – March 16, 2020 | | | | | |
| Generator Exhaust | Volumetric Flow Rate | 1-2 | | | |
| | Oxygen | 3A | 3 | 60 min | 8 hr |
| | Moisture Content | 4 | | | |
| | Nitrogen Oxides | 7E | | | |
| | Opacity | 9 | | | |
| | Carbon Monoxide | 10 | | | |
| | Formaldehyde | 320 | | | |
| | Non-Methane Volatile Organic Compounds | ALT-096 | | | |
| Treated LFG Gas | Sulfur Content | ASTM D-5504 | 1 | 60 min | |

## 2.4 Emission Limits

Emission limits for each pollutant are below.

**Table 2-2**
**Emission Limits**

| Source | Pollutant | Citation |
|---|---|---|
| Generator | NOx – 150 ppmvd @ 15% $O_2$<br>NOx – 0.60 g/hp-hr<br>NOX – 3.0 lb/hr | 40 CFR 60, Subpart JJJJ<br>FDEP Permit<br>FDEP Permit |
| | CO – 610 ppmvd @ 15% $O_2$<br>CO – 3.5 g/hp-hr<br>CO – 17.2 lb/hr | 40 CFR 60, Subpart JJJJ<br>FDEP Permit<br>FDEP Permit |
| | NMVOC – 80 ppmvd @ 15% $O_2$<br>NMVOC – 0.28 g/hp-hr<br>NMVOC – 1.4 lb/hr | 40 CFR 60, Subpart JJJJ<br>FDEP Permit<br>FDEP Permit |
| | $SO_2$ – 41.6 tpy | FDEP Permit |
| | $H_2CO$ – 0.42 g/hp-hr | FDEP Permit |
| | Opacity – 10% | FDEP Permit |

## 2.5 Test Report

The final test report must be submitted within 60 days of the completion of the performance test and will include the following information.

- *Introduction* – Brief discussion of project scope of work and activities.
- *Results and Discussion* – A summary of test results and process/control system operational data with comparison to regulatory requirements or vendor guarantees along with a description of process conditions and/or testing deviations that may have affected the testing results.
- *Methodology* – A description of the sampling and analytical methodologies.
- *Sample Calculations* – Example calculations for each target parameter.
- *Field Data* – Copies of actual handwritten or electronic field data sheets.
- *Quality Control Data* – Copies of all instrument calibration data and/or calibration gas certificates.
- *Process Operating/Control System Data* – Process operating and control system data (as provided by TRE) to support the test results.

## 3.0 Testing Methodology

This section provides a description of the sampling and analytical procedures for each test method that will be employed during the test program. All equipment, procedures and quality assurance measures necessary for the completion of the test program meet or exceed the specifications of each relevant test method. The emission testing program will be conducted in accordance with the test methods listed in Table 3-1.

**Table 3-1**
**Source Testing Methodology**

| Parameter | U.S. EPA Reference Test Methods | Notes/Remarks |
|---|---|---|
| Volumetric Flow Rate | 1, 2 | Full Velocity Traverses |
| Oxygen | 3A | Instrumental Analysis |
| Moisture Content | 4 | Volumetric / Gravimetric Analysis |
| Nitrogen Oxides | 7E | Instrumental Analysis |
| Visible Emission Evaluation | 9 | Certified Observer |
| Carbon Monoxide | 10 | Instrumental Analysis |
| Formaldehyde | 320 | FTIR Analysis |
| Non-Methane Volatile Organic Compounds | ALT-096 | Instrumental Analysis |
| Sulfur Content | ASTM D-5504 | Fuel Gas Sampling |
| Gas Dilution System Certification | 205 | -- |

All stack diameters, depths, widths, upstream and downstream disturbance distances and nipple lengths will be measured on site with a verification measurement provided by the Field Team Leader.

## 3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate

The sampling location and number of traverse (sampling) points will be selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances will be equated into equivalent diameters and compared to Figure 1-2 in U.S. EPA Reference Test Method 1.

Full velocity traverses will be conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system will consist of a pitot tube and inclined manometer. The stack gas temperature will be measured with a K-type thermocouple and pyrometer.

