UPPER MICHIGAN ENERGY RESOURCES

Upper Michigan Energy Resources Corporation
231 W. Michigan St.
Milwaukee, WI 53203

UNITED PARCEL SERVICE

May 2, 2019

RECEIVED
MAY 06 2019
AIR QUALITY DIVISION

Mr. Joseph Scanlan
Michigan Department of Environment, Great Lakes, and Energy
Air Quality Division
1504 West Washington Street
Marquette, MI 49855

Subject: **A.J. Mihm Generating Station**
Pelkie, Michigan
Permit to Install 34-17 and 40 CFR Part 60 Subpart JJJJ
EURICE1, EURICE2, and EURICE3 Compliance Emissions Test Report Submittal

Dear Mr. Scanlan:

Upper Michigan Energy Resources Corporation (UMERC) respectfully submits the results of reciprocating internal combustion engine (RICE) initial compliance testing conducted at the A.J. Mihm Generating Station units EURICE1, EURICE2, and EURICE3 during the period March 14-16, 2019.

The results demonstrate compliance with the conditions of Permit To Install 34-17 and 40 CFR Part 60 Subpart JJJJ. A summary of results by emission unit is presented below.

Source	Pollutant	Test Result	Permit Limit
EURICE1	NOx	2.1 lb/hr	3.0 lb/hr
EURICE1	NOx	3.1 ppmvd @ 15% O2	82 ppmvd @ 15% O2
EURICE1	CO	1.0 lb/hr	5.5 lb/hr
EURICE1	CO	2.5 ppmvd @ 15% O2	270 ppmvd @ 15% O2
EURICE1	VOC	2.0 lb/hr	5.5 lb/hr
EURICE1	VOC	3.2 ppmvd @ 15% O2	60 ppmvd @ 15% O2
EURICE1	TPM	0.532 lb/hr	3.72 lb/hr

Source	Pollutant	Test Result	Permit Limit
EURICE2	NOx	5.0 ppmvd @ 15% O2	82 ppmvd @ 15% O2
EURICE2	CO	1.1 lb/hr	5.5 lb/hr
EURICE2	CO	2.9 ppmvd @ 15% O2	270 ppmvd @ 15% O2
EURICE2	VOC	2.8 lb/hr	5.5 lb/hr
EURICE2	VOC	4.9 ppmvd @ 15% O2	60 ppmvd @ 15% O2
EURICE2	TPM	0.435 lb/hr	3.72 lb/hr

Source	Pollutant	Test Result	Permit Limit
EURICE3	NOx	1.2 lb/hr	3.0 lb/hr
EURICE3	NOx	2.0 ppmvd @ 15% O2	82 ppmvd @ 15% O2
EURICE3	CO	2.6 lb/hr	5.5 lb/hr
EURICE3	CO	6.8 ppmvd @ 15% O2	270 ppmvd @ 15% O2
EURICE3	VOC	2.2 lb/hr	5.5 lb/hr
EURICE3	VOC	3.7 ppmvd @ 15% O2	60 ppmvd @ 15% O2
EURICE3	TPM	0.548 lb/hr	3.72 lb/hr

For EURICE2, NOx emissions on a lb/hr basis is not included in the summary due to the control device operation during the compliance testing. Further discussion is included in Appendix A of report for Mostardi Platt Project No. M190803.

Enclosed please find the following Mostardi Platt test reports:

- *Compliance Emissions Test Report, Performed for: Upper Michigan Energy Resources Corporation, At The: A.J. Mihm Generating Station, EURICE1 Outlet Duct, Pelkie, Michigan, Project No. M190803A, March 14, 2019*
- *Compliance Emissions Test Report, Performed for: Upper Michigan Energy Resources Corporation, At The: A.J. Mihm Generating Station, EURICE2 Outlet Duct, Pelkie, Michigan, Project No. M190803B, March 15, 2019*
- *Compliance Emissions Test Report, Performed for: Upper Michigan Energy Resources Corporation, At The: A.J. Mihm Generating Station, EURICE3 Outlet Duct, Pelkie, Michigan, Project No. M190803C, March 16, 2019*

If you have any questions or need additional information, please contact me at (414) 221-2389 or laura.jarmuz@wecenergygroup.com.

Sincerely,

Laura M Jarmuz

Laura Jarmuz
Senior Engineer

cc: Karen Kajiya-Mills, Technical Programs Unit, EGLE, Air Quality Division
Ed Lancaster, District Supervisor, EGLE, Air Quality Division—w/o enclosures
Scott Johnson, UMERC—electronic w/o enclosures
Justin Kowalski, UMERC—electronic w/o enclosures

Enclosures:

1. Mostardi Platt Project No. M190803A Report
2. Mostardi Platt Project No. M190803B Report
3. Mostardi Platt Project No. M190803C Report

mostardi platt

Compliance Emissions Test Report

Performed for: Upper Michigan Energy Resources Corporation
At The: A.J. Mihm Generating Station
Permit No. 34-17
EURICE2 Outlet Duct
Pelkie, Michigan
March 15, 2019

Report Submittal Date
April 26, 2019

Project No. M190803B

888 Industrial Drive
Elmhurst, Illinois 60126
630-993-2100

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1.0 EXECUTIVE SUMMARY

MOSTARDI PLATT conducted a compliance emissions test program for Upper Michigan Energy Resources Corporation (UMERC) on March 15, 2019 at A.J. Mihm Generating Station on the Reciprocating Internal Combustion Engine 2 (EURICE2) Outlet Duct in Pelkie, Michigan. The purpose of the test program was to meet the initial compliance demonstration requirements for emission rates in accordance with Permit to Install 34-17 and 40 CFR Part 60 Subpart JJJJ. This report summarizes the results of the test program and test methods used.

The test location, test date, and test parameters are summarized below.

Test Location	Test Date	Test Parameters
EURICE2 Outlet Duct	March 15, 2019	Nitrogen Oxides (NO_x), Carbon Monoxide (CO), Carbon Dioxide (CO_2), Oxygen (O_2), Volatile Organic Compounds (VOCs), Total Particulate Matter (TPM), Volumetric Flow, and Moisture

A.J. Mihm Generating Station electric generation facility includes three (3) Wärtsilä W18V50SG natural gas-fired, four stroke, lean burn, spark ignition reciprocating internal combustion engines (RICE) coupled to 18,817 kW electric generators, a 1,000 kW natural gas-fired emergency generator, and one natural gas-fired natural gas conditioning heater. The RICE electric generating unit engines utilize pipeline quality natural gas and are equipped with selective catalytic reduction (SCR) for nitrogen oxides (NOx) control and oxidation catalyst systems for carbon monoxide (CO), volatile organic compound (VOC), and organic hazardous air pollutant (HAP) control. Each RICE electric generating unit exhausts into an individual stack.

Selected results of the test program are summarized below. A complete summary of emission test results follows the narrative portion of this report.

TEST RESULTS				
Test Location	Test Date	Test Parameter	Emission Rate	Emission Limit
EURICE2 Outlet Duct	3/15/19	NO_x	5.0 ppmvd @ 15% O_2	82 ppmvd @ 15% O_2
		CO	2.9 ppmvd @ 15% O_2	270 ppmvd @ 15% O_2
			1.1 lb/hr	5.5 lb/hr
		VOC (as C_3H_8)	4.9 ppmvd @ 15% O_2	60 ppmvd @ 15% O_2
			2.8 lb/hr	5.5 lb/hr
		TPM	0.435 lb/hr	3.72 lb/hr

NOx emissions on a lb/hr basis is not included in the emission rate summary due to the control device operation. Discussion of the control operations is included in Appendix A. Plant operating data supplied by plant personnel is also included in Appendix A.

The identifications of the individuals associated with the test program are summarized below.

