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# TEST REPORT

## Wood-Fired Boiler - Multiple Metals, Poly-Chlorinated Dibenzop-p-Dioxin/Furan, Acrolein & Hydrochloric Acid Test Program

**Prepared for:**

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**Air Tox Project No. 6053**

**January 2007**

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## **1.0 INTRODUCTION**

Air Tox Environmental Company, Inc. (Air Tox) of Willington, Connecticut was retained by Boralex, Inc. to perform multiple metals, poly-chlorinated dibenzo-p-dioxin/furan's, acrolein and hydrogen chloride (HCl) testing on the wood fired boiler serving the Boralex Livermore Falls (BLF) generating facility in Livermore Falls, Maine.. All testing was performed in accordance with the applicable US EPA and Maine Department of Environmental Protection (ME DEP) regulations.

The test plan described herein was conducted during the week of December 5 - 8, 2006. All testing was performed under the supervision of Eric Dithrich, Senior Environmental Engineer, of Air Tox. The process and operations coordination of the facility was conducted by Michael Daigle, the facility Plant Manager, of Boralex Livermore Falls. Mr. Roy Rike of the ME DEP was present during this test program.

This report details the methodology that Air Tox used to determine system compliance with the required performance specifications. Section 2.0 contains the Scope of the Sampling Program description, while Section 3.0 describes the Process and Operations. Section 4.0 details the test methods used during the test program. Section 5.0 contains Air Tox's Quality Assurance procedures.

## **2.0 RESULTS AND DISCUSSION**

All sampling and analyses performed during this test program were carried out in accordance with the requirements of the Maine DEP and the United States Environmental Protection Agency (US EPA). Testing was based on the requirements outlined in the 40 CFR 60, Appendix A. A detailed summary of the test methodology and results are presented below.

### **2.1 Testing Parameters & Methodologies**

The following parameters were measured at the single outlet stack exhausting from the Boralex Livermore Falls power plant in accordance with the methods listed.

**Table 2-1  
Sampling Parameters**

<b><u>EMISSION PARAMETER</u></b>	<b><u>REFERENCE METHOD</u></b>
■ Volumetric Flowrate	■ EPA Methods 1& 2
■ Molecular Weight (O <sub>2</sub> , CO <sub>2</sub> )	■ EPA Methods 3A
■ Dioxin/Furan (PCDD/PCDF)	■ EPA Method 23
■ Hydrogen Chloride (HCl)	■ EPA Method 26A
■ Multiple Metals (MM)	■ EPA Method 29
■ Acrolein (C <sub>3</sub> H <sub>4</sub> O)	■ CARB Method 430M

### **2.2 Emission Measurement Test Program**

#### **2.2.1 Multiple Metals Emissions Results**

Three (3) two-hour PM/MM tests were performed on December 7, 2006 between 07:20 and 13:30. Metals analysis was performed for the following metals: arsenic (As), antimony (Sb), cadmium (Ca), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), selenium (Se), and vanadium (V). Data summaries and field data for all metals testing can be found in the Appendix of this report.

The multiple metals samples were shipped to Maxxam Analytics, Inc. of Burlington, Ontario Canada for analysis. Mary-Anne Johnson, Ph.D, Senior Analytical Project Manager, Maxxam Analytics, Inc. was the laboratory contact responsible for the multiple metals sample analysis.

Results from the multiple metals sample analysis are reported in the units of milligrams per dry standard cubic meters corrected to 7.0 % oxygen (mg/dscm @ 7% O<sub>2</sub>).

**Table 2-2**  
**Multiple Metals Test Results**  
**Boralex Stratton Energy**  
**December 7,2006**

Analyte	Units	Test No. 1	Test No. 2	Test No. 3	Average
Arsenic	ug/DSCM @ 7% O <sub>2</sub>	<36.7	<41.4	<24.7	<34.3
	lbs/hr	<1.60E-02	<1.79E-02	<1.07E-02	<1.49E-02
Antimony	ug/DSCM @ 7% O <sub>2</sub>	<4.0	<4.8	<2.8	<3.9
	lbs/hr	<1.77E-03	<2.06E-03	<1.23E-03	<1.69E-03
Cadmium	ug/DSCM @ 7% O <sub>2</sub>	1.0	1.2	0.8	1.0
	lbs/hr	4.33E-04	5.40E-04	3.45E-04	4.39E-04
Chromium	ug/DSCM @ 7% O <sub>2</sub>	<7.8	<8.7	6.0	<7.5
	lbs/hr	<3.39E-03	<3.76E-03	2.58E-03	<3.24E-03
Copper	ug/DSCM @ 7% O <sub>2</sub>	13.5	15.7	9.5	12.9
	lbs/hr	5.89E-03	6.78E-03	4.09E-03	5.59E-03
Lead	ug/DSCM @ 7% O <sub>2</sub>	211.4	232.5	142.8	195.6
	lbs/hr	9.23E-02	1.01E-01	6.16E-02	8.49E-02
Mercury	ug/DSCM @ 7% O <sub>2</sub>	<0.8	<1.1	0.7	<0.9
	lbs/hr	<3.70E-04	<4.93E-04	3.16E-04	<3.93E-04
Nickel	ug/DSCM @ 7% O <sub>2</sub>	2.0	<1.2	1.6	<1.6
	lbs/hr	8.66E-04	<5.20E-04	7.06E-04	<6.97E-04
Selenium	ug/DSCM @ 7% O <sub>2</sub>	<0.6	<0.6	<0.6	<0.6
	lbs/hr	<2.50E-04	<2.56E-04	<2.52E-04	<2.53E-04
Vanadium	ug/DSCM @ 7% O <sub>2</sub>	<0.1	<0.1	<0.1	<0.1
	lbs/hr	<5.00E-05	<5.11E-05	<5.05E-05	<5.05E-05

## 2.2.2 Dioxins/Furans Emissions Results

Three (3) three-hour PCDD/PCDF test runs were performed on December 6, 2006 between the hours of 07:28 – 16:31 on the outlet stack of the boiler. The boiler was operated at greater than 90 % steam load conditions during the performance of this test program. A summary of the PCDD/PCDF emission measurements for the three control level test runs is provided below in Table 2-2.

