BTEC Inc.

VOC, CO, NOx, $PM_{2.5}$, and Formaldehyde Emissions Test Plan

N 5910

Prepared for:

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KW
LFG use
LFG BTU
air to fuel ratio

inlet Pressure
exhaust temp

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TABLE OF CONTENTS

1.d Batch Operations

The Engines run steady all the time.

1.e Process Regulation

The Engines are monitored by KW output and Exhaust temp.

1.f Process Rating

Engines 3-7 are rated at 1148 bhp each, Engine 8 is rated at 861 bhp, and Engines 9-10 are rated at 2233 bhp each.

2. Air Pollution Control Equipment

Sections 2.a through 2.d summarize information regarding air pollution control equipment.

2.a Control Device Type

NA.

3. Permit No. and Emission Limits

AQD Permit to install No. 123-11 applies to the Lennon, Michigan facility and includes the emission limitations listed in Tables 1-4.

Table 1
FGENGINES3-6 Emission Limitations

Pollutant	Emission Limitation	Emission Limitation Units
NOx	5.8	lb/hr
CO	8.7	lb/hr
VOC	?	lb/hr
PM2.5	0.51	lb/hr
Formaldehyde	0.68	lb/hr

Table 2
EUNANRENGINE7 Emission Limitations

Pollutant	Emission Limitation	Emission Limitation Units
NOx	5.06	lb/hr
NOx	2.0	g/bhp*Hr
CO	7.85	lb/hr
CO	3.1	g/bhp*Hr
VOC	0.45	g/bhp*Hr
$PM_{2.5}$	0.51	lb/hr
$PM_{2.5}$	0.20	g/bhp*Hr
Formaldehyde	0.68	lb/hr

Table 3
EUNANRENGINE8 Emission Limitations

Pollutant	Emission Limitation	Emission Limitation Units
NOx	3.80	lb/hr
NOx	2.0	g/bhp*Hr
CO	5.75	lb/hr
CO	3.03	g/bhp*Hr
VOC	0.42	g/bhp*Hr
$PM_{2.5}$	0.38	lb/hr
$PM_{2.5}$	0.20	g/bhp*Hr
Formaldehyde	0.52	lb/hr

Table 4
FGENGINES9-10 Emission Limitations

Pollutant	Emission Limitation	Emission Limitation Units
NOx	2.96	lb/hr
NOx	0.6	g/bhp*Hr
CO	16.25	lb/hr
CO	3.3	g/bhp*Hr
VOC*	1.0	g/bhp*Hr
VOC**	0.63	g/bhp*Hr
$PM_{2.5}$	0.99	lb/hr
$PM_{2.5}$	1.0	g/bhp*Hr
Formaldehyde	2.07	lb/hr

*: Per NSPS JJJJ, this VOC limit does not include formaldehyde
**: This VOC limit includes formaldehyde

One representative engine from FGENGINES3-6 will be tested for NOx, CO, VOC, and formaldehyde.

EUNANRENGINE8 will be tested for NOx, CO, VOC, and formaldehyde.

Both Engine 9 and Engine 10 will be tested for NOx, CO, and VOC.

One engine out of Engine 9 or Engine 10 will be tested for $PM_{2.5}$ and formaldehyde.

4. Pollutants

BTEC will measure NOx, CO, VOC, $PM_{2.5}$, and Formaldehyde.

5. Sampling Train Description

The NO_x content of the exhaust gas will be measured using a TECO 42C NO_x gas analyzer (or equivalent) and the CO content will be measured using a TECO 48i CO gas analyzer (or equivalent). A sample of the gas stream will be drawn through an insulated stainless-steel probe with an in-line glass fiber filter to remove any particulate, a heated Teflon® sample line, and through a Universal Analyzers 3080PV electronic sample conditioner to remove the moisture from the sample before it enters the analyzer. Data will be recorded at 4-second intervals on a PC equipped with data acquisition software.