## 3.2 U.S. EPA Reference Test Method 3A – Oxygen

The oxygen ($O_2$) and carbon dioxide ($CO_2$) testing will be conducted in accordance with U.S. EPA Reference Test Method 3A. Data will be collected online and reported in one-minute averages. The sampling system will consist of a stainless steel probe, heated Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system will be a non-contact condenser used to remove moisture from the stack gas. The quality control measures are described in Section 3.11.

### 3.3 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content will be determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train will consist of a series of chilled impingers. Prior to testing, each impinger will be filled with a known quantity of water or silica gel. Post testing, the quantities of water and silica gel will be measured to determine the amount of moisture condensed during the test run. Alternatively, each impinger will be analyzed gravimetrically before and after each test run on the same analytical balance to determine the amount of moisture condensed.

### 3.4 U.S. EPA Reference Test Method 7E – Nitrogen Oxides

The nitrogen oxides (NOx) testing will be conducted in accordance with U.S. EPA Reference Test Method 7E. Data will be collected online and reported in one-minute averages. The sampling system will consist of a stainless steel probe, heated Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system will be a non-contact condenser used to remove moisture from the stack gas. The quality control measures are described in Section 3.11.

### 3.5 U.S. EPA Reference Test Method 9 – Visible Emissions Evaluations

The stack gas opacity will be determined in accordance with U.S. EPA Reference Test 9. Visible emission evaluations will be conducted by a certified visible emissions evaluator. Opacity readings will be recorded in 15-second intervals during each of three (3) 60-minute evaluations.

### 3.6 U.S. EPA Reference Test Method 10 – Carbon Monoxide

The carbon monoxide (CO) testing will be conducted in accordance with U.S. EPA Reference Test Method 10. Data will be collected online and reported in one-minute averages. The sampling system will consist of a stainless steel probe, heated Teflon sample line(s), gas conditioning system, and the identified gas analyzer. The gas conditioning system will be a non-contact condenser used to remove moisture from the gas. IThe quality control measures are described in Section 3.11.

### 3.7 U.S. EPA Reference Test Method 320 – Formaldehyde

The concentrations of formaldehyde compounds will be determined in accordance with U.S. EPA Reference Test Method 320. Each source gas stream will be extracted at a constant rate through a heated probe, heated filter and heated sample line and analyzed with a FTIR operated by a portable computer. The computer has FTIR spectra of calibration gases stored on the hard drive. These single component calibration spectra are used to analyze the measured sample spectra. The gas components to be measured will be selected from the spectra library and incorporated into the analytical method. The signal amplitude, linearity, and signal to noise ratio will be measured and recorded to document analyzer performance. A leak check will be performed on the sample cell. The instrument path length will be verified using ethylene as the Calibration Transfer Standard. Dynamic spiking will be performed using a certified standard of the target compound or appropriate surrogate in nitrogen with sulfur hexafluoride blended as a tracer to calculate the dilution factor. All test spectra, interferograms, and analytical method information are recorded and stored with the calculated analytical results. The quality control measures are described in Section 3.12.

### 3.8 U.S. EPA Alternative Test Method ALT-096 – Non-Methane Volatile Organic Compounds

The non-methane volatile organic compounds (NMVOC) testing will be conducted in accordance with U.S. EPA Alternate Test Method ALT-096. EPA Method 25A is incorporated by reference. The sampling system will consist of a stainless steel probe, heated Teflon sample line(s) and the identified gas analyzer. NMVOC content will be measured every four minutes and fifteen points will be recorded per sixty minute test. The GC with backflush separates methane from all other hydrocarbons (residual). The residual VOC will be directly measured and reported on a propane basis. The quality control measures are described in Section 3.13.

### 3.9 ASTM Method D-5504 – Sulfur Content

The sulfur content of the LFG gas will be determined in accordance with ASTM Method D-5504. The LFG gas will be withdrawn through Teflon sample line and collected in a summa canister. All samples will be sealed and labeled for transport to the identified laboratory for analysis.

### 3.10 U.S. EPA Reference Test Method 205 – Gas Dilution System Certification

A calibration gas dilution system field check will be conducted in accordance with U.S. EPA Reference Method 205. Multiple dilution rates and total gas flow rates will be utilized to force the dilution system to perform two dilutions on each mass flow controller. The diluted calibration gases will be sent directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The analyzer response must agree within 2% of the actual diluted gas concentration. A second Protocol 1 calibration gas, with a cylinder concentration within 10% of one of the gas divider settings described above, will be introduced directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The cylinder concentration and the analyzer response must agree within 2%. These steps will be repeated three (3) times.