The PCDD/PCDF samples were shipped to Alta Analytical Perspectives of Wilmington, North Carolina for PCDD/PCDF (total tetra- through octa- congeners) analysis. Eyves Tondue, Ph.D., General Manager, Alta Analytical Perspectives was the laboratory contact responsible for the PCDD/PCDF sample analysis. Results from the sample analysis will be reported in the units of nanograms TEQ per dry standard cubic meters corrected to 7.0 % oxygen (ng TEQ/dscm @ 7% O<sub>2</sub>).

The total PCDD/PCDF average emission measurement of 0.10 (ng TEQ/dscm @ 7% O<sub>2</sub>) are expressed as TCDD based on U.S. EPA toxic equivalents factors (TEF's). All field and laboratory data is presented in the Appendix of this report.

**Table 2-3**

**PCDD/PCDF Test Results  
Boralex – Stratton Energy  
December 6, 2006**

Test No.		D/F-1	D/F-2	D/F-3	
Date		12/6/06	12/6/06	12/6/06	
Time		07:28-10:36	10:37-13:44	13:45-16:31	
	Units				Average
Stack Temperature	deg. F	322.2	330.0	327.8	326.7
Volume of Sample	dscm	4.4	4.5	4.3	4.4
Carbon Dioxide Content	%	10.4	9.6	9.8	9.9
Oxygen Content	%	8.9	9.5	9.5	9.3
Isokinetic Ratio	%	91.0	94.1	93.3	
Moisture Content	%	14.6	14.9	15.6	15.0
<b>Total PCDD/F's</b>	<b>ng/dscm @7% O<sub>2</sub></b>	<b>12.9</b>	<b>6.9</b>	<b>8.8</b>	<b>9.5</b>
<b>Total PCDD/F's (TEQ)</b>	<b>ng/dscm @7% O<sub>2</sub></b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>

### 2.2.3 Hydrogen Chloride Results

Three (3) one-hour non-isokinetic HCl tests were performed on December 5, 2006 between 14:27 and 18:06. The HCl samples were shipped to Maxxam Analytics, Inc. of Burlington, Ontario Canada for analysis. Mary-Anne Johnson, Ph.D, Senior Analytical Project Manager, Maxxam Analytics, Inc. was the laboratory contact responsible for the HCl sample analysis. Data summaries and field data for all HCl testing can be found in the Appendix of this report.

**Table 2-4**

**Hydrogen Chloride Test Results  
Boralex – Stratton Energy  
December 5, 2006**

Analyte	Units	Test No. 1	Test No. 2	Test No. 3	Average
Hydrogen Chloride	ppm @12%CO <sub>2</sub>	7.9	6.1	6.5	6.8
	lbs/hr	5.4	4.3	4.3	4.7

### 2.2.3 Acrolein Results

Three (3) one-hour acrolein tests were performed on December 6, 2006 between 13:50 and 17:07. The acrolein samples were shipped to Atmospheric Analysis & Consulting, Inc. of Ventura, California for analysis of acrolein by high performance liquid chromatography (HPLC). Sucha Parmar, Ph.D., Laboratory Director, Atmospheric Analysis & Consulting, Inc. was the laboratory contact responsible for the acrolein analysis. The acrolein samples emission measurements were calculated based on the method detection limit of 0.075ug/sample. All field and laboratory data is presented in the Appendix of this report.

**Table 2-5**

**Acrolein Test Results  
Boralex – Stratton Energy  
December 6, 2006**

Analyte	Units	Test No. 1	Test No. 2	Test No. 3	Average
Acrolien	ppm @12%CO <sub>2</sub>	<2.44E-07	<2.34E-07	<2.61E-07	<2.46E-07
	lbs/hr	<2.13E-04	<2.05E-04	<2.29E-04	<2.16E-04

### **3.0 PROCESS AND OPERATIONS**

Boralex, Inc. owns an electric generating facility located in Livermore Falls, Androscoggin County, Maine. The Livermore Falls facility is licensed by the Maine Department of Environmental Protection (ME DEP) under Air Emissions License # A-555-70-D-A/I to operate a single wood-fired boiler with a maximum continuous heat input capacity of 534 MMBtu/hr, and a maximum peak heat input capacity of 585.9 MMBtu/hr.

The wood-fired boiler supplies steam to a turbine, which generates 39.6 megawatts (gross) of electricity. Up to 50% of the annual fuel usage by weight may be from processed construction & demolition wood (CDW) fuel. The facility is controlled by a system of local instrumentation and a central programmable controller. The control system is configured to allow plant operation down to 50% of the maximum net electrical output.

The generating plant consists of one traveling-grate water tube boiler, one condensing steam turbine generator, one condenser, two feedwater heaters, one cooling tower, one electrostatic precipitator, an electrical distribution system, and instrumentation and control systems.

Fuels, consisting of wood chips, mill residues and CDW, are delivered to the site in tractor-trailers. The trucks are weighed on a scale, and then unloaded via one of two back-in tilt dumpers. The as-received fuel is conveyed to a disc screen for size classifying, then reduced in size by an in-line wood hog, if required. The sized fuel is then conveyed to a covered fuel storage building. Fuel is reclaimed from the storage building, then conveyed to the boiler and fed to the furnace via six variable speed screw feeders. High-pressure transport air and trajectory plates distribute fuel on the traveling grate. Fine fuel particles are burned in suspension while heavier particles are evenly spread on the back of the traveling grate surface.

Superheated steam from the boiler is routed to the steam turbine generator, which is supplied with two uncontrolled extractions to supply steam for deaeration and condensate heating. Exhaust steam from the turbine is condensed in the surface condenser and the resulting condensate is pressurized, heated, deaerated, and routed back to the boiler for reuse. The circulating water leaving the condenser is cooled in a three-cell cooling tower and pumped back to the condenser. Hot flue gas from the steam generator is used to preheat combustion air in a tube preheater. Pre-heated combustion air is divided into overfire air and undergrate air. Undergrate air is evenly distributed through the active grate area to begin the combustion process while overfire air jets provide mixing of fuel and air to complete the combustion process. An Ecotube advanced overfire air system is also employed to further stage combustion and reduce emissions of NO<sub>x</sub>. After leaving the preheater, the flue gas is stripped of particulate matter in a multiple cyclone dust collector followed by an electrostatic precipitator. Cleaned flue gas is then discharged to the atmosphere through the stack.

