POWER BOILER NO. 2
EMISSION TEST REPORT

WHITE PINE ELECTRIC POWER, LLC
WHITE PINE, MICHIGAN

Renewable Operating Permit No. MI-ROP-B1966-2014

Prepared for:

WHITE PINE ELECTRIC POWER, LLC
33707 Power Plant Road
White Pine, MI 49971

Prepared by:

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1400 Weston Way
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April 2015

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT
REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating (RO) Permit program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as described in General Condition No. 22 in the RO Permit and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: White Pine Electric Power, LLC County: Ontonagon

Source Address: 33707 Power Plant Road City: White Pine

AQD Source ID (SRN): EUPP06 RO Permit No.: MI-ROP-B1966-2014 RO Permit Section No.: _____

Please check the appropriate box(es):

☐ **Annual Compliance Certification (General Condition No. 28 and No. 29 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the RO Permit.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (General Condition No. 23 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From _____ To _____

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:

Emission Test Report

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete.

J. R. Richardson	Technical Manager	906-885-7187
Name of Responsible Official (print or type)	Title	Phone Number
James R. Richardson		4-23-2015
Signature of Responsible Official		Date

* Photocopy this form as needed.

EQP 5736 (Rev 9/01)

1. INTRODUCTION

Weston Solutions, Inc. (WESTON®) was retained by White Pine Electric Power, LLC (WPEP) to conduct an air emissions testing program at the WPEP generating facility located in White Pine, Michigan. WPEP currently operates under Renewable Operating Permit No. MI-ROP-B1966-2014 and Michigan Department of Environmental Quality (MDEQ) Air Quality Division Permit To Install (PTI 142.14) WPEP operates two power boilers designated as Power Boiler Nos. 1 and 2 (Source ID Nos. EUPP05 and EUPP06) that fire coal and/or natural gas. By 30 June 2014, WPEP permanently ceased firing coal and switched to natural gas firing (single fuel only) for both boilers. Air emissions testing was recently conducted on Power Boiler No. 2 while firing natural gas to demonstrate compliance with the nitrogen oxides (NOx), sulfur dioxide (SO_2), and particulate matter (PM) emission limits set forth in the Consent Agreement and Final Order (CAFO) recently issued to WPEP by the United States Environmental Protection Agency (EPA), Region 5. This test report documents the results and sampling and analytical procedures used during the test program.

The information collected for this test effort includes: NOx, SO_2, and PM emission test results and boiler operating data. Table 1-1 provides a summary of the testing requirements.

Contact information for WPEP and WESTON are listed below:

Source Owner and Operator	Testing Firm	Laboratory
White Pine Electric Power, LLC	Weston Solutions, Inc.	Stericycle Environmental Solutions
33707 Power Plant Road	1400 Weston Way	(formerly PSC Analytics Inc.)
White Pine, MI 49971	P.O. Box 2653	2869 Sandstone Drive
Contact: JR Richardson	West Chester, PA 19380	Hatfield, PA 19440
Phone: 906-885-7187	Contact: Ken Hill	Contact: Vaughn O'Neill
	Phone: 610-701-3043	Phone: 215-822-8995

Following this introduction, Section 2 provides a summary and discussion of the test results. Section 3 describes the process and sampling locations. Section 4 outlines the sampling and analytical procedures. Quality Control (QC) procedures are shown in Section 5. Detailed test results, raw test data, laboratory data, boiler operating data, example calculations and quality control data are provided in Appendices A through F.

Table 1-1

Test Program Summary

Parameter	Method[1]	No. of Test Runs[2]	Reporting Units	Emissions Limit[3]
NOx	EPA 7E/19	3 (≥ 60 min. each)	ppm, lb/MMBtu	0.190 lb/MMBtu
SO_2	EPA 6C/19	3 (≥ 60 min. each)	ppm, lb/MMBtu	0.010 lb/MMBtu
PM (filterable)	EPA 5/19	3 (≥ 60 min. each)	gr/dscf, lb/MMBtu lb/1000 lb Exhaust Gas at 50% Excess Air	0.010 lb/MMBtu 0.27 lb/1000 lb Exhaust Gas at 50% Excess Air
Volumetric Flow Rate (VFR)	EPA 1, 2	3	dscfm	NA
Carbon Dioxide (CO_2) and Oxygen (O_2)	EPA 3A	3 (≥ 60 min. each)	%	NA
Moisture	EPA 4	3	%	NA

1 lb/MMBtu emission factors calculated as per equation 19-1 and the published Fd value for natural gas (8710 dscf/MMBtu) from EPA 19.