### 3.11 Quality Assurance/Quality Control – U.S. EPA Reference Test Methods 3A, 7E & 10

Cylinder calibration gases will meet EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates will be included in the Quality Assurance/Quality Control Appendix of the report.

Low Level gas will be introduced directly to the analyzer. After adjusting the analyzer to the Low Level gas concentration and once the analyzer reading is stable, the analyzer value will be recorded. This process will be repeated for the High Level gas. For the Calibration Error Test, Low, Mid, and High Level calibration gases will be sequentially introduced directly to the analyzer. The Calibration Error for each gas must be within 2.0 percent of the Calibration Span or 0.5 ppmv absolute difference.

High or Mid Level gas (whichever is closer to the stack gas concentration) will be introduced at the probe and the time required for the analyzer reading to reach 95 percent or 0.5 ppm (whichever is less restrictive) of the gas concentration will be recorded. The analyzer reading will be observed until it reaches a stable value, and this value will be recorded. Next, Low Level gas will be introduced at the probe and the time required for the analyzer reading to decrease to a value within 5.0 percent or 0.5 ppm (whichever is less restrictive) will be recorded. If the Low Level gas is zero gas, the acceptable response must be 5.0 percent of the upscale gas concentration or 0.5 ppm (whichever is less restrictive). The analyzer reading will be observed until it reaches a stable value and this value will be recorded. The measurement system response time and initial system bias will be determined from these data. The System Bias for each gas must be within 5.0 percent of the Calibration Span or 0.5 ppmv absolute difference.

High or Mid Level gas (whichever is closer to the stack gas concentration) will be introduced at the probe. After the analyzer response is stable, the value will be recorded. Next, Low Level gas will be introduced at the probe, and the analyzer value will be recorded once it reaches a stable response. The System Bias for each gas must be within 5.0 percent of the Calibration Span or 0.5 ppmv absolute difference or the data is invalidated and the Calibration Error Test and System Bias must be repeated.

The Drift between pre- and post-run System Bias must be within 0.5 ppmv absolute difference or the Calibration Error Test and System Bias must be repeated.

To determine the number of sampling points, a gas stratification check will be conducted prior to initiating testing. The pollutant concentrations will be measured at three points (16.7, 50.0 and 83.3 percent of the measurement line). Each traverse point will be sampled for a minimum of twice the system response time.

If the pollutant concentration at each traverse point do not differ more than 5% or 0.5 ppm (whichever is less restrictive) of the average pollutant concentration, then single point sampling will be conducted during the test runs. If the pollutant concentration does not meet these specifications but differs less than 10% or 1.0 ppm from the average concentration, then three (3) point sampling will be conducted (stacks less than 7.8 feet in diameter - 16.7, 50.0 and 83.3 percent of the measurement line; stacks greater than 7.8 feet in diameter – 0.4, 1.0, and 2.0 meters from the stack wall). If the pollutant concentration differs by more than 10% or 1.0 ppm from the average concentration, then sampling will be conducted at a minimum of twelve (12) traverse points. Copies of stratification check data will be included in the Quality Assurance/Quality Control Appendix of the report.

An $NO_2$ – NO converter check will be performed on the analyzer prior to initiating testing. An approximately 50 ppm nitrogen dioxide cylinder gas will be introduced directly to the NOx analyzer and the instrument response will be recorded in an electronic data sheet. The instrument response must be within +/- 10 percent of the cylinder concentration.

A Data Acquisition System with battery backup will be used to record the instrument response in one (1) minute averages. The data will be continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data will also be saved to the AST server. All data will be reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data will be relinquished to the report coordinator and then a final review will be performed by the Project Manager.

### 3.12 Quality Assurance/Quality Control – U.S. EPA Reference Method 320

EPA Protocol 1 Calibration Gases – Cylinder calibration gases used will meet EPA Protocol 1 (+/- 2%) standards or will be certified standards.

After providing ample time for the FTIR to reach the desired temperature and to stabilize, zero gas (nitrogen) will be introduced directly to the instrument sample port. While flowing nitrogen the signal amplitude will be recorded, a background spectra will be taken, a linearity check will be performed and recorded, the peak to peak noise and the root mean square in the spectral region of interest will be measured and a screenshot will be recorded.