TEST PERSONNEL INFORMATION		
Location	**Address**	**Contact**
Test Coordinator	WEC Energy Group, Inc 231 W. Michigan Street Milwaukee, Wisconsin 53203	Ms. Laura Jarmuz Senior Engineer (414)-221-2389 office Laura.jarmuz@wecenergygroup.com
Test Facility	Upper Michigan Energy Resources Corporation A.J. Mihm Generating Station 16017 Sarya Road Pelkie, Michigan 49958	
Testing Company Representative	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Mr. Richard Sollars (630) 993-2100 (phone) rsollars@mp-mail.com

The test crew consisted of Messrs. J. Nestor, T. Schmidt, S. Dyra, J. Gross, J. Carlson, K. Krofel and R. Sollars of Mostardi Platt.

2.0 TEST METHODOLOGY

Emission testing was conducted following the methods specified in Code of Federal Regulations, Title 40, Part 60, Appendix A (40CFR60), 40CFR51, and 40CFR63. Schematics of the test section diagrams and sampling trains used are included in Appendix B and C, respectively. Calculation examples and nomenclature are included in Appendix D. Copies of analyzer print-outs and field data sheets for each test run are included in Appendices E and F, respectively.

The following methodologies were used during the test program:

Method 1 Traverse Point Determination

Test measurement points were selected in accordance with Method 1. The characteristics of the measurement location are summarized below.

TEST POINT INFORMATION						
Location	**Diameter (Feet)**	**Area (Square Feet)**	**Upstream Distance (Inches)**	**Downstream Distance (Inches)**	**Test Parameter**	**Number of Sampling Points**
EURICE2 Outlet Duct	5.29	21.979	>0.5	>2.0	Volumetric Flow	16
					$NO_x/CO/VOC/O_2/CO_2$	12 (strat), 3
					TPM	24

A null point pitot traverse check was performed utilizing a Type S pitot tube prior to any testing to verify the absence of cyclonic flow at each test location per USEPA Method 1, Section 11.4. The null point at the test location averaged 6.6 degrees which meets the requirements. The results can be found in Appendix E.

Method 2 Volumetric Flowrate Determination

Gas velocity was measured following Method 2, for purposes of calculating stack gas volumetric flow rate. An S-type pitot tube, differential pressure gauge, Thermoouple and temperature readout were used to determine gas velocity at each sample point. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix G.

Method 3A Oxygen (O_2)/Carbon Dioxide (CO_2) Determination

Flue gas O_2 was determined in accordance with Method 3A. An ECOM analyzer was used to determine stack gas oxygen content connected to the outlet of the FTIR analyzer.

Flue gas carbon dioxide concentrations and emission rates were determined in accordance with Method 3A. An MKS MultiGas 2030 FTIR spectrometer was used to determine the CO_2 concentrations, in the manner specified in the Method. Nitrogen content was determined from the difference of CO_2 and O_2.

Stack gas was delivered to the analyzer via a Teflon® sampling line, heated to a minimum temperature of 375°F. The entire system was calibrated in accordance with the Method, using certified calibration gases introduced at the probe, before and after each test run.

All of the equipment used was calibrated in accordance with the specifications of the Method and calibration data are included in Appendix G. Copies of the gas cylinder certifications are included in Appendix J.

Method 5 Particulate Determination

Stack gas particulate concentrations and emission rates were determined in accordance with Method 5, 40 CFR, Part 60, Appendix A at the test location. An Environmental Supply Company, Inc. sampling train was used to sample stack gas at an isokinetic rate, as specified in the Method. Particulate matter in the sample probe was recovered using an acetone rinse. The probe wash and filter catch were analyzed by Mostardi Platt in accordance with the Method in the Elmhurst, Illinois laboratory. Laboratory data are found in Appendix H. All of the equipment used was calibrated in accordance with the specifications of the Method. Field data sheets are provided in Appendix E and calibration data are presented in Appendix G.

Method 7E Nitrogen Oxide (NO_X) Determination

Flue gas nitrogen oxide concentrations and emission rates were determined in accordance with Method 7E. An MKS MultiGas 2030 FTIR spectrometer was used to determine nitrogen oxide concentrations, in the manner specified in the Method.

Stack gas was delivered to the analyzer via a Teflon® sampling line, heated to a minimum temperature of 375°F. The entire system was calibrated in accordance with the Method, using certified calibration gases introduced at the probe, before and after each test run.

A list of calibration gases used and the results of all calibration and other required quality assurance checks can be found in Appendix G. Copies of calibration gas certifications can be found in Appendix J.

Method 10 Carbon Monoxide (CO) Determination

Flue gas nitrogen oxide concentrations and emission rates were determined in accordance with Method 10. An MKS MultiGas 2030 FTIR spectrometer was used to determine carbon monoxide concentrations, in the manner specified in the Method.

Stack gas was delivered to the analyzer via a Teflon® sampling line, heated to a minimum temperature of 375°F. The entire system was calibrated in accordance with the Method, using certified calibration gases introduced at the probe, before and after each test run.

A list of calibration gases used and the results of all calibration and other required quality assurance checks can be found in Appendix G. Copies of calibration gas certifications can be found in Appendix J.

Method 25A Volatile Organic Compound (VOC) Determination

Total hydrocarbon (THC) concentrations and emission rates were determined in accordance with Method 25A. A Thermo Fisher 51i analyzer was used to determine THC concentrations. Stack gas was delivered to the system via a Teflon® sampling line, heated to a minimum temperature of 375°F.

Methane and ethane concentrations were determined in accordance with Method 320 and then subtracted from the THC concentrations in order to comply with non-methane, non-ethane hydrocarbon criteria as specified in the permit. The methane concentration was also corrected for a response factor for the TECO 51i analyzer. These results can be found in Appendix G along with the calibration data.

The system was calibrated before and after each test run using certified calibration gases of propane for the THC determination. Copies of gas certifications are presented in Appendix J.

Method 202 Condensable Particulate Determination

Stack gas condensable particulate matter concentrations and emission rates were determined in accordance with USEPA Method 202, in conjunction with Method 5 filterable particulate sampling. This method applies to the determination of condensable particulate matter (CPM) emissions from stationary sources. It is intended to represent condensable matter as material that condenses after passing through a filter and as measured by this method.

The CPM was collected in the impinger portion of the Method 5 (Appendix A, 40CFR60) type sampling trains. The impinger contents were immediately purged after each run with nitrogen (N_2) to remove dissolved sulfur dioxide (SO_2) gases from the impinger contents. The impinger solution was then extracted with hexane. The organic and aqueous fractions were then taken to dryness and the residues weighed. A correction was made for any ammonia present due to laboratory analysis procedures. The total of both fractions represents the CPM.

All sample recovery was performed at the test site by the test crew. Mostardi Platt personnel at the laboratory in Elmhurst, Illinois, performed all final particulate sample analyses. Laboratory data are found in Appendix H. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix G.

Method 320 Fourier Transform Infrared (FTIR) Detector for Methane and Ethane Determination

Flue gas methane, ethane, and moisture concentrations and emission rates were determined in accordance with Method 320. FTIR data was collected using an MKS MultiGas 2030 FTIR spectrometer. The FTIR was equipped with a temperature-controlled, 5.11 meter multi-pass gas cell maintained at 191°C. Gas flows and sampling system pressures were monitored using a rotameter and pressure transducer.

All data was collected at 0.5 cm^{-1} resolution. Each spectrum was derived from the coaddition of 62 scans, with a new data point generated approximately every one minute. Analyzer data for each run is present is Appendix E.

SAMPLING SYSTEM PARAMETERS				
MKS Serial #	**Sampling Line**	**Probe Assembly**	**Particulate Filter Media**	**Operating Temperatures**
019088128	100' 3/8" dia., heated Teflon	Heated 3', 3/8" dia. SS	0.01µ heated borosilicate glass fiber	191°C

QA/QC procedures followed US EPA Method 320. See below for QA/QC procedure details and list of calibration gas standards. All calibration gases were introduced to the analyzer and the sampling system using an instrument grade stainless steel rotameter. All QA/QC procedures were within the acceptance criteria allowance of the applicable EPA methodology. See Appendix I for FTIR QA/QC Data.