2 Volumetric flow rate and moisture determinations derived from the corresponding particulate test train.

3 As per the existing EPA CAFO document and MI-ROP-B1966-2014.

2. RESULTS AND DISCUSSION

Table 2-1 presents the test results compared to the allowable permit limits. The test results show compliance with the CAFO and ROP requirements. Any difference between the summary tables and the detailed test data as shown in Appendix A are due to rounding the results for presentation.

Table 2-1
Power Boiler No. 2 – Summary of PM, NOx, and SO_2 Emissions Test Results
4 March 2015

Run No.	Time	PM		NOx	SO_2
		lb/MMBtu	lb/1000 lb Exhaust Gas at 50% Excess Air	lb/MMBtu	lb/MMBtu
1	1430-1539	0.004	0.004	0.177	0.007
2	1642-1755	0.003	0.003	0.172	0.004
3	1825-1934	0.002	0.002	0.168	0.004
Average		0.003	0.003	0.172	0.005
Emission Limits		0.010	0.27	0.190	0.010

All testing was conducted with the boiler operating at a maximum normal load rating (≥ 90% of rated capacity). It should be noted Power Boiler No. 1 was not tested during this effort, but testing has been scheduled for June 2015. No unusual operating problems occurred during the program.

3. DESCRIPTION OF TEST LOCATIONS

3.1 BOILER DESCRIPTION

WPEP located in White Pine, Michigan, operates two 20 MW turbines and also provides steam for a nearby copper refinery. Power Boiler Nos. 1 and 2 have the capacity to be fueled with either coal or natural gas or a mixture of coal and natural gas. They are each rated at 222 MMBtu/hr. During the test, the boiler was operated at 18.2 MW at maximum normal load and only fired natural gas.

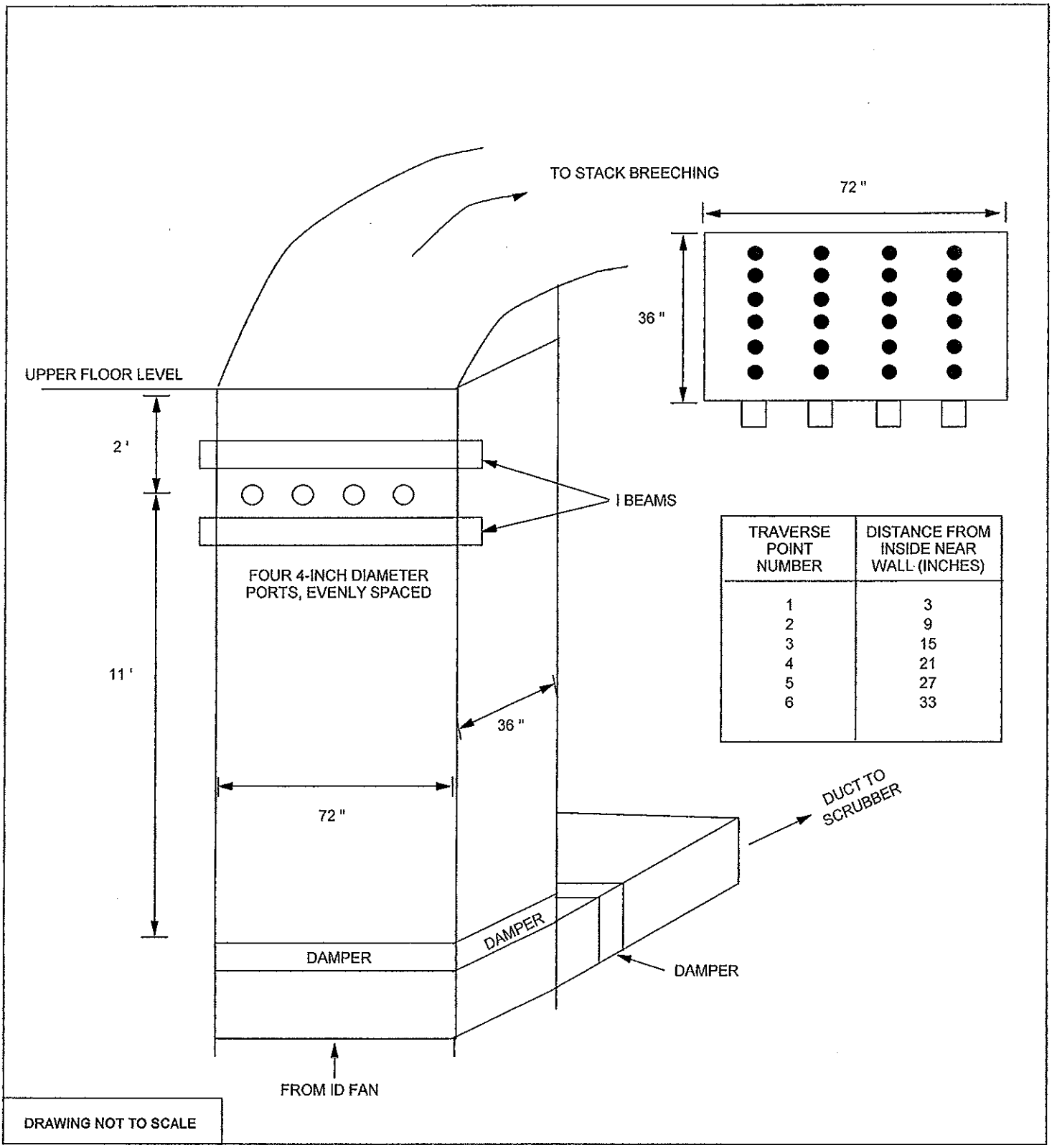
WPEP personnel recorded the process data listed below during each test period.