The VOC content of the exhaust gas will be measured using a JUM Model 109A analyzer (or equivalent). A sample of the gas stream will be drawn through an insulated stainless-steel probe with an in-line glass fiber filter to remove any particulate and a heated Teflon® sample line to prevent the condensation of any moisture from the sample before it enters the analyzer. Data will be recorded at 4-second intervals on a PC equipped with data acquisition software.

The JUM Model 109A analyzer utilizes two flame ionization detectors (FIDs) in order to report the average ppmv for total hydrocarbons (THC), as propane, as well as the average ppmv for methane (as methane). Upon entry, the analyzer splits the gas stream. One FID ionizes all of the hydrocarbons in the gas stream sample into carbon, which is then detected as a concentration of total hydrocarbons. Using an analog signal, specifically voltage, the concentration of THC is then sent to the data acquisition system (DAS), where recordings are taken at 4-second intervals to produce an average based on the overall duration of the test. This average is then used to determine the average ppmv for THC reported as the calibration gas, propane, in equivalent units.

The second FID reports methane only. The sample enters a chamber containing a catalyst that destroys all of the hydrocarbons present in the gas stream other than methane. As with the THC sample, the methane gas concentration is sent to the DAS and recorded. The methane concentration, reported as methane, can then be converted to methane, reported as propane, by dividing the measured methane concentration by the analyzer's response factor.

The analyzer's response factor is obtained by introducing a methane calibration gas to the calibrated J.U.M. 109A. The response of the analyzer's THC FID to the methane calibration gas, in ppmv as propane, is divided by the Methane analyzer's response to the methane calibration gas, in ppmv as methane.

For analyzer calibrations, calibration gases will be mixed to desired concentrations using an Environics Series 4040 Computerized Gas Dilution System. The Series 4040 consists of a single chassis with four mass flow controllers. The mass flow controllers are factory-calibrated using a primary flow standard traceable to the United State's National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11 point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity. A schematic drawing of the continuous emission system is provided as Figure 1.

40 CFR 60, Appendix A, Method 201A, *"Determination of PM_{10} and $PM_{2.5}$ Emissions From Stationary Sources"* and 40 CFR 60, Appendix A, Method 202, *"Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"* will be used to measure PM concentrations and calculate PM emission rates (see Figure 3 for a schematic of the sampling train). Triplicate approximate 120-minute test runs will be conducted for each source.

BTEC's Nutech® Model 2010 modular isokinetic $PM_{2.5}$ stack sampling system consists of (1) a stainless-steel nozzle, (2) a stainless-steel $PM_{2.5}$ head, (3) a vertical condenser, (4) an empty pot bellied impinger, (5) an empty modified Greenburg-Smith (GS) impinger, (6) unheated filter holder with a teflon filter, (7) a second modified GS impinger with 100 ml of deionized water, and a third modified GS impinger containing approximately 300 g of silica gel desiccant, (8) a length of sample line, and (9) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice.

40 CFR 60, Appendix A, Method 323, *"Measurement of Formaldehyde Emissions From Natural Gas-Fired Stationary Sources—Acetyl Acetone Derivitization Method"* will be used to measure formaldehyde concentrations and calculate formaldehyde emission rates (see Figure 4 for a schematic of the sampling train). Triplicate 60-minute test runs will be conducted on each source. — one spiked train & one spike sample taken to the field & analyzed by the lab.

BTEC's Method 323 sampling train will consist of (1) a stainless steel probe, (2) Teflon line to connect probe to impingers, (2) one empty midget impinger, (3) one midget impinger containing 20ml of reagent water, (4) one midget impinge containing silica gel dessicant, (5) a length of sample line, and (6) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice.