FTIR QA/QC PROCEDURES						
QA/QC Specification	**Purpose**	**Calibration Gas Analyte**	**Delivery**	**Frequency**	**Acceptance Criteria**	**Result**
M320: Zero	Verify that the FTIR is free of contaminants & zero the FTIR	Nitrogen (zero)	Direct to FTIR	pre/post test	< MDL or Noise	**Pass**
M320:Calibration Transfer Standard (CTS) Direct	Verify FTIR stability, confirm optical path length	Ethylene	Direct to FTIR	pretest	+/- 5% cert. value	**Pass**
M320: Analyte Direct	Verify FTIR calibration	Acetaldehyde, Methanol, SF6	Direct to FTIR	pretest	+/- 5% cert. value	**Pass**
M320: CTS Response	Verify system stability, recovery, response time	Ethylene	Sampling System	Daily, pre/post test	+/- 5% of Direct Measurement	**Pass**
M320: Zero Response	Verify system is free of system bias	Nitrogen (zero)	Sampling System	pretest	Bias correct data	**Pass**
M320: Analyte Spike	Verify system ability to deliver and quantify analyte of interest in the presence of effluent gases	Acetaldehyde, Methanol, SF6	Dynamic Addition to Sampling System, 1:10 effluent	Throughout testing – daily	+/- 30% theoretical recovery	**Pass**

Note: The determined concentrations from direct analyses were used in all system/spike recovery calculations.

CALIBRATION GAS STANDARDS				
Components	Concentration (ppm)	Vendor	Cylinder #	Standard Type
Ethylene	100.0	Airgas	CC111625	Primary +/- 1%
Acetaldehyde/ Methanol/SF6	194.4/195.3/ 4.820	Airgas	CC475635	Certified Standard-Spec +/- 5%
Nitrogen	Zero Gas	Airgas	N/A	UHP Grade

Analyte Spiking

Acetaldehyde and methanol spiking was performed prior to testing to verify the ability of the sampling system to quantitatively deliver a sample containing acetaldehyde and methanol from the base of the probe to the FTIR. Analyte spiking assures the ability of the FTIR sampling system to recover volatile organics in the presence of effluent gas.

As part of the spiking procedure, samples were measured to determine native acetaldehyde and methanol concentrations to be used in the spike recovery calculations. The analyte spiking gases contained a low concentration of sulfur hexafluoride (SF_6). The determined SF_6 concentration in the spiked sample was used to calculate the dilution factor of the spike and thus used to calculate the concentration of the spiked acetaldehyde and methanol. The spike target dilution ratio was 1:10 or less.

The following equation illustrates the percent recovery calculation.

$$DF = \frac{SF6(spk)}{SF6(direct)}$$ (Sec. 9.2.3 (3) USEPA Method 320)

$$CS = DF * Spike(dir) + Unspike(1 - DF)$$ (Sec. 9.2.3 (4) USEPA Method 320)

DF = Dilution factor of the spike gas
$SF_{6(dir)}$ = SF_6 concentration measured directly in undiluted spike gas
$SF_{6(spk)}$ = Diluted SF_6 concentration measured in a spiked sample
$Spike_{dir}$ = Concentration of the analyte in the spike standard measure by the FTIR directly
CS = Expected concentration of the spiked samples
Unspike = Native concentration of analytes in unspiked samples

Post Collection Data Validation

As part of the data validation procedure, reference spectra are manually fit to that of the sample spectra and a concentration is determined. The reference spectra are scaled to match the peak amplitude of the sample, thus providing a scale factor. The scale factor multiplied by the reference spectra concentration is used to determine the concentration value for the sample spectra. Sample pressure and temperature corrections are then applied to compute the final sample concentration. The manually calculated results are then compared with the software-generated results. The data is then validated if the two concentrations are within ± 20% agreement. If there is a difference greater than ± 20% the spectra are reviewed for possible spectra interferences or any other possible causes leading to incorrectly quantified data.

Detection Limit

The detection limit of each analyte was calculated following Annex A2 of ASTM D6348-12 procedure using spectra that contained similar amounts of moisture and carbon dioxide.

Analyte	Detection Limit (ppmv wet)	Detection Limit (%v)
Methane	1.0	-
Ethane	0.5	-
Moisture	-	0.1

QA/QC data are found in Appendix H. Copies of gas cylinder certifications are found in Appendix J. All concentration data were recorded on a wet, volume basis. The sample and data collection followed the procedures outlined in Method 320.

3.0 TEST RESULT SUMMARY

Upper Michigan Energy Resources Corporation
Mihm Generating Station
EURICE2
Gaseous Summary

Test No.	Date	Start Time	End Time	NO_x ppmvd	CO ppmvd	CO_2 % (dry)	O_2 % (dry)	Moisture, %	Flowrate, DSCFM	Flowrate, SCFM	THC ppm as C_3H_8 (wet)	CH_4 ppm as C_3H_8 (wet)*	C_2H_6 ppm as C_3H_8 (wet)	NMNE VOC ppm as C_3H_8 (wet)
1	03/15/19	08:10	09:09	8.0	4.9	5.4	11.4	9.8	53,209	58,856	173.2	159.3	7.1	6.9
2	03/15/19	10:52	11:51	8.0	4.6	5.3	11.5	9.7	52,840	58,580	172.8	158.3	7.1	7.3
3	03/15/19	13:33	14:32	7.9	4.6	5.3	11.4	9.7	52,440	57,902	171.4	156.9	7.5	7.0
Average				8.0	4.7	5.3	11.4	9.7	52,830	58,446	172.5	158.2	7.2	7.1

Emission Rate Summary

Test No.	Date	Start Time	End Time	Fd Factor, dscf/MMBtu	CO ppmvd @ 15% O_2	NO_x ppmvd @ 15% O_2	NMNE VOC ppmvd @ 15% O_2	CO lb/hr	NMNE VOC lb/hr as C_3H_8
1	03/15/19	08:10	09:09	8,710.0	3.0	5.0	4.7	1.1	2.8
2	03/15/19	10:52	11:51	8,710.0	2.9	5.0	5.1	1.1	2.9
3	03/15/19	13:33	14:32	8,710.0	2.9	4.9	4.8	1.1	2.8
Average				8,710.0	2.9	5.0	4.9	1.1	2.8

* Methane is corrected for a response factor of 1.21 for the TECO 51i analyzer

Client:	**Upper Michigan Energy Resources Corporation**
Facility:	**A.J. Mihm Generating Station**
Test Location:	**EURICE2 Outlet Duct**
Test Method:	**5/202**

Source Condition	Full Load	Full Load	Full Load	
Date	3/15/19	3/15/19	3/15/19	
Start Time	8:10	10:52	13:33	
End Time	10:15	12:58	15:38	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Temperature, °F	723.0	722.8	723.5	723.1
Flue Gas Moisture, percent by volume	9.6%	9.8%	9.4%	9.6%
Average Flue Pressure, in. Hg	29.19	29.19	29.19	29.19
Gas Sample Volume, dscf	82.94	82.481	81.566	82.329
Average Gas Velocity, ft/sec	102.481	101.986	100.863	101.777
Gas Volumetric Flow Rate, acfm	135,144	134,491	133,010	134,215
Gas Volumetric Flow Rate, dscfm	53,209	52,840	52,440	52,830
Gas Volumetric Flow Rate, scfm	58,856	58,580	57,902	58,446
Average %CO_2 by volume, dry basis	5.4	5.3	5.3	5.3
Average %O_2 by volume, dry basis	11.4	11.5	11.4	11.4
Isokinetic Variance	99.9	100.0	99.7	99.9
Standard Fuel Factor Fd, dscf/mmBtu	8,710.0	8,710.0	8,710.0	8,710.0
Filterable Particulate Matter (Method 5)				
grams collected	0.00055	0.00066	0.00048	0.00056
mg/dscm	0.234	0.283	0.208	0.2415
grains/acf	0.0000	0.0000	0.0000	0.0000
grains/dscf	0.0001	0.0001	0.0001	0.0001
lb/hr	0.047	0.056	0.041	0.048
lb/mmBtu (Standard Fd Factor)	0.0003	0.0003	0.0002	0.0003
Condensable Particulate Matter (Method 202)				
grams collected	0.00466	0.00449	0.00454	0.00456
grains/acf	0.0003	0.0003	0.0003	0.0003
grains/dscf	0.0009	0.0008	0.0009	0.0009
lb/hr	0.395	0.380	0.386	0.387
lb/mmBtu (Standard Fd Factor)	0.0024	0.0023	0.0024	0.0024
Total Particulate Matter (5/202)				
grams collected	0.00521	0.00515	0.00502	0.00513
grains/acf	0.0003	0.0003	0.0003	0.0003
grains/dscf	0.0010	0.0009	0.0010	0.0010
lb/hr	0.442	0.436	0.427	0.435
lb/mmBtu (Standard Fd Factor)	0.0027	0.0026	0.0026	0.0026

4.0 CERTIFICATION

MOSTARDI PLATT is pleased to have been of service to Upper Michigan Energy Resources Corporation. If you have any questions regarding this test report, please do not hesitate to contact us at 630-993-2100.

CERTIFICATION

As project manager, I hereby certify that this test report represents a true and accurate summary of emissions test results and the methodologies employed to obtain those results, and the test program was performed in accordance with the methods specified in this test report.

MOSTARDI PLATT

_______________________ Program Manager
Richard J. Sollars

_______________________ Quality Assurance
Scott W. Banach

APPENDICES

Appendix A – Plant Operating Data

A.J. Mihm Generating Station
Compliance Emissions Testing
Summary of Operating Data

EURICE2				
3/15/2019				
Method 5/202				
Start Time	*810*	*1052*	*1333*	
End Time	*1015*	*1258*	*1538*	
Method 3A, 7E, 10, 25A, and 320				
Start Time	*810*	*1052*	*1333*	
End Time	*909*	*1151*	*1432*	
	Run 1	**Run 2**	**Run 3**	**Average**
Engine (kW)	18,867	18,851	18,860	**18,859**
Engine natural gas use (pound/hour)	6,597	6,538	6,540	**6,558**
SCR/Oxidation catalyst inlet temperature) (deg F)	724	724	725	**725**
Pressure drop across the oxidation catalyst (PSI)	0.10	0.10	0.10	**0.10**
Urea injection rate to the SCR (gallons/hour)	6.3	6.1	6.0	**6.1**

EURICE2
SCR/Oxidation Catalyst Inlet Temperature

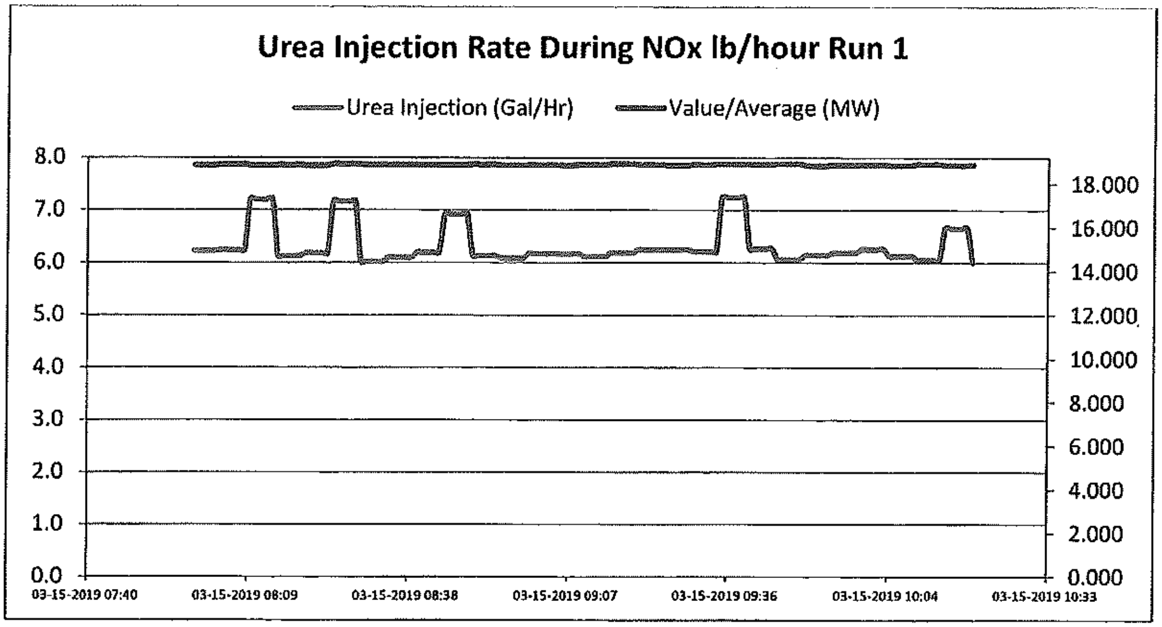
Start Time	End Time	Value/Average (Deg F)
03-15-2019 08:10 EDT	03-15-2019 08:15 EDT	723
03-15-2019 08:15 EDT	03-15-2019 08:20 EDT	723
03-15-2019 08:20 EDT	03-15-2019 08:25 EDT	723
03-15-2019 08:25 EDT	03-15-2019 08:30 EDT	724
03-15-2019 08:30 EDT	03-15-2019 08:35 EDT	725
03-15-2019 08:35 EDT	03-15-2019 08:40 EDT	725
03-15-2019 08:40 EDT	03-15-2019 08:45 EDT	725
03-15-2019 08:45 EDT	03-15-2019 08:50 EDT	725
03-15-2019 08:50 EDT	03-15-2019 08:55 EDT	725
03-15-2019 08:55 EDT	03-15-2019 09:00 EDT	725
03-15-2019 09:00 EDT	03-15-2019 09:05 EDT	725
03-15-2019 09:05 EDT	03-15-2019 09:10 EDT	725
03-15-2019 09:10 EDT	03-15-2019 09:15 EDT	725
03-15-2019 09:15 EDT	03-15-2019 09:20 EDT	725
03-15-2019 09:20 EDT	03-15-2019 09:25 EDT	725
03-15-2019 09:25 EDT	03-15-2019 09:30 EDT	725
03-15-2019 09:30 EDT	03-15-2019 09:35 EDT	725
03-15-2019 09:35 EDT	03-15-2019 09:40 EDT	724
03-15-2019 09:40 EDT	03-15-2019 09:45 EDT	723
03-15-2019 09:45 EDT	03-15-2019 09:50 EDT	723
03-15-2019 09:50 EDT	03-15-2019 09:55 EDT	724
03-15-2019 09:55 EDT	03-15-2019 10:00 EDT	725
03-15-2019 10:00 EDT	03-15-2019 10:05 EDT	725
03-15-2019 10:05 EDT	03-15-2019 10:10 EDT	725
03-15-2019 10:10 EDT	03-15-2019 10:15 EDT	725
03-15-2019 10:15 EDT	03-15-2019 10:20 EDT	725
03-15-2019 10:20 EDT	03-15-2019 10:25 EDT	725
03-15-2019 10:25 EDT	03-15-2019 10:30 EDT	725
03-15-2019 10:30 EDT	03-15-2019 10:35 EDT	725
03-15-2019 10:35 EDT	03-15-2019 10:40 EDT	725
03-15-2019 10:40 EDT	03-15-2019 10:45 EDT	725
03-15-2019 10:45 EDT	03-15-2019 10:50 EDT	725
03-15-2019 10:50 EDT	03-15-2019 10:55 EDT	725
03-15-2019 10:55 EDT	03-15-2019 11:00 EDT	725
03-15-2019 11:00 EDT	03-15-2019 11:05 EDT	725
03-15-2019 11:05 EDT	03-15-2019 11:10 EDT	725
03-15-2019 11:10 EDT	03-15-2019 11:15 EDT	724
03-15-2019 11:15 EDT	03-15-2019 11:20 EDT	724
03-15-2019 11:20 EDT	03-15-2019 11:25 EDT	725
03-15-2019 11:25 EDT	03-15-2019 11:30 EDT	725
03-15-2019 11:30 EDT	03-15-2019 11:35 EDT	725
03-15-2019 11:35 EDT	03-15-2019 11:40 EDT	724
03-15-2019 11:40 EDT	03-15-2019 11:45 EDT	723
03-15-2019 11:45 EDT	03-15-2019 11:50 EDT	723
03-15-2019 11:50 EDT	03-15-2019 11:55 EDT	723
03-15-2019 11:55 EDT	03-15-2019 12:00 EDT	723
03-15-2019 12:00 EDT	03-15-2019 12:05 EDT	723