- Power Generation (MW)
- Steam Production Rate (lb/hr)
- Heat Input (MMBtu/hr)

3.2 BOILER SAMPLING LOCATIONS

3.2.1 No. 2 Boiler

The No. 2 Boiler test location is located inside the boiler house building on a vertical section of ductwork (72"x36") just ahead of the breeching to the steel bypass stack. The sample ports are spaced equidistant apart across the 72" face of the duct approximately 11' (2.75 equivalent diameters) downstream from a flow disturbance (stack damper) and 2' (0.5 equivalent duct diameters) upstream from a flow disturbance (stack breeching). Twenty four (24) sample points (4x6 traverse grid) were selected for the PM sampling train. All stack geometry measurements were confirmed prior to formal testing. Figure 3-1 illustrates the Power Boiler No. 2 sampling location.



TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE NEAR WALL (INCHES)
1	3
2	9
3	15
4	21
5	27
6	33

FIGURE 3-1
BOILER NO. 2 UPPER DUCT
TEST PORT AND TRAVERSE POINT LOCATIONS

4. DESCRIPTION OF SAMPLING AND ANALYTICAL PROCEDURES

This section outlines the sampling, monitoring and analytical procedures used throughout the test program. WESTON followed methodologies approved by the EPA and the MDEQ.

4.1 PRELIMINARY TESTING

Preliminary test data was obtained for each test location. Stack geometry measurements were measured and recorded, and traverse point distances verified. A check for the presence or absence of cyclonic flow was performed using an S-type pitot tube at the test locations prior to compliance testing.

Calibration of probe nozzles, pitot tubes, metering systems, and temperature measurement devices was as specified in Section 5 of EPA Method 5 test procedures.

4.2 VOLUMETRIC FLOW RATE

Velocities were measured during each run by traversing the stack according to EPA Methods 1 and 2 utilizing an S-type pitot tube and inclined manometer. Stack temperatures were measured during each velocity traverse using a K-type thermocouple and digital temperature indicator. The velocity traverse measurements were used to determine volumetric flow rates and mass emission rates.

The moisture content of the gas stream was determined by EPA Reference Method 4. At the conclusion of each run the volume of condensed moisture in the impingers of the EPA Reference Method 5 sampling train was measured and used to calculate the moisture content of the gas stream.