Following the zero gas checks, room air will be pulled through the sample chamber and the line width and resolution will be verified to be at 1879 cm-1, the peak position will be entered and the FWHH will be recorded (screenshot). Following these checks, another background spectra will be recorded and the calibration transfer standard (CTS) will be introduced directly to the instrument sample port. The CTS instrument recovery will be recorded and the instrument mechanical response time will be measured.

Next, stack gas will be introduced to the FTIR through the sampling system and several scans will be taken until a stable reading will be achieved. The native concentration of our surrogate spiking analyte (acetaldehyde) will be recorded. Spike gas will be introduced to the sampling system at a constant flow rate ≤ 10% of the total sample flow rate and a corresponding dilution ratio will be calculated along with a system response time. Matrix spike recovery spectra will be recorded and will be within the ± 30% of the calculated value of the spike concentration that the method requires.

The matrix spike recovery will be conducted once at the beginning of the testing and the CTS recovery procedures will be repeated following each test run. The corresponding values will be recorded.

### 3.13 Quality Assurance/Quality Control – U.S. EPA Reference Method ALT-096

EPA Protocol 1 Calibration Gases – Cylinder calibration gases used will meet EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates will be provided in the Quality Assurance/Quality Control Appendix.

Zero gas will be introduced through the sampling system to the analyzer. After adjusting the analyzer to the Zero gas concentration and once the analyzer reading is stable, the analyzer value will be recorded. This process will be repeated for the High Level gas, and the time required for the analyzer reading to reach 95 percent of the gas concentration will be recorded to determine the response time. Next, Mid and Low Level gases will be introduced through the sampling system to the analyzer, and the response will be recorded when it is stable. All values must be within +/- 5% of the calibration gas concentrations.

A separation efficiency check will be performed using a certified (+/- 2%) blend of methane, ethane, acetylene, and propane in nitrogen. The recorded residual value must be within 5% of the predicted cylinder concentration.

Post Test Drift Checks – Mid Level gas will be introduced through the sampling system. After the analyzer response is stable, the value will be recorded. Next, Zero gas will be introduced through the sampling system, and the analyzer value recorded once it reaches a stable response. The Analyzer Drift must be less than 3 percent of the Calibration Span.

Data Collection – A Data Acquisition System with battery backup will be used to record the instrument response (analog 0-10 volt signal) in one (1) minute averages. The data will be continuously stored as a *.CSV file in Excel format on the hard drive of a desktop computer. At the completion of the emissions testing the data will be also saved to disk.

## 4.0 Quality Assurance Program

AST follows the procedures outlined in the Quality Assurance/Quality Control Management Plan to ensure the continuous production of useful and valid data throughout the course of this test program. The QC checks and procedures described in this section represent an integral part of the overall sampling and analytical scheme. Adherence to prescribed procedures is quite often the most applicable QC check.

### 4.1 Equipment

Field test equipment is assigned a unique, permanent identification number. Prior to mobilizing for the test program, equipment is inspected before being packed to detect equipment problems prior to arriving on site. This minimizes lost time on the job site due to equipment failure. Occasional equipment failure in the field is unavoidable despite the most rigorous inspection and maintenance procedures. Therefore, replacements for critical equipment or components are brought to the job site. Equipment returning from the field is inspected before it is returned to storage. During the course of these inspections, items are cleaned, repaired, reconditioned and recalibrated where necessary.

Calibrations are conducted in a manner, and at a frequency, which meets or exceeds U.S. EPA specifications. The calibration procedures outlined in the U.S. EPA Methods, and those recommended within the Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III (EPA-600/R-94/038c, September 1994) are utilized. When these methods are inapplicable, methods such as those prescribed by the American Society for Testing and Materials (ASTM) or other nationally recognized agency may be used. Data obtained during calibrations is checked for completeness and accuracy. Copies of calibration forms are included in the report.

The following sections elaborate on the calibration procedures followed by AST for these items of equipment.