## **4.0 SAMPLING AND ANALYTICAL METHODOLOGY**

Emission measurements were performed at the exhaust stack to determine the concentration of O<sub>2</sub> and CO<sub>2</sub>, multiple metals, polychlorinated dibenzo-p-dioxin/furans, hydrogen chloride, and acrolein according to EPA Reference Methods 3A, 29, 23, 26, and CARB Modified Method 430M respectively. Measurements of O<sub>2</sub> and CO<sub>2</sub> were taken concurrently with the MM, PCDD/PDDF, HCl, and Acrolein testing.

### **4.1 Instrument Reference Method Sampling**

#### **4.1.1 Reference Method Sampling System**

Stack gas was drawn through a heated sintered stainless steel probe, heated Teflon sample line (300°F nominal), and a stainless steel sample conditioner by a leakless Teflon diaphragm pump. The sample was then pumped through a manifold under slightly positive pressure with a bypass to atmosphere. Samples were continuously drawn from this manifold to the instruments listed below:

**TABLE 4-1  
REFERENCE METHOD SAMPLING SYSTEM**

<b>Parameter</b>	<b>Analyzer</b>	<b>Measurement Principle</b>
O <sub>2</sub>	Servomex 1400	Paramagnetic
CO <sub>2</sub>	CAI Model ZRH	NDIR

The analyzer outputs were continuously recorded using an ESC 8816 data logger supported by ESC's software on a PC. The signals from the analyzers were "viewed" by the data logger at 1-second intervals, from which one-minute averages were formed. The ESC software was then used to generate reports for discrete test periods. Printouts of these periods are contained in the Appendix of the certification test report.

#### **4.1.2 Analyzer Calibrations**

A multiple point (zero, mid, and span) calibration was performed directly on each analyzer (bypassing the sample transport and conditioning system) at the beginning of the test program to determine calibration error and demonstrate analyzer linearity. A zero and upscale bias check and calibration drift check was performed prior to and after each test run. An injection point at the base of the sample extraction probe was used for the introduction of gases to the entire sample transport and conditioning system for pre and post run calibration checks. Calibration drift was determined using the pre-run and post-run monitor responses, and was used to correct each average test run concentration of each of the two measured parameters. Procedures and calculations contained in EPA Reference Method 6C, Sections 7 & 8 were used to determine the average stack concentration of the measured constituents for each test run.