4.3 CONTINUOUS EMISSIONS MONITORING (INSTRUMENTAL ANALYZERS)

A mobile instrument trailer containing a continuous emissions monitoring system (CEMS) was used to measure concentrations of O_2, CO_2, NOx, and SO_2 (see Figure 4-1). A description of the reference method analyzers is provided below:

Pollutant	EPA Reference Method	Operating Principle	Measurement Span
NOx	7E	Chemiluminescent	0 – 253 ppm
SO_2	6C	Ultraviolet	0 – 11.9 ppm
O_2	3A	Paramagnetic	0 – 21.4%
CO_2	3A	Non-dispersive Infrared	0 – 16.6%

Each analyzer was calibrated internally by introduction of calibration gas standards through a calibration manifold directly to the sample port of the analyzer. The manifold vented the excess gas to the atmosphere to maintain the calibration at ambient pressure. The internal calibration sequence consisted of alternate injections of zero and high span gases with appropriate adjustments made until the desired response was obtained. The mid span standards (as required by the reference methods) was then introduced in sequence without further instrument adjustment. All calibration gas standards were EPA Protocol standards.

A heated stainless steel tee and filter was located at the exit of a heated stainless steel probe to permit introduction of calibration gases. (An inconel probe may be used due to the high temperature of the flue gas.) A heated Teflon® line was used to transport the sample and zero/calibration gases to the sample conditioner where the moisture was removed. The conditioned sample was carried from the sample conditioner through ¼ inch unheated Teflon® sample line to the instrumental analyzers. The output from the instrumental analyzers recorded instantaneously and average in one-minute intervals using computer software developed by WESTON.

The sample line integrity was verified by conducting pre and post-test bias checks. The sampling system bias test consisted of introducing zero gas and the mid-range calibration standard to the tee at the probe exit while the system operated normally. Calibration gas was supplied in excess and permitted to flow out through the probe to maintain sampling system pressure. Instrument bias check response was evaluated to ensure the sampling system integrity and, where required by the reference method, test results were corrected for calibration drift and system bias.