- <u>Dry Gas Meter and Orifice</u>. A full meter calibration using critical orifices as the calibration standard is conducted at least semi-annually, more frequently if required. The meter calibration procedure determines the meter correction factor (Y) and the meter's orifice pressure differential (ΔH@). AST uses approved Alternative Method 009 as a post-test calibration check to ensure that the correction factor has not changed more than 5% since the last full meter calibration. This check is performed after each test series.
- <u>Pitot Tubes and Manometers</u>. Type-S pitot tubes that meet the geometric criteria required by U.S. EPA Reference Test Method 2 are assigned a coefficient of 0.84 unless a specific coefficient has been determined from a wind tunnel calibration. If a specific coefficient from a wind tunnel calibration has been obtained that coefficient will be used in lieu of 0.84. Standard pitot tubes that meet the geometric criteria required by U.S. EPA Reference Test Method 2 are assigned a coefficient of 0.99. Any pitot tubes not meeting the appropriate geometric criteria are discarded and replaced. Manometers are verified to be level and zeroed prior to each test run and do not require further calibration.
- <u>Temperature Measuring Devices</u>. All thermocouple sensors mounted in Dry Gas Meter Consoles are calibrated semi-annually with a NIST-traceable thermocouple calibrator (temperature simulator) and verified during field use using a second NIST-traceable meter. NIST-traceable thermocouple calibrators are calibrated annually by an outside laboratory.
- <u>Nozzles</u>. Nozzles are measured three (3) times prior to initiating sampling with a caliper. The maximum difference between any two (2) dimensions is 0.004 in.
- <u>Digital Calipers</u>. Calipers are calibrated annually by AST by using gage blocks that are calibrated annually by an outside laboratory.

- Barometer. The barometric pressure is obtained from a nationally recognized agency or a calibrated barometer. Calibrated barometers are checked prior to each filed trip against a mercury barometer. The barometer is acceptable if the values agree within ± 2 percent absolute. Barometers not meeting this requirement are adjusted or taken out of service.
- Balances and Weights. Balances are calibrated annually by an outside laboratory. A functional check is conducted on the balance each day it is use in the field using a calibration weight. Weights are re-certified every two (2) years by an outside laboratory or internally. If conducted internally, they are weighed on a NIST traceable balance. If the weight does not meet the expected criteria, they are replaced.
- Other Equipment. A mass flow controller calibration is conducted on each Environics system annually following the procedures in the Manufacturer's Operation manual. A methane/ethane penetration factor check is conducted on the total hydrocarbon analyzers equipped with non-methane cutters every six (6) months following the procedures in 40 CFR 60, Subpart JJJJ. Other equipment such as probes, umbilical lines, cold boxes, etc. are routinely maintained and inspected to ensure that they are in good working order. They are repaired or replaced as needed.

### 4.2 Field Sampling

Field sampling will be done in accordance with the Standard Operating Procedures (SOP) for the applicable test method(s). General QC measures for the test program include:

- Cleaned glassware and sample train components will be sealed until assembly.
- Sample trains will be leak checked before and after each test run.
- Appropriate probe, filter and impinger temperatures will be maintained.
- The sampling port will be sealed to prevent air from leaking from the port.
- Dry gas meter, ΔP, ΔH, temperature and pump vacuum data will be recorded during each sample point.
- An isokinetic sampling rate of 90-110% will be maintained, as applicable.
- All raw data will be maintained in organized manner.
- All raw data will be reviewed on a daily basis for completeness and acceptability.

## 5.0 Quality Assurance Program

AST follows the procedures outlined in the Quality Assurance/Quality Control Management Plan to ensure the continuous production of useful and valid data throughout the course of this test program. The QC checks and procedures described in this section represent an integral part of the overall sampling and analytical scheme. Adherence to prescribed procedures is quite often the most applicable QC check.

### 5.1 Equipment

Field test equipment is assigned a unique, permanent identification number. Prior to mobilizing for the test program, equipment is inspected before being packed to detect equipment problems prior to arriving on site. This minimizes lost time on the job site due to equipment failure. Occasional equipment failure in the field is unavoidable despite the most rigorous inspection and maintenance procedures. Therefore, replacements for critical equipment or components are brought to the job site. Equipment returning from the field is inspected before it is returned to storage. During the course of these inspections, items are cleaned, repaired, reconditioned and recalibrated where necessary.