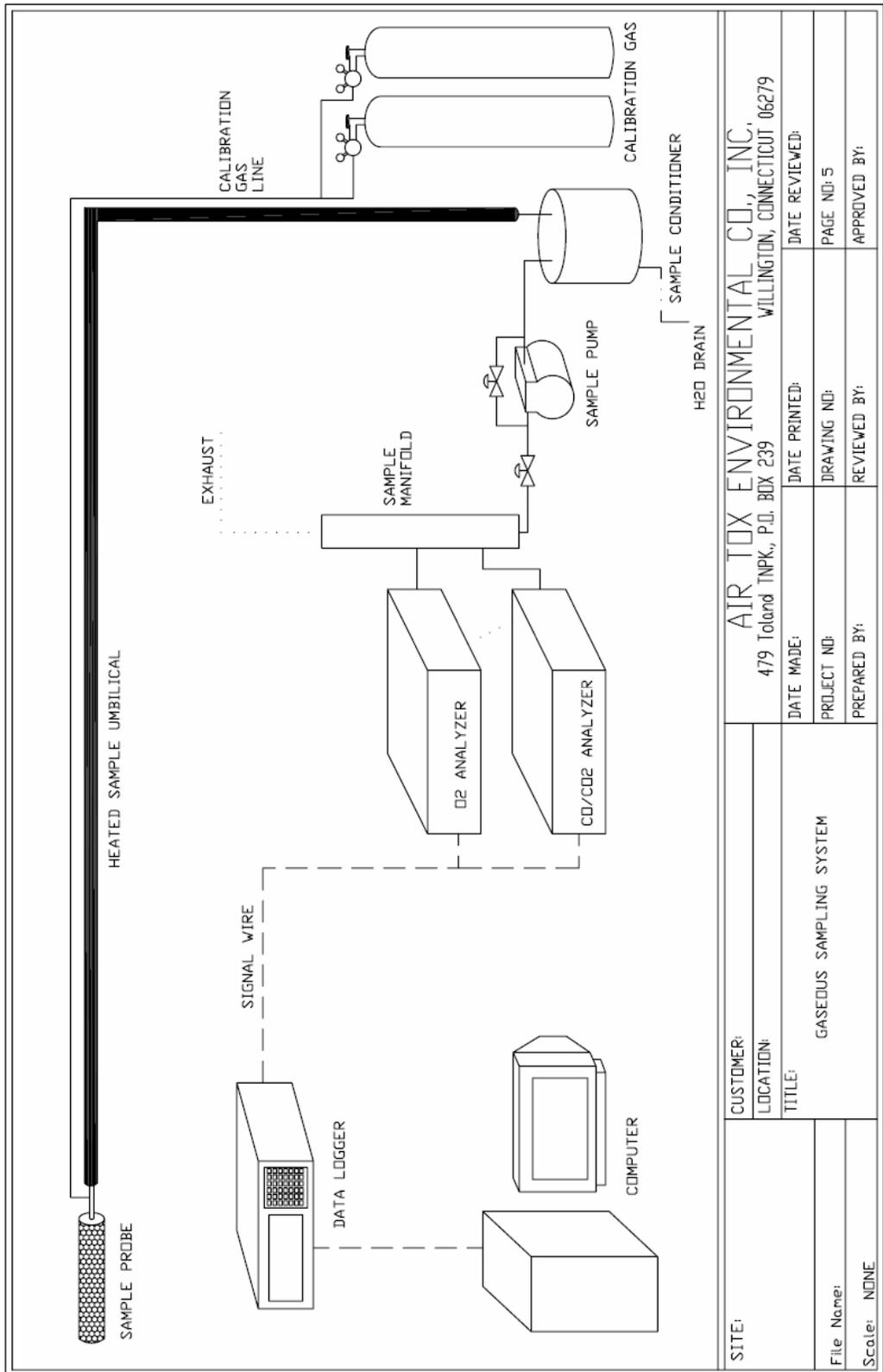


Figure 4.1 – Gaseous Sampling System

SITE:	CUSTOMER:	AIR TOX ENVIRONMENTAL CO., INC.		
LOCATION:	LOCATION:	WILLINGTON, CONNECTICUT 06279		
TITLE:	TITLE:	GASEOUS SAMPLING SYSTEM		
File Name:	DATE MADE:	DATE PRINTED:	DATE REVIEWED:	
Scale: NONE	PROJECT NO:	DRAWING NO:	PAGE NO: 5	
	PREPARED BY:	REVIEWED BY:	APPROVED BY:	

## **4.2 Manual Emission Measurements**

Concurrent with the instrumental measurements detailed above, measurements were performed utilizing manual test methods to determine stack gas molecular weight, moisture content, and volumetric flowrate. This data was used to calculate the lbs/hr emission rates, where applicable.

### **4.2.1 Stack Gas Molecular Weight Determination**

Molecular weight was determined using calculations listed in EPA Reference Method 3. As detailed above, the composition of the gas stream was continuously analyzed for carbon dioxide concentration in accordance with EPA Reference Method 3A. This data allows the stack gas molecular weight to be calculated.

### **4.2.2 Stack Gas Moisture Content Measurements**

Stack gas moisture content was determined according to EPA Reference Method 4. The necessary moisture runs were performed in conjunction with the Method 29 (Multiple Metals), Method 23 (PCDD/PCDF) and Method 26 (HCl) testing.

### **4.2.3 Volumetric Flow Measurements**

Exhaust stack volumetric flowrates were determined for each manual emission measurement test run in accordance with EPA Reference Methods 1 and 2.

### **4.2.4 Multiple Metals and Particulate Matter Emissions Measurement**

The exhaust stack concentration of heavy metals was determined utilizing Reference Method 29. Three (3) two-hour isokinetic test runs were performed to determine the emissions of particulate matter and the following metals: antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and vanadium. The train consisted of a calibrated quartz nozzle, a heated quartz-lined probe, a heated quartz-fiber (pre-cleaned) filter encased in a glass holder with a porous Teflon<sup>®</sup> frit, and seven impingers. Impingers one (modified Greenburg-Smith) and two (Greenburg-Smith) were each charged with 100 ml of a nitric acid/hydrogen peroxide solution (5% HNO<sub>3</sub>/10% H<sub>2</sub>O<sub>2</sub>). The third impinger was empty, while the fourth and fifth impingers (modified) were each charged with 100 ml potassium permanganate/sulfuric acid solution (4% KMnO<sub>4</sub>/10% H<sub>2</sub>SO<sub>4</sub>). The sixth impinger contained 200 grams of indicating silica gel to remove any remaining moisture. A schematic of the multiple metals sampling train is presented in Figure 4-2.

Prior to testing, all sample train components was cleaned and assembled in accordance with Section 5.1.1 of Reference Method 29. Glassware connections utilize Teflon/silicon O-rings to provide a leak-free seal without the use of silicone grease. Prior to and following sampling, the sample train was sealed with Parafilm<sup>®</sup> to prevent contamination. Upon completion of each 2-hour sample run, the train components were moved to a clean and dust free area to minimize the chances of contamination during sample recovery.

The sample train was then inspected for abnormal conditions and completely disassembled. Samples were recovered and placed in five (optionally six) sample containers, as follows:

Container No. 1 Filter is removed from holder and deposited in 1000 ml sample jar. The nozzle, probe, and front half of the filter holder and brushed and rinsed in triplicate with 100 ml of nitric acid solution. The washes are deposited into this container. Container is labeled and sealed for transport.

Container No. 2 Contents of impingers 1, 2. Contents are measured to determine moisture gain and deposited into sample jar. The back half of the filter holder, the first three impingers, and connecting glassware are rinsed in triplicate with 100 ml nitric acid solution. Container is labeled and sealed for transport.

Container No. 3 Contents of impinger 3. Contents are measured to determine moisture gain and deposited into sample jar. The impinger is rinsed in triplicate with 100 ml nitric acid solution. Container is labeled and sealed for transport.

Container No. 4 Contents of impingers 4 & 5. Contents of impingers are measured and deposited into sample jar. The impingers and connecting glassware are rinsed in triplicate with potassium permanganate solution. Rinses are deposited into this container. Container is labeled and sealed for transport.

Container No. 5 (optional) Additional rinses of impingers 4 & 5 are performed with 8N HCl solution if visible deposits remain following the initial rinses. Container is labeled and sealed for transport.

Container No. 6 - Silica Gel.

The samples was transported to the laboratory where the following analyses were performed:

Containers Nos. 1 thru 5 Perform analysis by ion chromatography in accordance with Sections 5.3 and 5.4 of Reference Method 29.

Container No. 6 Contents are weighed to nearest 0.5 g and discarded.

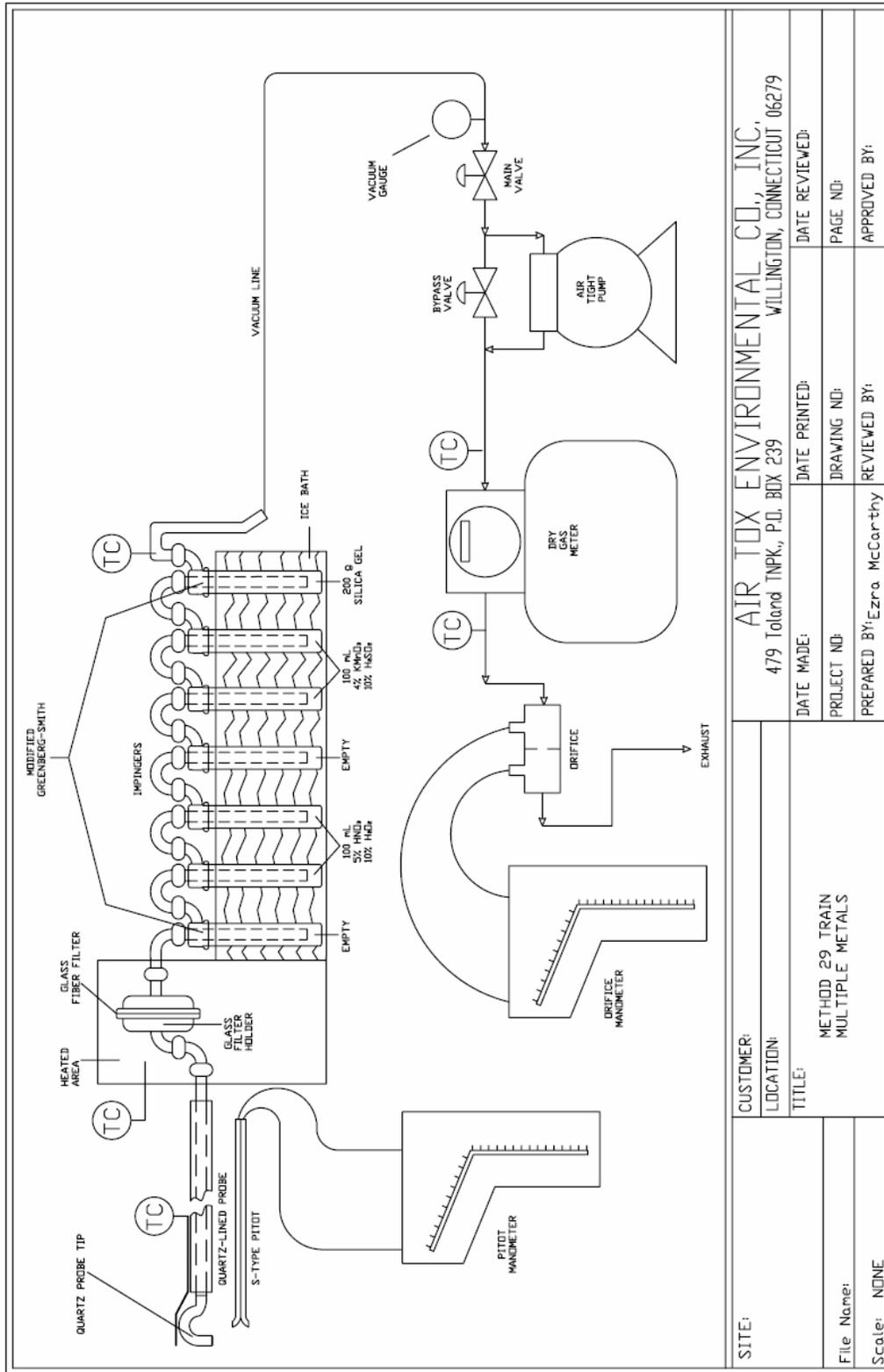


Figure 4.2 – EPA Method 29 Multiple Metals Sampling Train

SITE:	AIR TOX ENVIRONMENTAL CO., INC., WILLINGTON, CONNECTICUT 06279		
CUSTOMER:	479 Toland TPK., P.O. BOX 239		
LOCATION:	DATE MADE:	DATE PRINTED:	DATE REVIEWED:
TITLE:	PROJECT NO:	DRAWING NO:	PAGE NO:
File Name:	PREPARED BY: Ezra McCarthy	REVIEWED BY:	APPROVED BY:
Scale: NONE	METHOD 29 TRAIN MULTIPLE METALS		

#### 4.2.5 Dioxins/Furans Emission Measurement

Measurement of Polychlorinated Dibenzop-Dioxins (PCDD's) and Polychlorinated Dibenzofurans (PCDF's) were performed in accordance with EPA Reference Method 23. A total of three 3-hour isokinetic test runs were performed for each of the three fuel blends during this test program. This method is essentially a modified version of Reference Method 5. The train consists of a calibrated quartz nozzle, a heated quartz-lined probe, a heated glass fiber (pre-cleaned) filter encased in a glass holder with a Teflon frit, a flexible heated Teflon sample line, a Graham spiral-type condenser, a water jacketed sorbent module containing cleaned XAD-2 resin, and five Greenburg-Smith impingers. The sorbent module is positioned vertically and sample gas flows downward to prevent channeling. The first impinger is modified to serve as a moisture knockout by shortening the stem. Impinger's two and three are each charged with 100 ml HPLC water. The fourth impinger is empty, while the fifth contains 200 grams of indicating silica gel.

Prior to testing, all sample train components were cleaned and assembled in accordance with Section 4.1 of Reference Method 23. Glassware connections utilized Teflon/silicon O-rings to provide a leak-free seal without the use of silicone grease. Prior to and following sampling, the sample train was sealed with hexane rinsed aluminum foil to prevent contamination. Upon completion of each three-hour sample run, the train components were moved to a relatively clean area (Air Tox's Mobile Laboratory) to minimize the chances of contamination during sample recovery. A schematic of the sampling train is presented in Figure 4-2.

The sample train was then inspected for abnormal conditions and completely disassembled. Samples were recovered and placed in five sample containers, as follows:

<u>Container No. 1</u>	Filter
<u>XAD-2 Adsorbent Module</u>	Module was removed from sample train, immediately sealed with hexane rinsed aluminum foil, and stored on ice for transport to the laboratory.
<u>Container No. 2</u>	Acetone/methylene chloride washes of probe and front half of filter holder. The probe and nozzle were washed and brushed three times, followed by three rinses (no brushing) with methylene chloride. The back half of the filter holder, the transfer line (if used), and the spiral condenser were also rinsed three times with acetone and three times with methylene chloride. These rinses were deposited in this container. The container was sealed, labeled, and the liquid level marked.
<u>Container No. 3</u>	The transfer line, and condenser were washed three times with toluene and deposited in this container. The container was sealed, labeled, and the liquid level was marked.

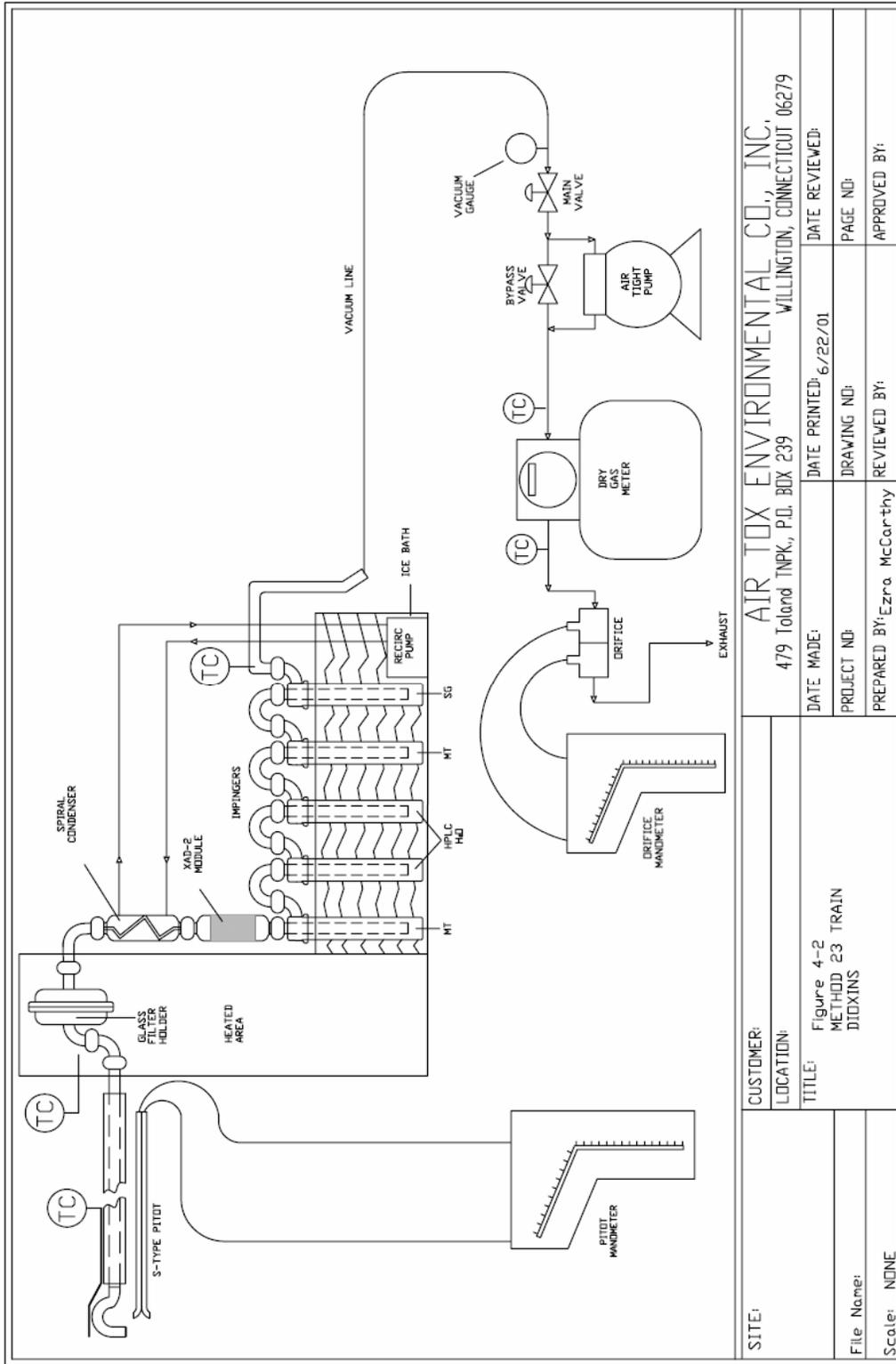


Figure 4.3 – EPA Method 23 PCDD/PCDF Sampling Train

SITE:	AIR TOX ENVIRONMENTAL CO., INC., WILLINGTON, CONNECTICUT 06279		
LOCATION:	479 Toland TPK., P.O. BOX 239		
TITLE:	Figure 4-2	DATE PRINTED:	6/22/01
File Name:	METHOD 23 TRAIN	DRAWING NO:	
Scale:	NONE	PREPARED BY:	Ezra McCarthy
		REVIEWED BY:	
		DATE REVIEWED:	
		PAGE NO:	
		APPROVED BY:	

The contents of the first four impingers were measured to the nearest 1.0 ml to determine moisture gain and discarded. The silica gel from the fifth impinger was weighed to the nearest 0.5 grams following each test run and saved for future use.

The samples were then transported to the laboratory where the following analyses were performed:

Container Nos. 1 -3, & XAD-2 Perform analysis by gas chromatography/mass spectrometry in accordance with Section 5 of Reference Method 23.

#### **4.2.6 HCl Emission Measurement**

The stack concentration of hydrogen chloride was determined utilizing a modified Reference Method 26. Three (3) one-hour non-isokinetic test runs were performed for this test program. Hydrogen chloride emissions were expressed as the arithmetic mean of the three (3) one-hour test runs. A schematic of the HCl sampling train is presented in Figure 4-3.

A glass-lined probe was attached to a heated Teflon filter to prevent condensation. The remainder of the sample train consisted of four impingers in an ice bath, flexible tubing, vacuum gauge, needle valves, leakless vacuum pump, bypass valve, and a dry gas meter. Impingers one and two each contained 100 ml 0.1N H<sub>2</sub>SO<sub>4</sub> (sulfuric acid), the third impinger contained 100 ml 0.1N NaOH (sodium hydroxide) to act as a scrubber, and the fourth impinger contained silica gel. Following the pre-test purge, samples were collected at the flow rate of approximately 0.75 cubic feet per minute ( $\pm 10\%$ ).