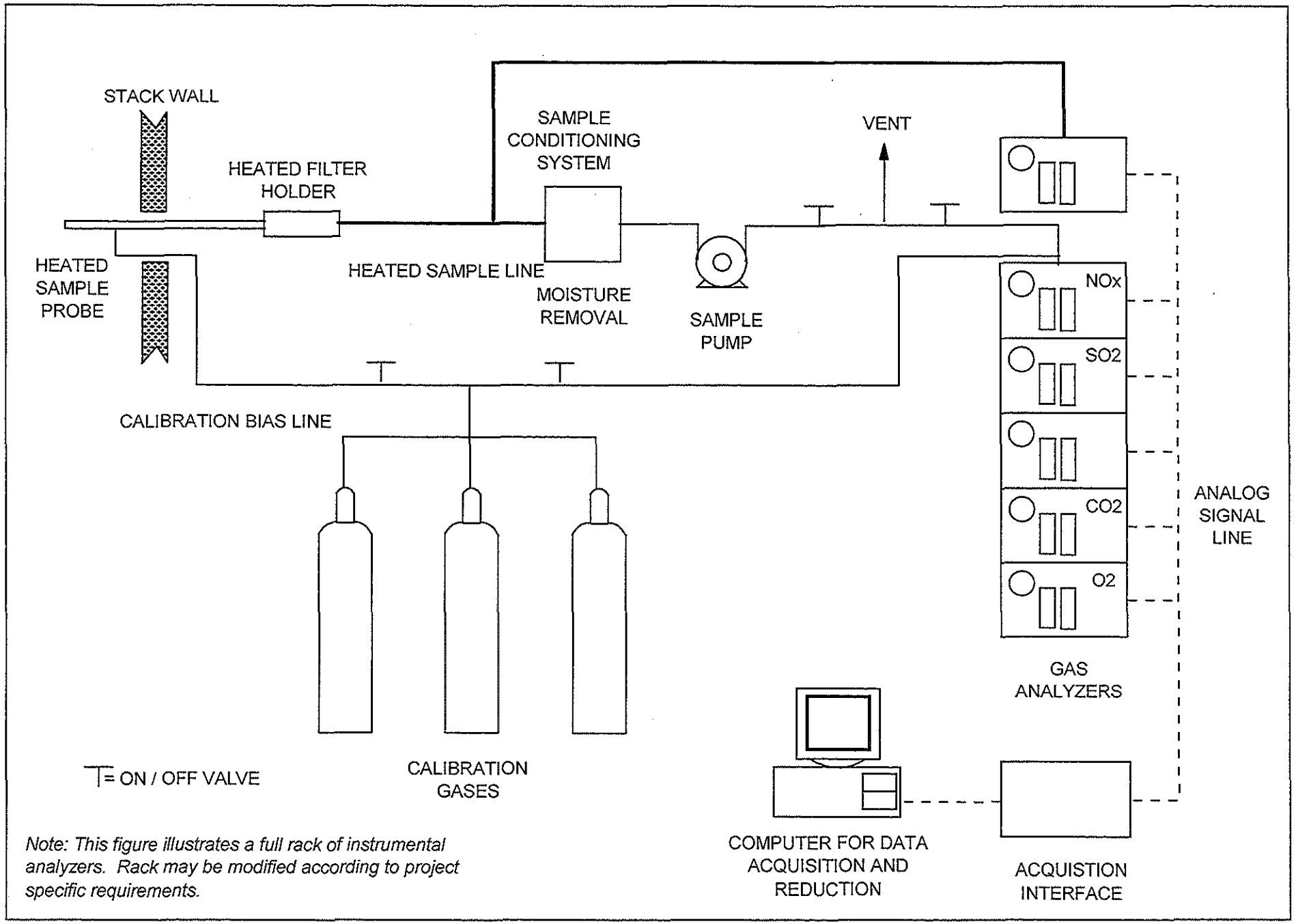


FIGURE 4 - 1
WESTON SAMPLING SYSTEM

Interference checks were performed prior to mobilization as per the applicable reference method. The NOx analyzer NO_2 to NO converter efficiency was performed prior to and after the test effort in accordance with EPA Reference Method 7E.

4.4 EPA METHOD 5 – PARTICULATE MATTER

Particulate matter (PM) emission testing was conducted using EPA Reference Method 5. EPA Reference Methods 1-4 were used, as appropriate, for traverse point selection, determination of stack gas molecular weight, stack gas moisture determination, and volumetric flow rate.

Sampling Equipment and Procedures

The sampling train utilized to perform the PM sampling was an EPA Reference Method 5 train (see Figure 4-2). A measured borosilicate glass nozzle was attached to a heated (248 ± 25°F) borosilicate glass probe of appropriate length. The probe was connected to a heated (248 ± 25 °F) borosilicate glass filter holder containing a 9-cm glass fiber filter (preweighed to a constant 0.1 mg weight). The first and second impingers each contained 100 mL of distilled water, the third impinger was empty, and the fourth impinger contained 200 to 300 grams of dry preweighed silica gel. The second impinger was a standard Greenburg-Smith type. The first, third, and fourth impingers were of a modified design. All impingers were maintained in a crushed ice bath. A gas measuring control console with a leak-free vacuum pump, a calibrated dry gas meter, a calibrated orifice, and inclined manometers were connected to the final impinger, probe, heated filter holder, and pitot tube via an umbilical cord to complete the train.

Flue gas velocity was measured with a calibrated S-type pitot tube (provided with extensions) fastened alongside the sampling nozzle. The sample nozzle and pitot tube were aligned with the stack gas flow as determined by preliminary null velocity and angel measurements. Flue gas temperature was monitored with a calibrated direct readout pyrometer equipped with a chromel-alumel (Type K) thermocouple positioned near the sampling nozzle. The probe, filter box, and impinger exit gas temperatures were monitored with a calibrated direct readout pyrometer equipped with Type K thermocouples positioned in the probe, heated filter chamber, and in the sample gas stream after the last impinger. Stack gas stream composition (carbon dioxide and oxygen content)