EURICE2
SCR/Oxidation Catalyst Inlet Temperature

Start Time	End Time	Value/Average (Deg F)
03-15-2019 12:05 EDT	03-15-2019 12:10 EDT	723
03-15-2019 12:10 EDT	03-15-2019 12:15 EDT	724
03-15-2019 12:15 EDT	03-15-2019 12:20 EDT	725
03-15-2019 12:20 EDT	03-15-2019 12:25 EDT	725
03-15-2019 12:25 EDT	03-15-2019 12:30 EDT	727
03-15-2019 12:30 EDT	03-15-2019 12:35 EDT	726
03-15-2019 12:35 EDT	03-15-2019 12:40 EDT	725
03-15-2019 12:40 EDT	03-15-2019 12:45 EDT	725
03-15-2019 12:45 EDT	03-15-2019 12:50 EDT	725
03-15-2019 12:50 EDT	03-15-2019 12:55 EDT	725
03-15-2019 12:55 EDT	03-15-2019 13:00 EDT	725
03-15-2019 13:00 EDT	03-15-2019 13:05 EDT	724
03-15-2019 13:05 EDT	03-15-2019 13:10 EDT	723
03-15-2019 13:10 EDT	03-15-2019 13:15 EDT	725
03-15-2019 13:15 EDT	03-15-2019 13:20 EDT	724
03-15-2019 13:20 EDT	03-15-2019 13:25 EDT	725
03-15-2019 13:25 EDT	03-15-2019 13:30 EDT	725
03-15-2019 13:30 EDT	03-15-2019 13:35 EDT	725
03-15-2019 13:35 EDT	03-15-2019 13:40 EDT	725
03-15-2019 13:40 EDT	03-15-2019 13:45 EDT	724
03-15-2019 13:45 EDT	03-15-2019 13:50 EDT	723
03-15-2019 13:50 EDT	03-15-2019 13:55 EDT	723
03-15-2019 13:55 EDT	03-15-2019 14:00 EDT	723
03-15-2019 14:00 EDT	03-15-2019 14:05 EDT	724
03-15-2019 14:05 EDT	03-15-2019 14:10 EDT	725
03-15-2019 14:10 EDT	03-15-2019 14:15 EDT	725
03-15-2019 14:15 EDT	03-15-2019 14:20 EDT	725
03-15-2019 14:20 EDT	03-15-2019 14:25 EDT	725
03-15-2019 14:25 EDT	03-15-2019 14:30 EDT	725
03-15-2019 14:30 EDT	03-15-2019 14:35 EDT	725
03-15-2019 14:35 EDT	03-15-2019 14:40 EDT	725
03-15-2019 14:40 EDT	03-15-2019 14:45 EDT	725
03-15-2019 14:45 EDT	03-15-2019 14:50 EDT	725
03-15-2019 14:50 EDT	03-15-2019 14:55 EDT	725
03-15-2019 14:55 EDT	03-15-2019 15:00 EDT	725
03-15-2019 15:00 EDT	03-15-2019 15:05 EDT	725
03-15-2019 15:05 EDT	03-15-2019 15:10 EDT	725
03-15-2019 15:10 EDT	03-15-2019 15:15 EDT	725
03-15-2019 15:15 EDT	03-15-2019 15:20 EDT	725
03-15-2019 15:20 EDT	03-15-2019 15:25 EDT	725
03-15-2019 15:25 EDT	03-15-2019 15:30 EDT	725
03-15-2019 15:30 EDT	03-15-2019 15:35 EDT	725
03-15-2019 15:35 EDT	03-15-2019 15:40 EDT	725

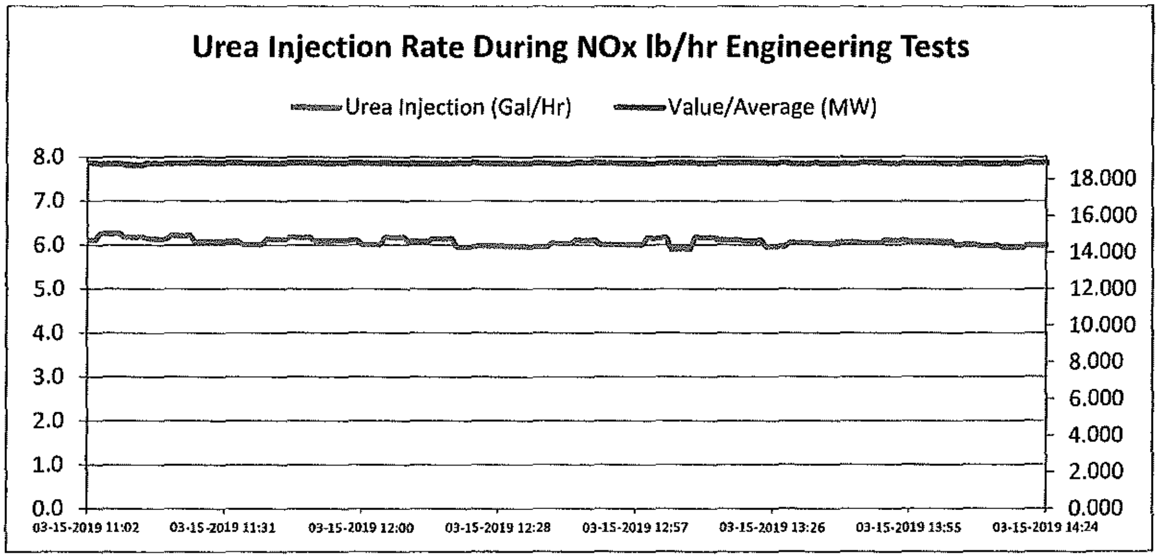
Discussion of SCR Operational Issues During NOx Compliance Testing

During Run 1 of Method 3A, 7E and 320 NOx pound/hour compliance testing at EURICE2 (0810-0909), urea injection to the Selective Catalytic Reduction (SCR) control device fluctuated unexpectedly as shown in the graph below.



At the time of the testing on 3/15/2019, preliminary results for Run 1 were 2.9 pounds/hour of NOx. Based on these preliminary results and the SCR injection rate trend, UMERC contacted the DEGLE testing representative to inform him of the results and the operational issues observed during the run. DEGLE confirmed UMERC could stop testing to address the observed operational issues. UMERC indicated the NOx pound/hour testing would be rescheduled after the SCR tuning was investigated. (The NOx pound/hour testing is due 180 days from engine startup, which is August 4, 2019 for EURICE2.)

Subsequent investigation the same day concluded the SCR urea injection had not been optimized by the equipment manufacturer prior to commencing the NOx pound/hour compliance testing. Upon recognition of the issue, the equipment manufacturer made some initial adjustments to the urea injection response. The results of these initial adjustments are shown in the graph below.



While UMERC had suspended the compliance testing, NOx pound/hour data was collected for engineering purposes during the remainder of the gaseous compliance testing on 3/15/2019. Final results of Run 1 and the engineering tests were obtained from Mostardi Platt several weeks after the compliance testing concluded. These results, which show compliance with applicable requiremetnts, are provided for informational purposes.

Upper Michigan Energy Resources Corporation
Mihm Generating Station
EURICE2
NOx lb/hour Summary

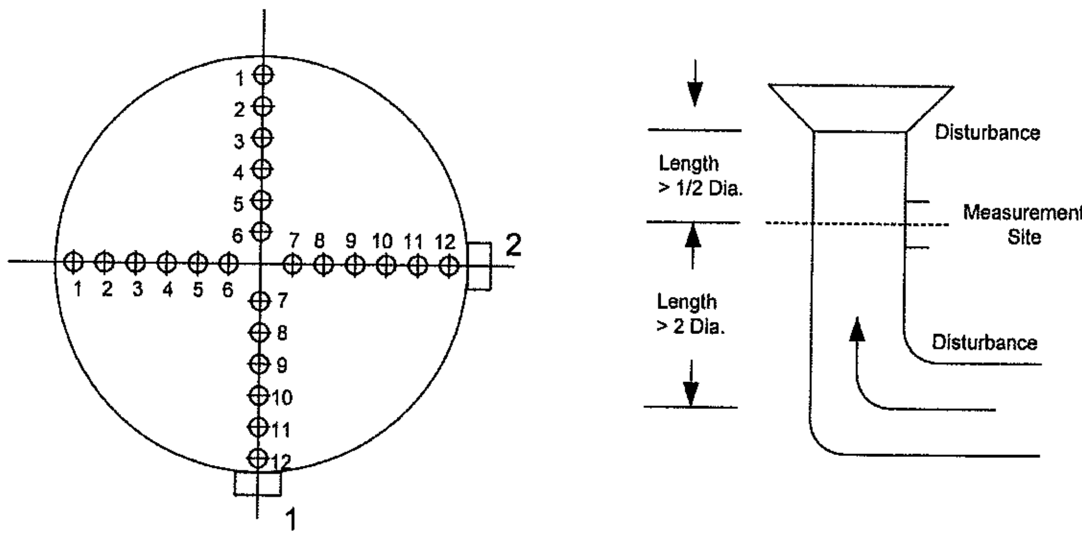
Test No.	Date	Start Time	End Time	NO_x ppmvd	CO_2 % (dry)	O_2 % (dry)	NO_x Inlet ppmvd @ 15% O2	Moisture, %	Flowrate, DSCFM	Flowrate, SCFM
1	03/15/19	08:10	09:09	7.95	5.4	11.4	4.9	9.8	53,209	58,856
Engineering	03/15/19	10:52	11:51	8.03	5.3	11.5	5.0	9.7	52,840	58,580
Engineering	03/15/19	13:33	14:32	7.90	5.3	11.4	4.9	9.7	52,440	57,902

Emission Rate Summary

Test No.	Date	Start Time	End Time	Fd Factor, dscf/MMBtu	NO_x ppmvd @ 15% O_2	NO_x lb/hr
1	03/15/19	08:10	09:09	8,710.0	4.9	3.03
Engineering	03/15/19	10:52	11:51	8,710.0	5.0	3.04
Engineering	03/15/19	13:33	14:32	8,710.0	4.9	2.97

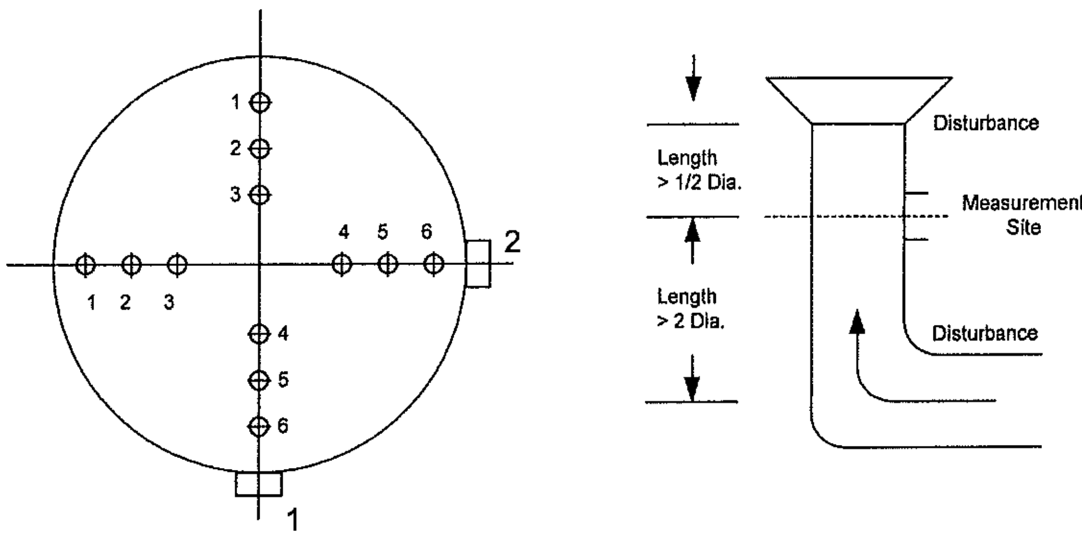
Appendix B - Test Section Diagrams

TPM TRAVERSE FOR ROUND DUCTS



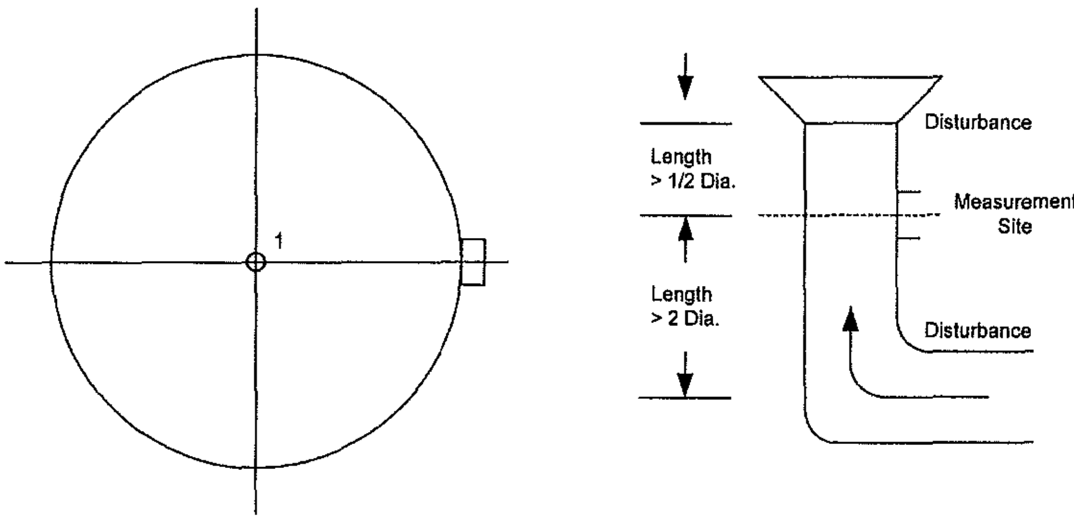
Job:	Upper Michigan Energy Resources Corporation A.J. Mihm Generating Station
Date:	3/15/19
Test Location:	EURICE2 Outlet Duct
Duct Diameter:	5.29 Feet
Duct Area:	21.979 Square Feet
No. Points Across Diameter:	24
No. of Ports:	2
Port Length:	8.0 Inches

STRATIFICATION TRAVERSE FOR ROUND DUCTS



Job:	Upper Michigan Energy Resources Corporation A.J. Mihm Generating Station
Date:	3/15/19
Test Location:	EURICE2 Outlet Duct
Duct Diameter:	5.29 Feet
Duct Area:	21.979 Square Feet
No. Points Across Diameter:	6
No. of Ports:	2
Port Length:	8.0 Inches