6. Sampling and Analysis Procedures

The emissions test program will utilize the following test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

- Method 1 - "Sample and Velocity Traverses for Stationary Sources"
- Method 2 - "Determination of Stack Gas Velocity and Volumetric Flowrate"

- Method 3A - "Determination of Molecular Weight of Dry Stack Gas"
- Method 4 - "Determination of Moisture Content in Stack Gases"
- Method 7E - "Determination of Nitrogen Oxide Emissions from Stationary Sources"
- Method 10 - "Determination of Carbon Monoxide Emissions from Stationary Sources"
- Method 25A - "Determination of total gaseous organic concentration using a flame ionization analyzer"
- Method 201A - "Determination of PM_{10} and $PM_{2.5}$ Emissions From Stationary Sources " (Constant Sampling Rate Procedure)
- Method 202 - "Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources Stationary Sources"
- Method 323 - "Measurement of Formaldehyde Emissions From Natural Gas-Fired Stationary Sources—Acetyl Acetone Derivitization Method"

7. Number and Length of Sampling Runs

Evaluation of pollutant emission rates will consist of triplicate 60-minute test runs for each engine, except for Method 201A/202 which will consist of triplicate approximate 120-minute test runs.

8. Sampling Port Locations

The sampling will be completed at the engine exhaust duct located outside the building. Two sampling ports positioned 90 degrees apart along the horizontal portion of the ductwork.

9. Estimated Exhaust Gas Conditions

Estimated flue gas conditions based on similar engines include a stack temperature of 800°F, exhaust gas velocity head of 2.6 in H_20, and moisture of 14.0%.

10. Process Operating Conditions

The engine runs at 2330 kW at an inlet pressure of 255 kPa if methane changes the inlet pressure changes and the operators adjust the engine fuel ratio to bring up Boost or kPa to maintain an average of 8% oxygen out exhaust.

11. Process Data

Inlet flow to engines, exhaust temp, methane content, and power output will all be monitored during the test; this includes any permit required information used to demonstrate the acceptable operations of emissions control processes and production rates.

12. Monitoring Data

NA

13. Chain of Custody Procedures

Sample collection and transfers will follow standard laboratory chain of custody procedures.

14. Field Quality Assurance/Quality Control Procedures

Field quality assurance/quality control procedures will consist of the analyzer calibrations required by and in conformance with the performance specifications of Method 7E and 205. Calibration gases will be mixed to desired concentrations using an Environics Series 4040 Computerized Gas Dilution System. The Series 4040 consists of a single chassis with four mass flow controllers. The mass flow controllers are factory-calibrated using a primary flow standard traceable to the United States National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11-point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity.

A field quality assurance check of the system will be performed pursuant to Method 205 by setting the diluted concentration to a value identical to a Protocol 1 calibration gas and then verifying that the analyzer response is the same with the diluted gas as with the Protocol 1 gas.

Sample collection and analysis procedures will include those proscribed by Methods 201A, 202, and 323. Reagent blanks and a filter blank will be prepared in the field and analyzed along with collected samples. After the completion of the third run of Method 323 an additional run with two side by side trains (one virgin and one spiked with a known quantity of formaldehyde) will be performed as requested by the AQD.

15. Laboratory Quality Assurance/Quality Control Procedures

Sample collection and analysis procedures will include those proscribed by Methods 201A, 202, and 323. Reagent blanks and a filter blank will be prepared in the field and analyzed along with collected samples. Audit samples will be analyzed if requested by AQD.

16. Test Personnel

Names, titles, and telephone numbers for the personnel directly involved with this study are listed in Table 1.

Table 1
Test Personnel

Name and Title	Affiliation	Telephone
Mr. Richard Spranger Environmental Manager	North American Natural Resources 4516 Rathbun Rd. Birch Run, Michigan 48415	(517) 719-1322
Mr. Barry P. Boulianne Senior Project Manager	BTEC 2615 Wolcott Street Ferndale, MI 48375	(248) 548-8072