Upon completion of each one-hour sample run, the train components were moved to a relatively clean area to minimize the chances of contamination during sample recovery. Samples were recovered and placed in one sample container, as follows:

Container No. 1 Contents of impingers 1 & 2. Rinse each impinger and connecting glassware with DI water. Also deposit rinses in this container. Container is labeled and sealed for transport.

The recovered samples were transported to the laboratory where the following analyses were performed:

Container No. 1 Perform analysis by ion chromatography in accordance with Section 4.4 of Reference Method 26.

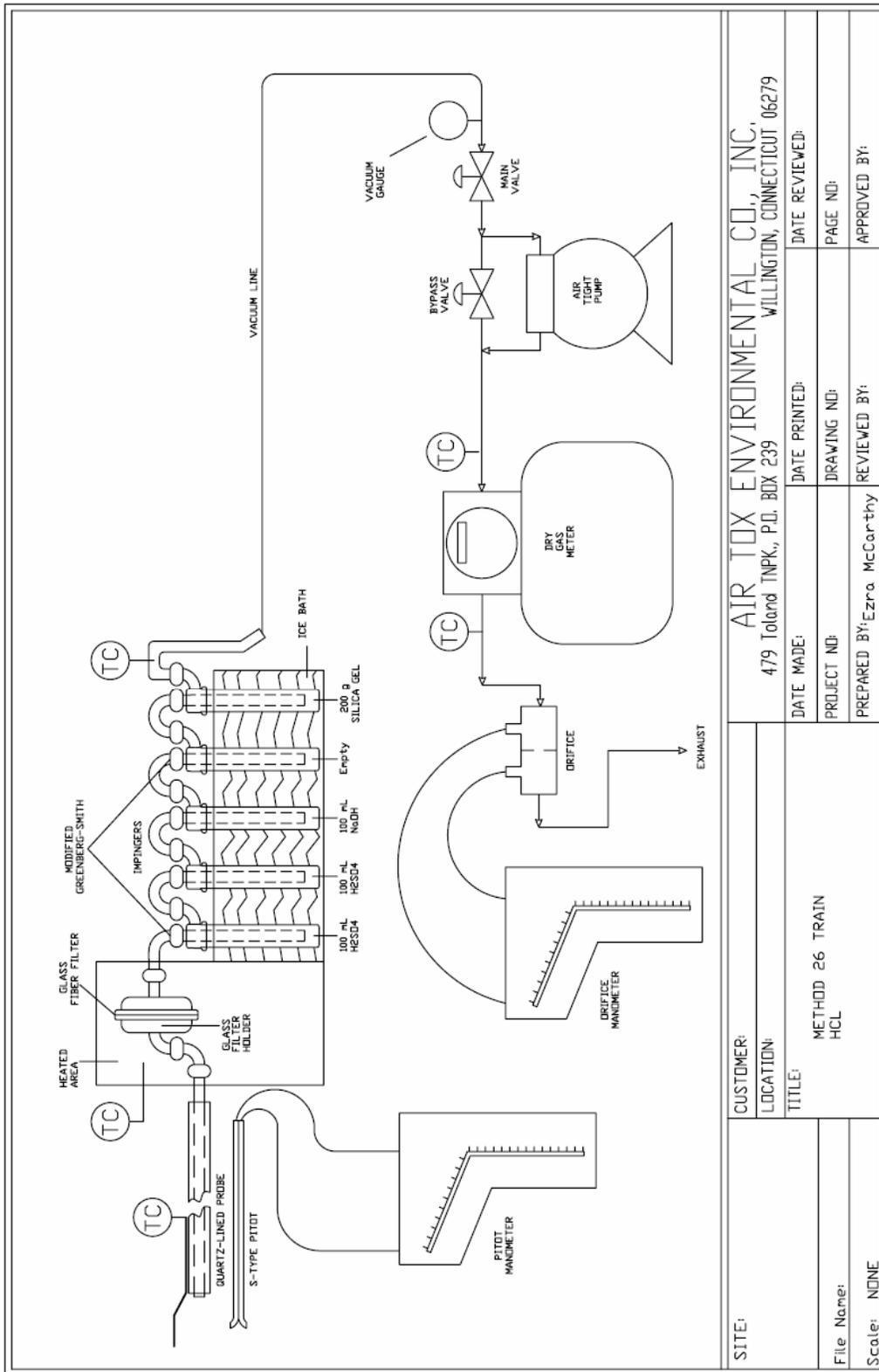


Figure 4.4 – EPA Method 26 HCl Sampling Train

SITE:	AIR TOX ENVIRONMENTAL CO., INC., WILLINGTON, CONNECTICUT 06279		
CUSTOMER:	479 Toland TPK., P.O. BOX 239		
LOCATION:	DATE MADE:	DATE PRINTED:	DATE REVIEWED:
TITLE:	PROJECT NO:	DRAWING NO:	PAGE NO:
File Name:	PREPARED BY: Ezra McCarthy		
Scale: NONE	REVIEWED BY:		

#### 4.2.7 Acrolein Emission Measurement

The stack concentration of acrolein will be determined utilizing California Air Resource Board (CARB) Method 430. Three 1-hour non-isokinetic test runs will be performed for this test program. Acrolein emissions will be expressed in nanograms per dry standard cubic meter (ng/dscm) and parts per million by volume (ppm<sub>v</sub>), using the arithmetic mean of the three one-hour test runs.

A Teflon probe is attached to two mini impingers in series, each impinger containing an aqueous acidic solution of 2,4-dinitrophenyl-hydrazine (DNPH), an ice bath, flexible tubing, vacuum gauge, needle valves, leakless vacuum pump, bypass valve, and a dry gas meter. The impingers each contain 10 ml DNPH, and the third impinger contains silica gel. Samples are collected at a flow rate of approximately 0.5 liters per minute ( $\pm 10\%$ ). A schematic of the sampling train is presented in Figure 4-4.