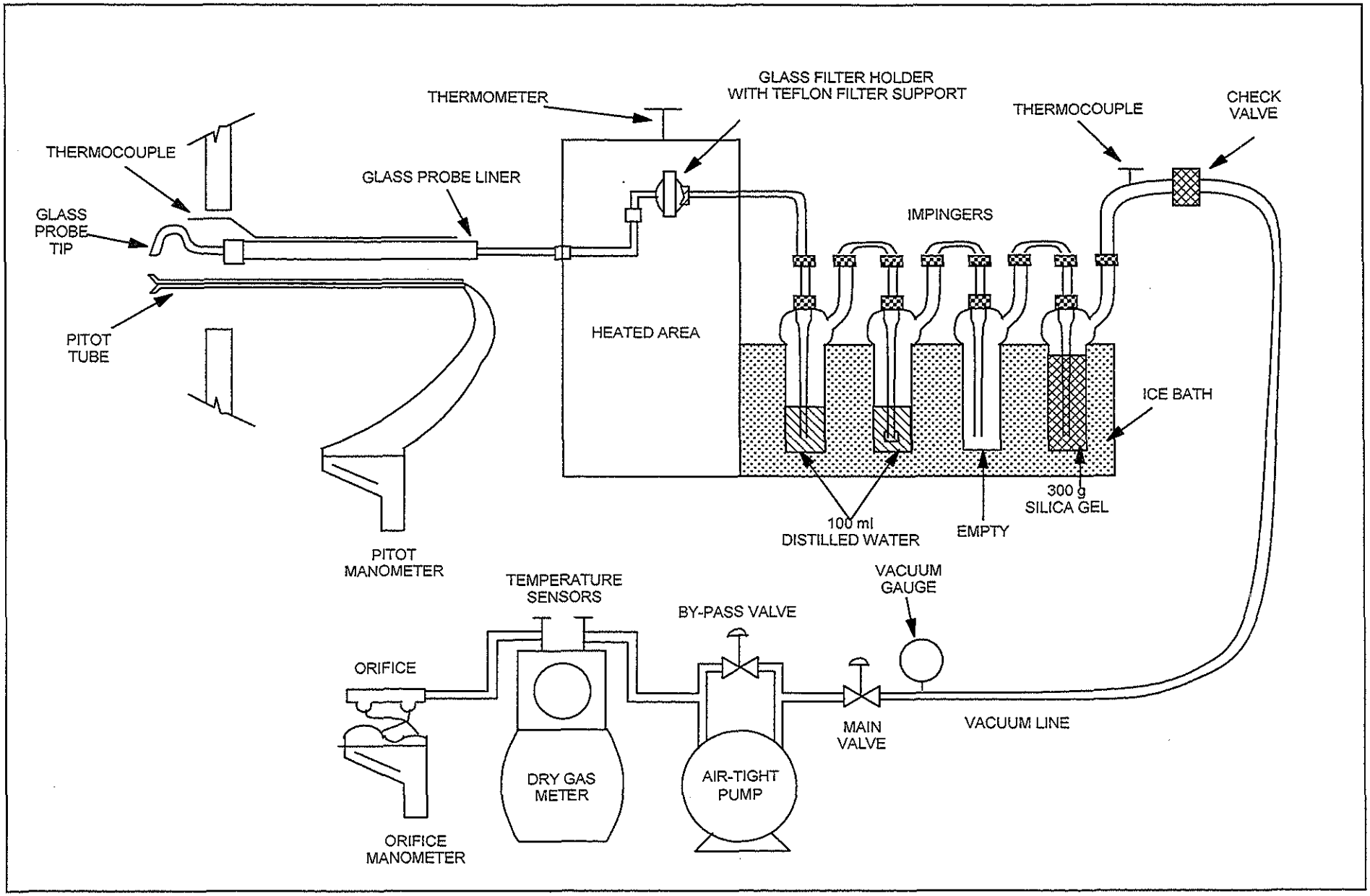


FIGURE 4-2
EPA METHOD 5
PARTICULATE MATTER SAMPLING TRAIN

was determined as previously described. The sampling rate was adjusted, based on stack velocity, at each point to ensure the sample was collected isokinetically.

At the conclusion of each test, the sampling train was leak checked. Upon completion of a successful leak check, the sampling train was dismantled, openings sealed, and the components recovered as described below.

- The glass fiber filter was removed from its holder with tweezers and placed in its original container, along with any particulate and filter fragments (Sample Fraction 1).
- The probe and nozzle were separated and the particulate rinsed with acetone into a polyethylene container while brushing a minimum of three times. Particulate adhering to the brush was rinsed with acetone into the same container. The front half of the filter holder and connecting glassware were also rinsed. These rinses were combined (Sample Fraction 2).
- The total liquid content of impingers one, two, and three were measured volumetrically for stack gas moisture content calculation. This liquid was discarded.

The silica gel was removed from the last impinger and immediately weighed to the nearest 0.1 g for stack gas moisture content calculation.

- Aliquots of the acetone and a filter were retained for blank analyses.

Each sample bottle was labeled to clearly identify its contents. The liquid level was marked on each bottle. The samples were then secured for transport to a laboratory for analysis. Sample integrity was assured by maintaining chain-of-custody records.

Sample Analysis

The particulate analysis proceeds as follows:

- The sample filters (Sample Fraction 1) and blank filter were desiccated for 24 hours and weighed to the nearest 0.1 mg to constant (± 0.5 mg) weight.
- The nozzle, probe, and front half of the filter holder wash samples (Sample Fraction 2), along with the acetone blank, were evaporated in tared beakers, then desiccated and weighed to the nearest 0.1 mg to constant (± 0.5 mg) weights.

The total weight of material measured in the front half wash in addition to the weight of material collected on the glass fiber filter represents the total PM catch for each train. Blank corrections were made where appropriate.

Data Acquisition and Reduction

Data were recorded at the time of collection on preprinted data sheets. Calculations were performed with preprogrammed calculators or spreadsheet software. Data transfers were minimized. Field and laboratory data sheets were checked for completeness and accuracy. Calculations were verified by a second person.

5. QUALITY ASSURANCE/QUALITY CONTROL

5.1 QUALITY CONTROL PROCEDURES

As part of the compliance test, WESTON implemented a QA/QC program. QA and QC are defined as follows:

- Quality Control: The overall system of activities whose purpose is to provide a quality product or service: for example, the routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process.
- Quality Assurance: A system of activities whose purpose is to provide assurance that the overall quality control is being done effectively. Further,

The field team manager for stack sampling was responsible for implementation of field QA/QC procedures. Individual laboratory managers were responsible for implementation of analytical QA/QC procedures. The overall project manager oversees all QA/QC procedures to ensure that sampling and analyses meet the QA/QC requirements and that accurate data results from the test program.

5.2 GAS STREAM SAMPLING QA PROCEDURES

General QA checks that were conducted during testing and apply to all methods include the following:

- Performance of leak checks.
- Use of standardized forms, labels and checklists.
- Maintenance of sample traceability.
- Collection of appropriate blanks.
- Use of calibrated instrumentation.
- Review of data sheets in the field to verify completeness.
- Use of validated spreadsheets for calculation of results.

The following section details specific QA procedures applied to the isokinetic methods.

5.2.1 Stack Gas Velocity/Volumetric Flow Rate QA Procedures

The QA procedures followed for velocity/volumetric flow rate determinations followed guidelines set forth by EPA Method 2. Incorporated into this method, are sample point determinations by EPA Method 1, and gas moisture content determination by EPA Method 4. QA procedures for Methods 1 and 2 are discussed below.

Volumetric flow rates were determined during the isokinetic flue gas tests. The following QC steps were followed during these tests:

- The S-type pitot tube was visually inspected before sampling.
- Both legs of the pitot tube were leak checked before sampling.
- Proper orientation of the S-type tube was maintained while making measurements. The yaw and pitch axes of the S-type pitot tube was maintained at 90° to the flow.
- The manometer oil was leveled and zeroed before each run.
- Pitot tube coefficients were determined based on physical measurement techniques as delineated in Method 2.