Figures

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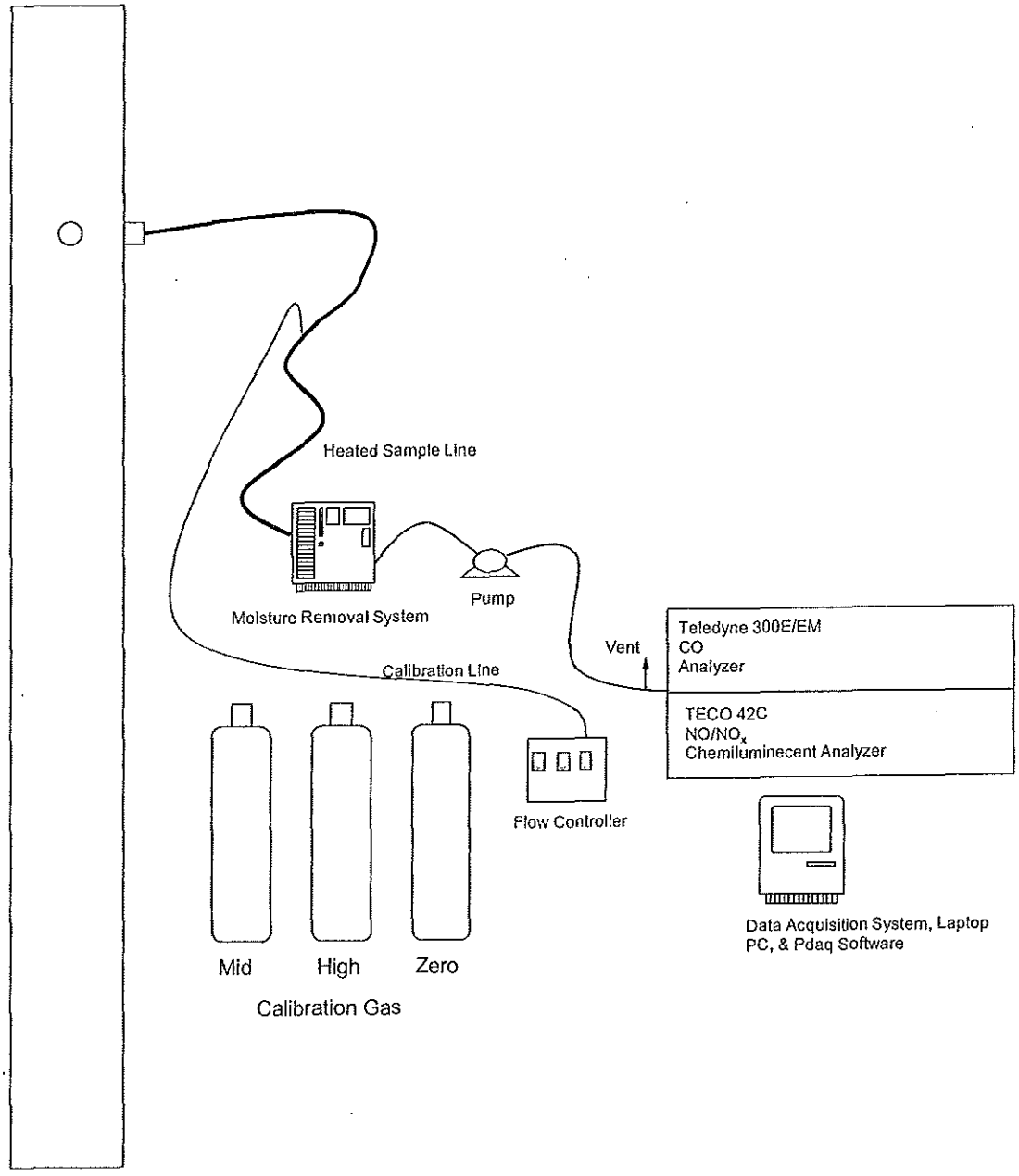

Figure No. 1

Site: USEPA Method 7E/10 North American Natural Resources Lennon, Michigan	Sampling Date: September 18, 2012	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