Calibrations are conducted in a manner, and at a frequency, which meets or exceeds U.S. EPA specifications. The calibration procedures outlined in the U.S. EPA Methods, and those recommended within the Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III (EPA-600/R-94/038c, September 1994) are utilized. When these methods are inapplicable, methods such as those prescribed by the American Society for Testing and Materials (ASTM) or other nationally recognized agency may be used. Data obtained during calibrations is checked for completeness and accuracy. Copies of calibration forms are included in the report.

The following sections elaborate on the calibration procedures followed by AST for these items of equipment.

- <u>Dry Gas Meter and Orifice</u>. A full meter calibration using critical orifices as the calibration standard is conducted at least semi-annually, more frequently if required. The meter calibration procedure determines the meter correction factor (Y) and the meter's orifice pressure differential ($\Delta H@$). AST uses approved Alternative Method 009 as a post-test calibration check to ensure that the correction factor has not changed more than 5% since the last full meter calibration. This check is performed after each test series.
- <u>Pitot Tubes and Manometers</u>. Type-S pitot tubes that meet the geometric criteria required by U.S. EPA Reference Test Method 2 are assigned a coefficient of 0.84 unless a specific coefficient has been determined from a wind tunnel calibration. If a specific coefficient from a wind tunnel calibration has been obtained that coefficient will be used in lieu of 0.84. Standard pitot tubes that meet the geometric criteria required by U.S. EPA Reference Test Method 2 are assigned a coefficient of 0.99. Any pitot tubes not meeting the appropriate geometric criteria are discarded and replaced. Manometers are verified to be level and zeroed prior to each test run and do not require further calibration.
- <u>Temperature Measuring Devices</u>. All thermocouple sensors mounted in Dry Gas Meter Consoles are calibrated semi-annually with a NIST-traceable thermocouple calibrator (temperature simulator) and verified during field use using a second NIST-traceable meter. NIST-traceable thermocouple calibrators are calibrated annually by an outside laboratory.
- <u>Nozzles</u>. Nozzles are measured three (3) times prior to initiating sampling with a caliper. The maximum difference between any two (2) dimensions is 0.004 in.
- <u>Digital Calipers</u>. Calipers are calibrated annually by AST by using gage blocks that are calibrated annually by an outside laboratory.

- Barometer. The barometric pressure is obtained from a nationally recognized agency or a calibrated barometer. Calibrated barometers are checked prior to each field trip against a mercury barometer. The barometer is acceptable if the values agree within ± 2 percent absolute. Barometers not meeting this requirement are adjusted or taken out of service.
- Balances and Weights. Balances are calibrated annually by an outside laboratory. A functional check is conducted on the balance each day it is use in the field using a calibration weight. Weights are re-certified every two (2) years by an outside laboratory or internally. If conducted internally, they are weighed on a NIST traceable balance. If the weight does not meet the expected criteria, they are replaced.
- Other Equipment. A mass flow controller calibration is conducted on each Environics system annually following the procedures in the Manufacturer's Operation manual. A methane/ethane penetration factor check is conducted on the total hydrocarbon analyzers equipped with non-methane cutters every six (6) months following the procedures in 40 CFR 60, Subpart JJJJ. Other equipment such as probes, umbilical lines, cold boxes, etc. are routinely maintained and inspected to ensure that they are in good working order. They are repaired or replaced as needed.

### 5.2 Field Sampling

Field sampling will be done in accordance with the Standard Operating Procedures (SOP) for the applicable test method(s). General QC measures for the test program include:

- Cleaned glassware and sample train components will be sealed until assembly.
- Sample trains will be leak checked before and after each test run.
- Appropriate probe, filter and impinger temperatures will be maintained.
- The sampling port will be sealed to prevent air from leaking from the port.
- Dry gas meter, ΔP, ΔH, temperature and pump vacuum data will be recorded during each sample point.
- An isokinetic sampling rate of 90-110% will be maintained, as applicable.
- All raw data will be maintained in organized manner.
- All raw data will be reviewed on a daily basis for completeness and acceptability.

### 5.3 Analytical Laboratory

Analytical laboratory selection for sample analyses is based on the capabilities, certifications and accreditations that the laboratory possesses. An approved analytical laboratory subcontractor list is maintained with a copy of the certificate and analyte list as evidence of compliance. AST assumes responsibility to the client for the subcontractor's work. AST maintains a verifiable copy of the results with chain of custody documentation.