5.2.2 Moisture and Sample Gas Volume QA Procedures

Gas stream moisture was determined as part of the isokinetic test trains. The following QA procedures were followed in determining the volume of moisture collected:

- Preliminary impinger train tare weights were weighed or measured volumetrically to the nearest 0.1 g or 1.0 ml.
- The balance was leveled and placed in a clean, motionless, environment for weighing.
- The indicating silica gel was fresh for each run and periodically inspected and replaced during runs if needed.
- The silica gel impinger gas temperature was maintained below 68°F.

The QA procedures that are followed in regards to accurate sample gas volume determination were:

- The dry gas meter is fully calibrated annually using an EPA approved intermediate standard device.

- Pre-test, port-change, and post-test leak-checks were completed (must be less than 0.02 cfm or 4 percent of the average sample rate).
- The gas meter was read to the thousandth of a cubic foot for all initial and final readings.
- Readings of the dry gas meter, meter orifice pressure (Delta H) and meter temperatures were taken at every sampling point.
- Accurate barometric pressures were recorded at least once per day.
- Pre- and Post-test dry gas meter checks were completed to verify the accuracy of the meter calibration constant (Y).

5.2.3 Isokinetic Sampling Train QA Procedures

The Quality Assurance procedures outlined in this section are designed to ensure collection of representative, high quality test parameter (PM) concentrations and mass emissions data. The sampling QA procedures followed to ensure representative measurements are:

- All glassware was prepared per reference method procedures.
- The sample rates were within ± 10 percent of the true isokinetic (100 percent) rate.
- All sampling nozzles were manufactured and calibrated according to EPA standards.
- Recovery procedures were completed in a clean environment.
- Sample containers for liquids and filters were constructed of borosilicate or polyethylene with Teflon®-lined lids.
- At least one reagent blank of each type of solution or filter was retained and analyzed.
- All test train components from the nozzle through the last impinger are constructed of glass (with the exception of the filter support pad which is Teflon®).
- All recovery equipment (i.e., brushes, graduated cylinders, etc.) was non-metallic.

5.2.4 Sample Identification and Custody

Sample custody procedures for this program are based on EPA recommended procedures. Since samples are analyzed at remote laboratories, the custody procedures emphasize careful documentation of sample collection and field analytical data and the use of chain-of-custody records for samples being transferred. These procedures are discussed below.

The Field Team Manager is responsible for ensuring that all stack samples taken are accounted for and that all proper custody and documentation procedures are followed for the field sampling and field analytical efforts. The Field Team Manager is assisted in this effort by key sampling personnel involved in sample recovery.

Following sample collection, all stack samples are given a unique sample identification code. Stack sample labels are completed and affixed to the sample container. The sample volumes are determined and recorded and the liquid levels on each bottle are marked. Sample bottle lids are sealed on the outside with Teflon® tape to prevent leakage. Additionally, the samples are stored in a secure area until they are shipped.

As the samples are packed for travel, chain-of-custody forms are completed for each shipment. The chain-of-custody forms, specifying the treatment of each sample, are also enclosed in the sample shipment container.

5.2.5 Continuous Emissions Monitoring QA Procedures

- Continuous emissions monitoring system (probe to sample conditioner) will be checked for leaks prior to the testing.
- Pre and post-test calibration bias tests will be performed as required by the reference methods.
- A permanent data record of analyzer response will be made using computer software designed by WESTON.
- All calibration gases used will meet EPA Protocol standards.
- Reference method calibration error, system bias and calibration drift limits will be adhered to as listed below:

Table 5-1
Reference Method Analyzers QA Procedures Summary

Check	Frequency	Limit
Instrument calibration/linearity error	▪ Beginning of each test day ▪ Range change ▪ After excessive calibration drift	± 2% of span
Sample system bias	Before and after each test run	± 5% of span
Calibration/zero drift	After each test run	± 3% of span

5.2.6 Data Reduction and Validation QC Checks

All data and/or calculations for flow rates, moisture contents, and isokinetic rates, are made using a computer software program validated by an independent check. In addition, all calculations are spot checked for accuracy and completeness by the Field Team Leader.

In general, all measurement data are validated based on the following criteria:

- Process conditions during sampling or testing.
- Acceptable sample collection procedures.
- Consistency with expected or other results.
- Adherence to prescribed QC procedures.

Any suspect data is flagged and identified with respect to the nature of the problem and potential effect on the data quality.