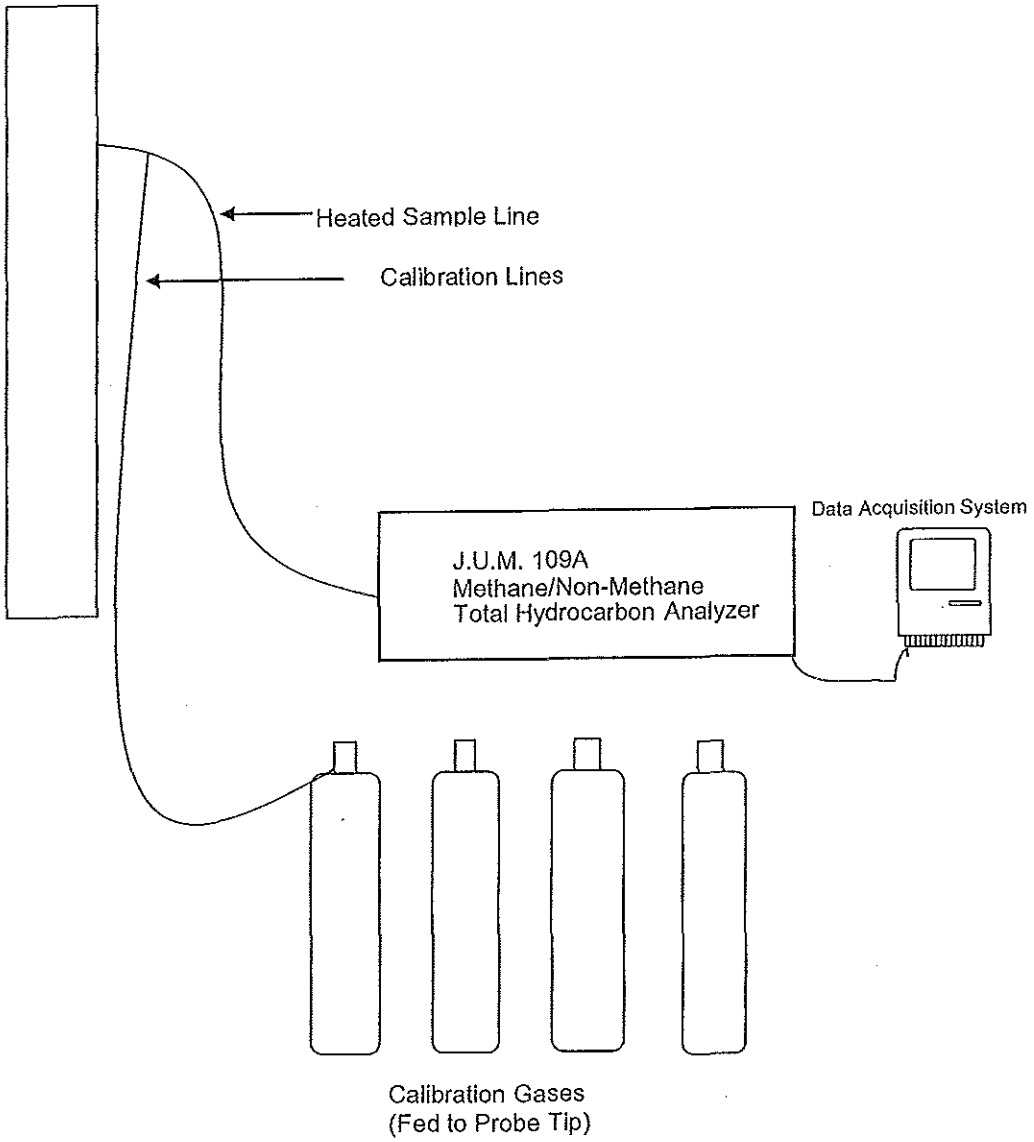

Figure No. 2

Site: USEPA Method 25A North American Natural Resources Lennon, Michigan	Sampling Date: September 18, 2012
	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