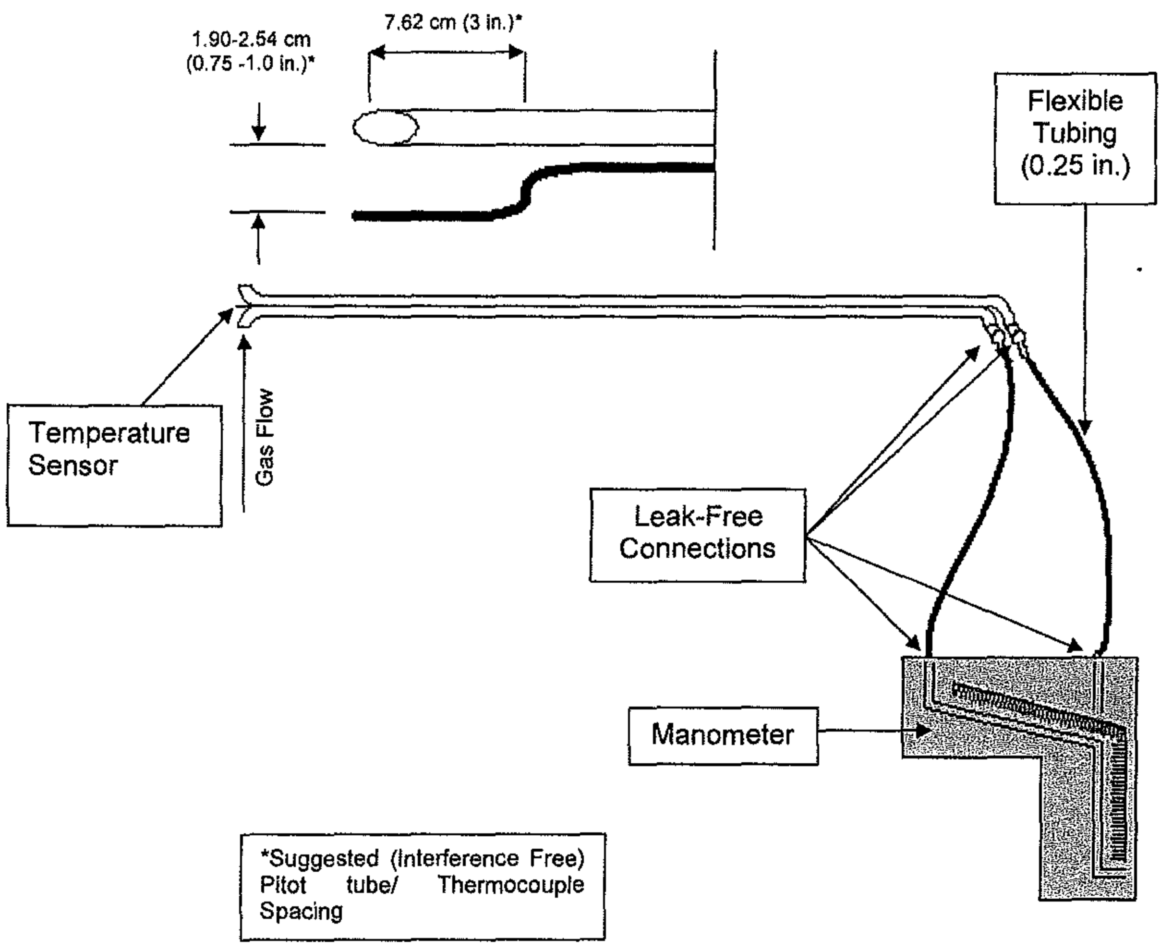
GASEOUS TRAVERSE FOR ROUND DUCTS



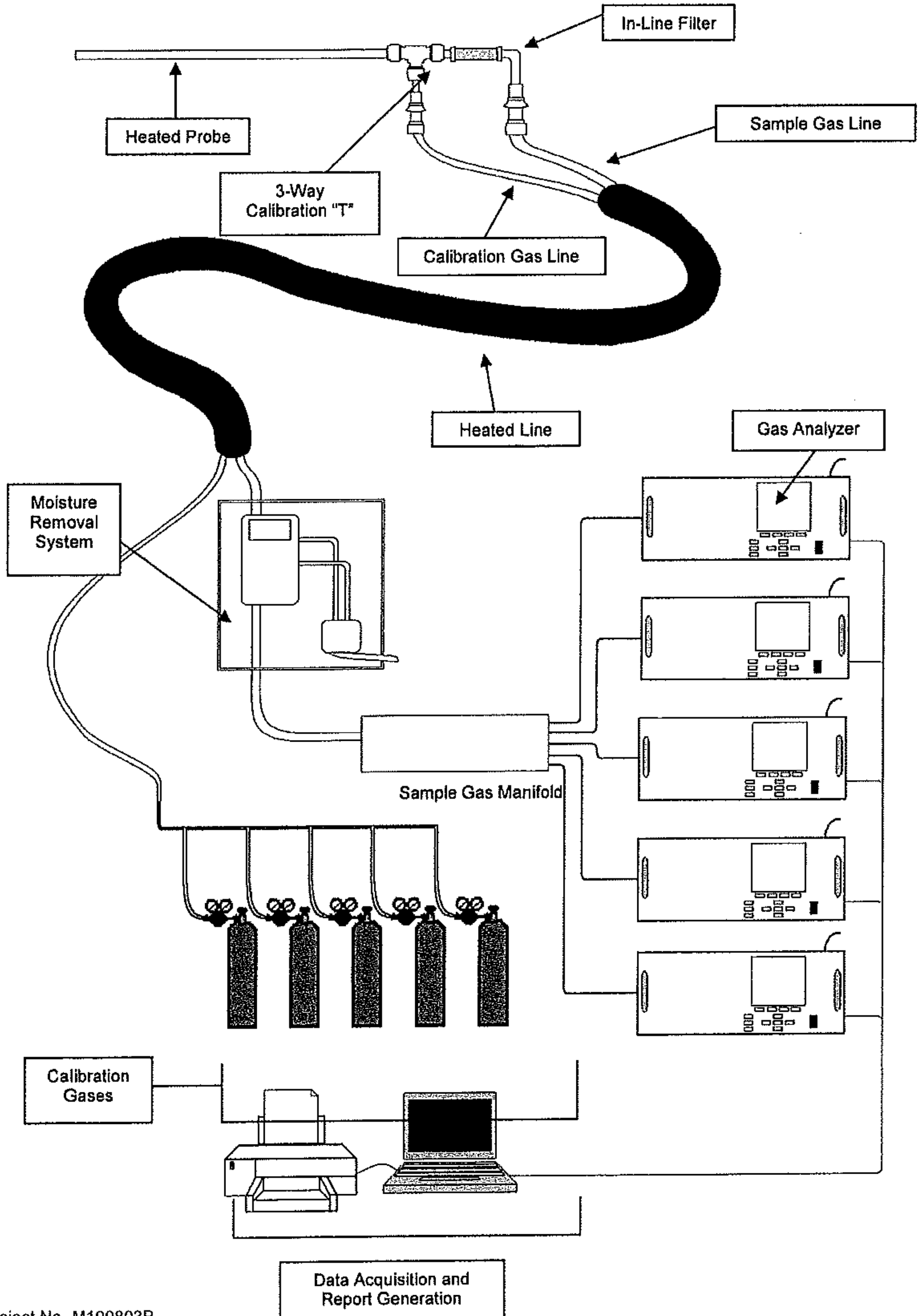
Job:	Upper Michigan Energy Resources Corporation A.J. Mihm Generating Station
Date:	3/15/19
Test Location:	EURICE2 Outlet Duct
Duct Diameter:	5.29 Feet
Duct Area:	21.979 Square Feet
No. Points Across Diameter:	1
No. of Ports:	1
Port Length:	8.0 Inches