Upon completion of each one-hour sample run, the train components will be moved to a clean area to minimize the chances of contamination during sample recovery. Samples are recovered and placed in one sample container, as follows:

<u>Container No. 1</u>	Contents of impingers 1 & 2. Rinse each impinger and connecting glassware with 2ml DNPH Solution. Also deposit rinses in this container. Container is labeled and sealed for transport.
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The recovered samples will be transported to the laboratory where the following analyses will be performed:

<u>Container No. 1</u>	Perform analysis by high performance liquid chromatography (HPLC) in accordance with Section 9 of CARB Method 430.
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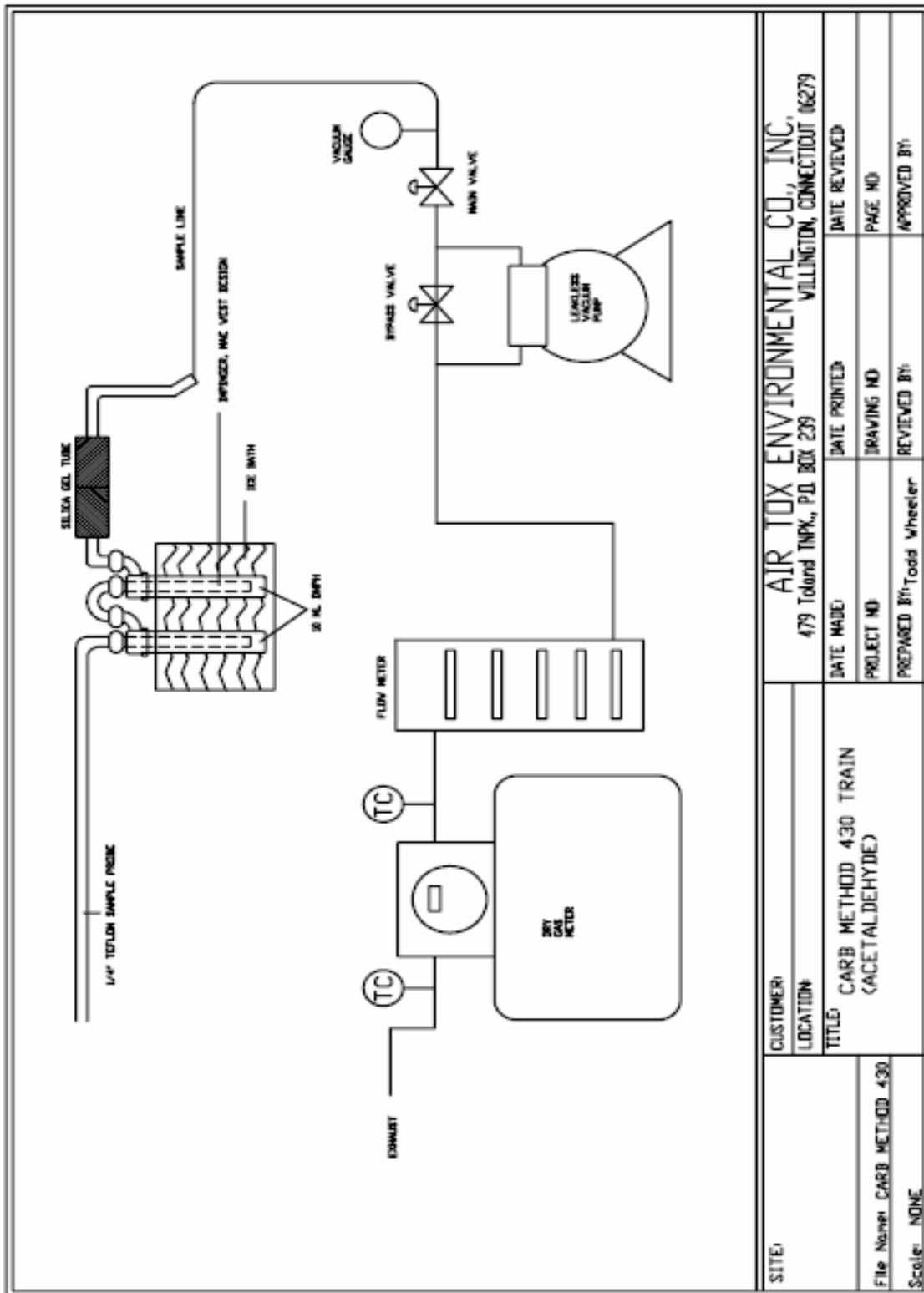


Figure 4.5 – CARB Method 430 Formaldehyde/Acetaldehyde Sampling Train

## **5.0 QUALITY ASSURANCE**

The project manager was responsible for implementation of the quality assurance program as applied to this project. Implementation of quality assurance procedures for source measurement programs is designed so work was done:

- By competent, trained individuals experienced in the methodologies being used.
- Using properly calibrated equipment.
- Using approved procedures for sample handling and documentation.

Measurement devices, pitot tubes, dry gas meters, thermocouples and portable gas analyzers are uniquely identified and calibrated with documented procedures and acceptance criteria before and after each field effort. Records of all calibration data are maintained in the files.

Data are recorded on standard forms. Bound field notebooks are used to record observations and miscellaneous elements effecting data, calculations, or evaluation.

Prior to the test program Air Tox provides the following:

- Calibrations of all pitot tubes, dry gas meters, orifice meters, sampling nozzles, and thermocouples that are used during the test. All calibrations are performed within four months prior to the test date.

Calibration gases utilized for gaseous analysis methods will be prepared in accordance with EPA Protocol 1, and will be certified to be within  $\pm 2\%$  of the cylinder "tag" value concentration. Analyzer linearity, bias, calibration drift, and calibration drift corrections will be determined in accordance with Reference Method 6C, as outlined in Section 4.1.6 of this document.

Specific details of Air Tox's QA program for stationary air pollution sources may be found in "Quality Assurance Handbook for Air Pollution Measurement Systems", Volume III (EPA-600/4-7-027b).