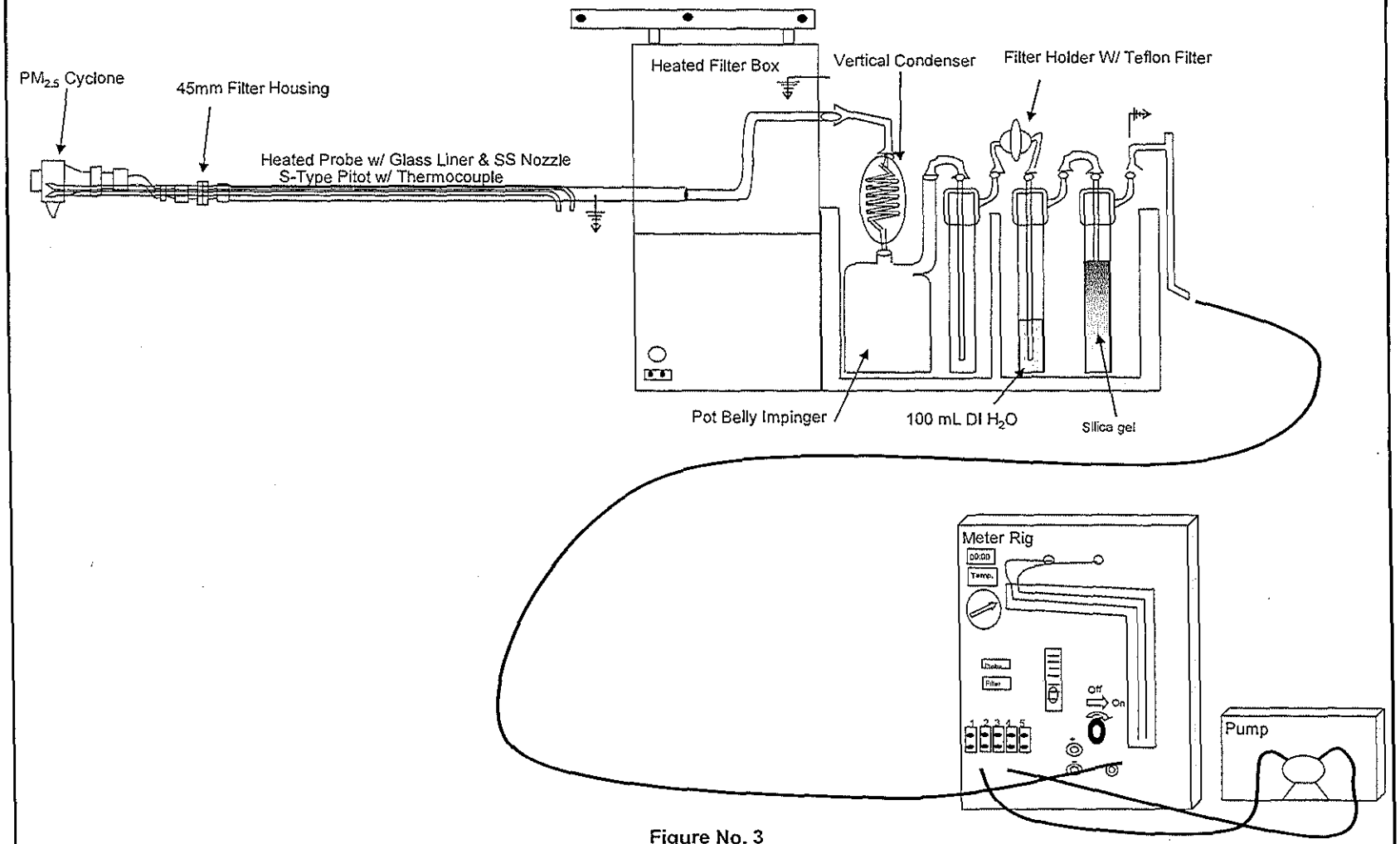

Figure No. 3

Site: USEPA 201a/202 North American Natural Resources Lennon, Michigan	Sampling Date: September 18, 2012	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