Appendix C - Sample Train Diagrams

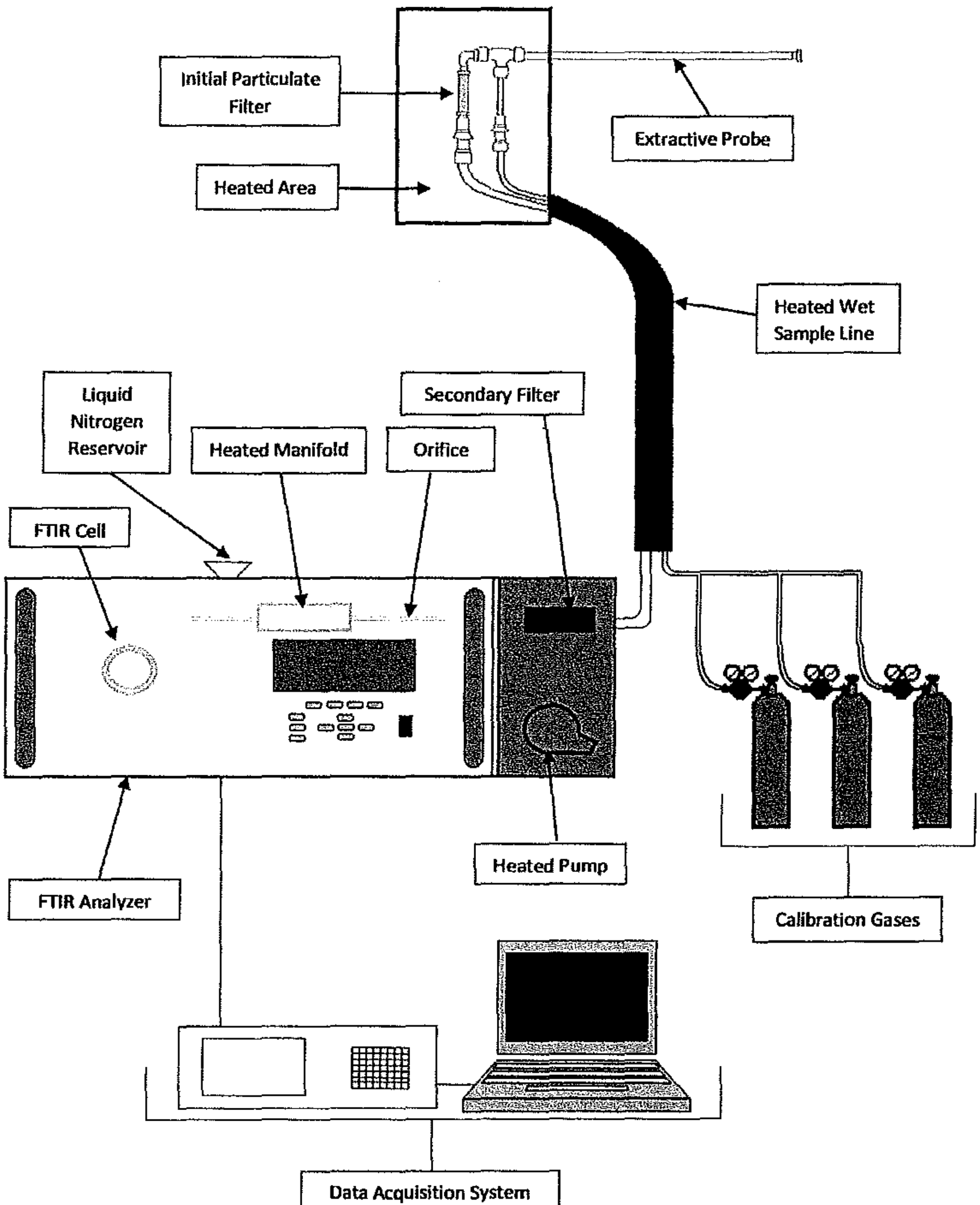
USEPA Method 2 – Type S Pitot Tube Manometer Assembly



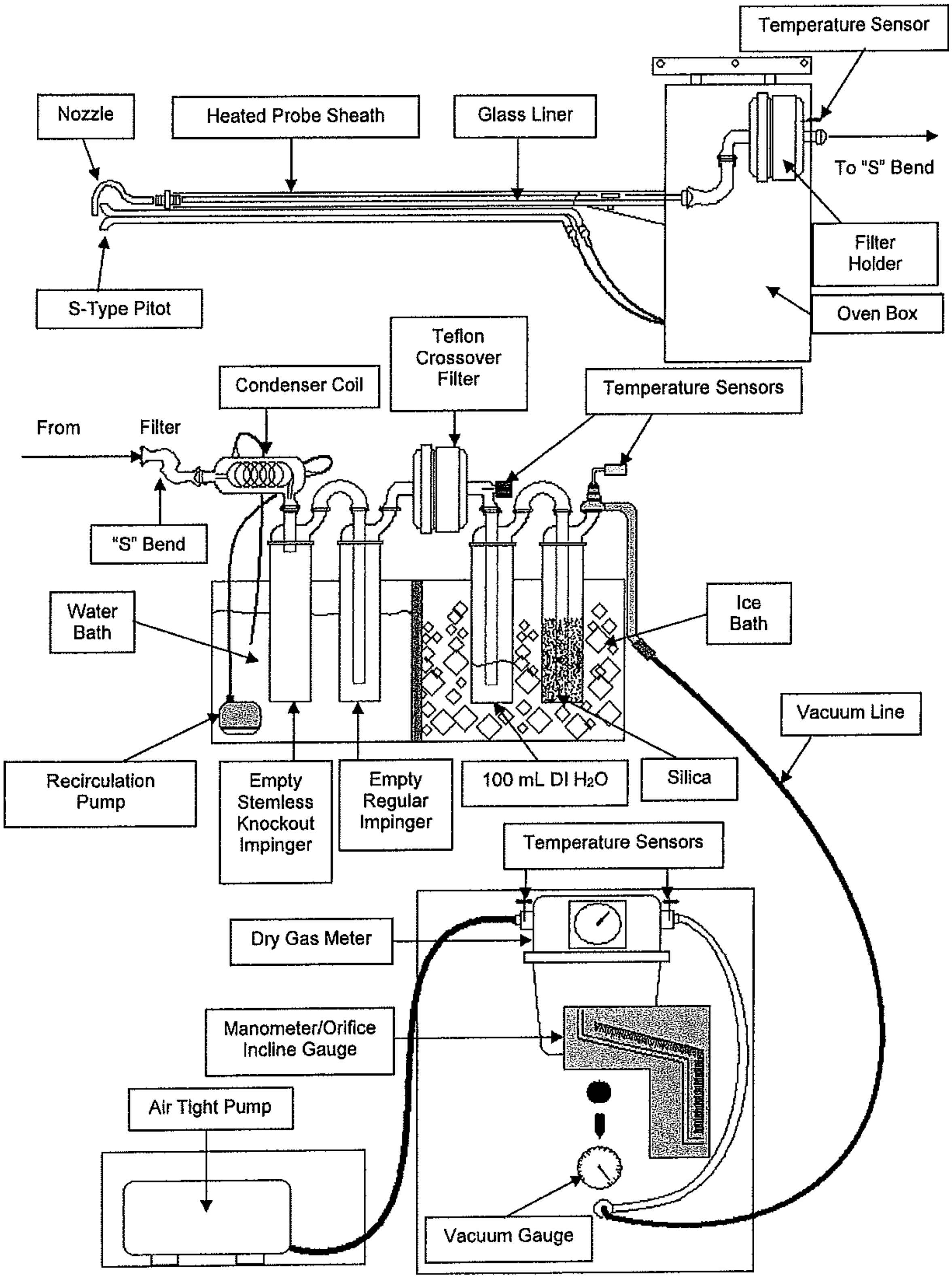
USEPA Method 3A Extractive Gaseous Sampling Diagram



USEPA Method 320 – Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared (FTIR) Spectroscopy Sample Train Diagram



USEPA Method 5/202- Condensable Particulate Matter



USEPA Method 25A – Total Gaseous Organic Compound Sample Train