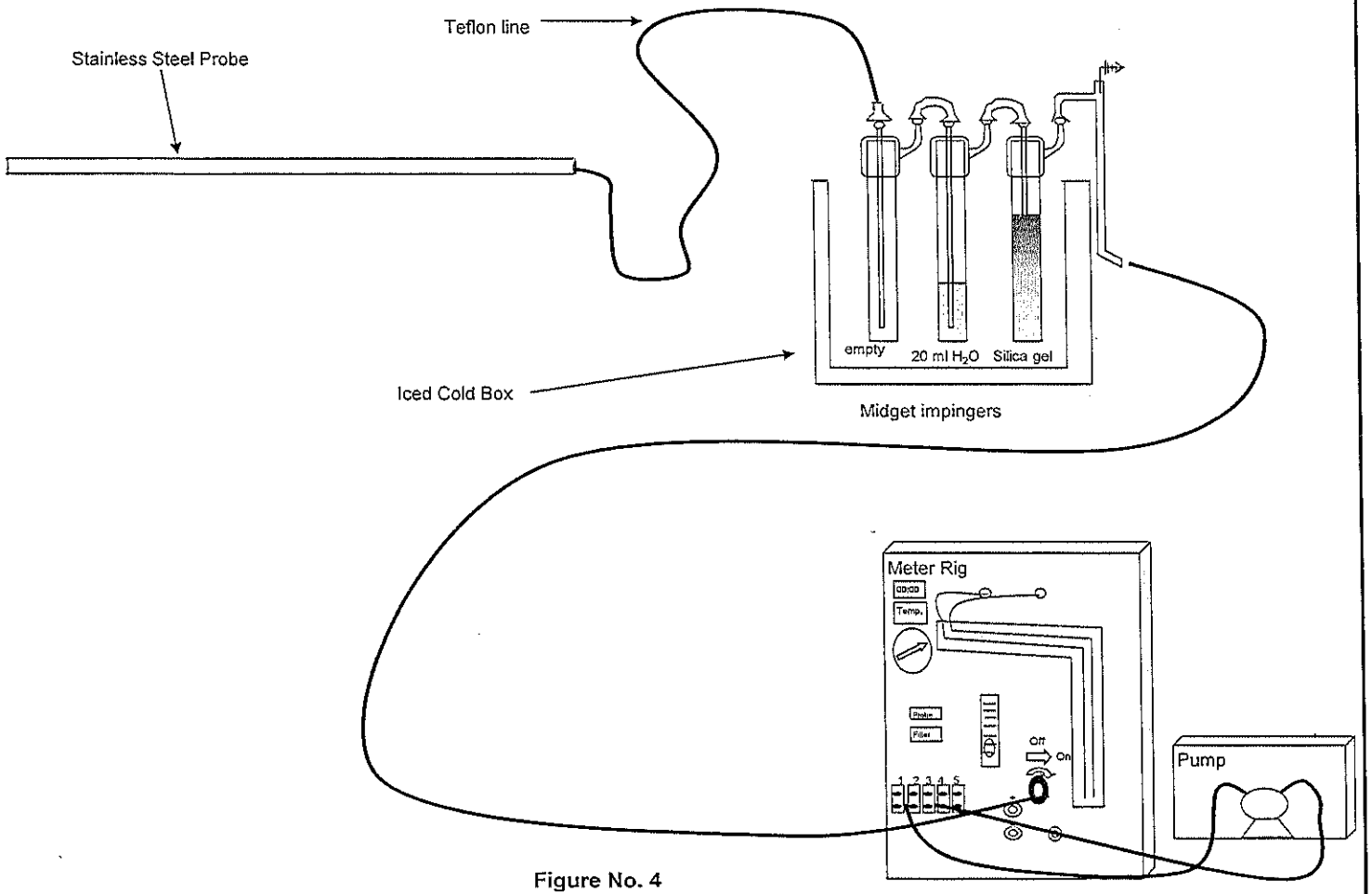

Figure No. 4

Site:	Sampling Date:	
USEPA Method 323 North American Natural Resources Lennon, Michigan	September 18, 2012	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan