



# St. Clair Unit 7 HCl Emissions Test Summary Report

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**MAY 29 2018**

**AIR QUALITY DIVISION**

*Prepared for:*

**DTE Energy**

St. Clair Power plant  
4877 M-29  
East China, Michigan

Project No. 049AS-378535.01  
May 25, 2018

BT Environmental Consulting, Inc.  
4949 Fernlee Avenue  
Royal Oak, Michigan 48073  
(248) 548-8070



**EXECUTIVE SUMMARY**

BT Environmental Consulting, Inc. (BTEC) was retained by DTE Energy (DTE) to conduct an evaluation of hydrogen chloride (HCl) from the St. Clair Unit 7 stack. The emissions test program was conducted on March 29<sup>th</sup>-30<sup>th</sup>, 2018.

Testing of the Unit 7 stack consisted of triplicate test runs for each pollutant. The emissions test program was required by 40 CFR Part 63, Subpart UUUUU. The results of the emission test program are summarized by Table I.

**Table I**  
**Overall Emission Summary**  
**Test Date: March 29<sup>th</sup>-30<sup>th</sup>, 2018**

<b>Emission Unit</b>	<b>Pollutant</b>	<b>Permit Limit</b>	<b>Test Result</b>
Unit 7	HCl	0.0020 lb/MMBtu	0.0020 lb/MMBtu



**1. Introduction**

BT Environmental Consulting, Inc. (BTEC) was retained by DTE Energy (DTE) to conduct an evaluation of hydrogen chloride (HCl) from the St. Clair Unit 7 stack. The emissions test program was conducted on March 29<sup>th</sup>-30<sup>th</sup>, 2018.

AQD has published a guidance document entitled “Format for Submittal of Source Emission Test Plans and Reports” (December 2013). The following is a summary of the emissions test program and results in the format suggested by the aforementioned document.

**1.a Identification, Location, and Dates of Test**

Sampling and analysis for the emission test program was conducted on March 29<sup>th</sup>-30<sup>th</sup>, 2018 at the DTE St. Clair facility located in East China, Michigan.

**1.b Purpose of Testing**

The emission limits are summarized by Table 1.

**Table 1  
Emission Limitations  
DTE St. Clair Unit 7  
Subpart UUUUU Emission Limitations**

<b>Emission Unit</b>	<b>Pollutant</b>	<b>Emission Limit</b>
Unit 7	HCl	0.0020 lb/MMBtu

**1.c Source Description**

The St Clair Power Plant (SCPP) located at 4901 Pointe Drive in East China Township, Michigan, employs the use of six (6) coal-fired boilers (units 1-4, 6, and 7). Units 1-4 each have Babcock and Wilcox boilers capable of producing 1,070,000 pounds per hour of steam. Units 1 and 4 are equipped with General Electric turbine generators each with a nominally rated capability of 167 megawatts (MW). Units 2 and 3 have Allis Chalmers turbine generators each with a nominally rated capability of 170 MW. Units 6 and 7 have Combustion Engineering boilers capable of producing 2,100,000 and 3,580,000 pounds of steam per hour respectively. The turbine generators on each unit were manufactured by Westinghouse and have a nominally rated capability of 325 and 500 MW respectively.



**1.d Test Program Contacts**

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The contacts for the source and test report are:

Mr. Mark Grigereit  
Air Quality Engineer  
DTE Energy  
6100 West Warren Ave.  
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(313) 897-1324

Mr. Barry Boulianne  
Senior Project Manager  
BT Environmental Consulting, Inc.  
4949 Fernlee Avenue  
Royal Oak, Michigan 48073  
(313) 449-2361

Names and affiliations for personnel who were present during the testing program are summarized by Table 2.

**Table 2  
Test Personnel**

<b>Name and Title</b>	<b>Affiliation</b>	<b>Telephone</b>
Mr. Matt Young Client Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Dave Trahan Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Jake Zott Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Molenda Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070

**2. Summary of Results**

Sections 2.a through 2.d summarize the results of the emissions compliance test program.



## **2.a Operating Data**

The units at SCPP operate as base loaded units. The operating parameters used to regulate the process are the same for any coal-fired boiler. In addition, opacity, NO<sub>x</sub> and SO<sub>2</sub> emissions are used to regulate the process.

## **2.b Applicable Permit**

AQD issued ROP B2796-2015b

## **2.c Results**

See Table 1 in Section 1.b.

## **3. Source Description**

Sections 3.a through 3.e provide a detailed description of the process.

### **3.a Process Description**

See Section 1.c.

### **3.b Process Flow Diagram**

A process flow diagram is available on request.

### **3.c Raw and Finished Materials**

The SCPP produces electricity used throughout SE Michigan.

### **3.d Process Capacity**

Full load conditions for unit 7 is 450 MW. The unit was tested at an average load of 358 MW. Individual loads for each run are included in Appendix E.

### **3.e Process Instrumentation**

The air pollution control equipment on Unit 7 consist of an American Standard electrostatic precipitator that has design collection efficiency of 99.6%. The exhaust stack is 600 feet tall with an internal diameter of 16 feet.

## **4. Sampling and Analytical Procedures**

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used.

#### 4.a Sampling Train and Field Procedures

Measurement molecular weight, and moisture content were conducted using the following reference test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

- Method 1 - *"Location of the Sampling Site and Sampling Points"*
- Method 3A - *"Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources" (Analyzer)*
- Method 4 - *"Determination of Moisture Content in Stack Gases"*

The O<sub>2</sub> and CO<sub>2</sub> content of the gas stream was measured using a Servomex 4100 gas analyzer. An integrated bag sample was taken for each run, which was then drawn through a refrigerated Teflon® sample conditioner to remove the moisture from the sample before it entered the analyzer. Data was recorded on a PC equipped with data acquisition software. Recorded O<sub>2</sub> concentrations were averaged and reported for the duration of each test (as drift corrected per Method 7E). In accordance with Method 3A, a 3-point (zero, mid, and high) bias check and calibration check was performed on the analyzer prior to initiating the test program. Following each test run, a 2-point (zero and high) calibration drift check was performed. The analyzer was operated at the 0-25 ppm range.

Barometric pressure readings are from a calibrated barometer at CEM level and were provided by DTE. Barometric pressure readings are included in Appendix E along with boiler load information.

Exhaust gas moisture content was evaluated using Method 4. Exhaust gas was extracted as part of the HCl sampling trains and passed through the impinger configuration (see Figure 1). Exhaust gas moisture content was then determined gravimetrically.

#### 4.b HCl (USEPA Method 26)

40 CFR 60, Appendix A, Method 26, *"Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources non-isokinetic method"* was used to evaluate HCl concentrations. The Method 26A sampling train consisted of: (1) a heated borosilicate or quartz probe liner; (2) a heated borosilicate or quartz glass filter holder containing a pre-weighed 90-mm diameter filter with Teflon filter support; (3) a set of three Greensburg-Smith (GS) impingers with first and second containing 100 ml of 0.1 Normal Sulfuric Acid (0.1 N H<sub>2</sub>SO<sub>4</sub>), and the third empty (4) a modified GS impinger containing a known weight of silica gel desiccant; (5) a length of sample line, and (6) a Nutech control case equipped with a pump, dry gas meter, and calibrated orifice. Figure 1 provides an illustration of the Method 26 sample train. Triplicate 90-minute test runs were conducted on the Unit 7 exhaust under normal operating conditions.

After completion of the final leak test for each test run, the impinger train was carefully disassembled. The liquid volume of each impinger was measured gravimetrically and any

mass increase was noted on field sheets. The impinger catch solution was then transferred to pre-cleaned sample containers. The impingers were then triple rinsed with deionized water (DI H<sub>2</sub>O), and the rinses added to the H<sub>2</sub>SO<sub>4</sub> sample containers. The back-half of the filter holder was rinsed and added to the H<sub>2</sub>SO<sub>4</sub> sample container.

BTEC labeled each container with the test number, test location, and test date, and marked the level of liquid on the outside of the container. In addition, blank samples of the DI water and H<sub>2</sub>SO<sub>4</sub> and filter were collected. DI water and H<sub>2</sub>SO<sub>4</sub> samples were picked up by Enthalpy and analyzed at their laboratory in Durham, NC.

**4.c Recovery and Analytical Procedures**

HCl samples were sent to Enthalpy in Durham, NC.

**4.d Sampling Ports**

Diagrams of the stack showing sampling ports in relation to upstream and downstream disturbances are included as Figure 2.

**4.e Traverse Points**

Diagrams of the stack indicating traverse point locations and stack dimensions are included as Figure 2.

**5. Test Results and Discussion**

Sections 5.a through 5.k provide a summary of the test results.

**5.a Results Tabulation**

The overall results of the emissions test program are summarized by Table 3. Detailed results for the emissions test program are summarized by Table 4.

**Table 3  
Overall Emission Summary  
Test Date: March 29<sup>th</sup>-30<sup>th</sup>, 2018**

<b>Emission Unit</b>	<b>Pollutant</b>	<b>Emission Limit</b>	<b>Test Result</b>
Unit 7	HCl	0.0020 lb/MMBtu	0.0020 lb/MMBtu

**5.b Discussion of Results**

The test result for HCl was less than the limit.

**5.c Sampling Procedure Variations**

Method 26 was modified to use full size impingers.



#### **5.d Process or Control Device Upsets**

Full load conditions for unit 7 is 450 MW. The unit was tested at an average load of 358 MW. Individual loads for each run are included in Appendix E.

#### **5.e Control Device Maintenance**

No control device maintenance was performed during the stack testing.

#### **5.f Re-Test**

The emissions test program was not a re-test.

#### **5.g Audit Sample Analyses**

No audit samples were collected as part of the test program.

#### **5.h Calibration Sheets**

Relevant equipment calibration documents are provided in Appendix B.

#### **5.i Sample Calculations**

Sample calculations are provided in Appendix C.

#### **5.j Field Data Sheets**

Field documents relevant to the emissions test program are presented in Appendix A.

#### **5.k Laboratory Data**

Laboratory analytical results for this test program are presented in Appendix D.



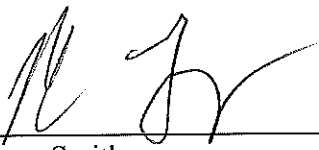


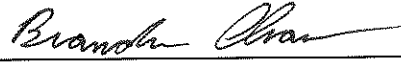
**MEASUREMENT UNCERTAINTY STATEMENT**

Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, Montrose Air Quality Services, LLC, (MAQS) personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, MAQS personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of our Quality Manual and ASTM D 7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

**Limitations**

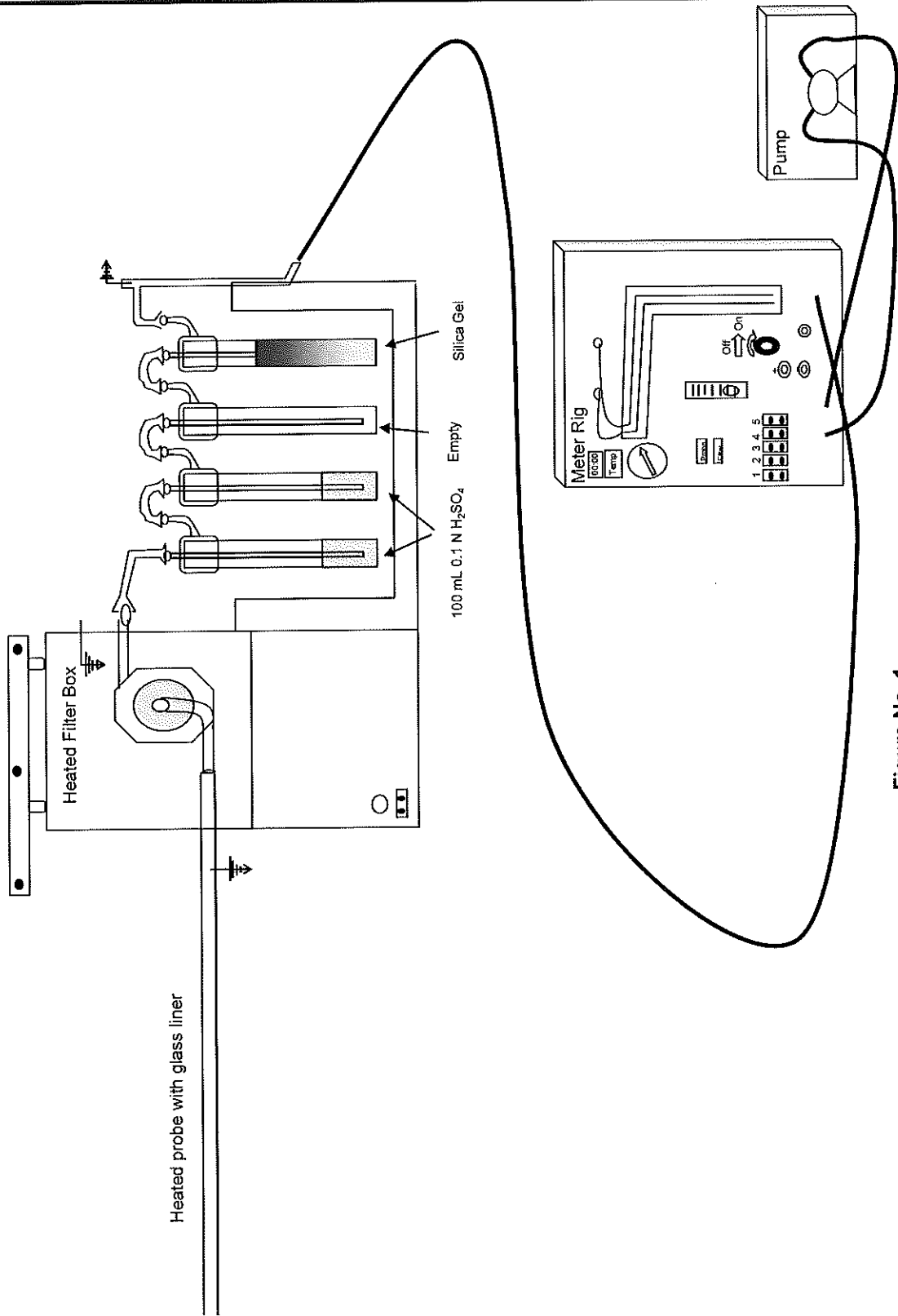
All testing performed was done in conformance to the ASTM D7036-04 standard. The information and opinions rendered in this report are exclusively for use by DTE Energy. BTEC will not distribute or publish this report without DTE Energy's consent except as required by law or court order. BTEC accepts responsibility for the competent performance of its duties in executing the assignment and preparing reports in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages.

This report was prepared by:   
for Steve Smith  
Project Manager

This report was reviewed by:   
Brandon Chase  
QA/QC Manager

**Table 4**  
**Unit 7 HCl Emission Rates**

Company Source Designation Test Date	DTE 7			Average
	3/29/2018	3/29/2018	3/30/2018	
<b>Meter/Nozzle Information</b>				
	Run 1	Run 2	Run 3	
Meter Temperature Tm (F)	73.9	70.4	63.5	69.3
Meter Pressure - Pm (in. Hg)	29.39	29.3	29.6	29.5
Measured Sample Volume (Vm)	66.49	65.8	65.6	66.0
Sample Volume (Vm-Std ft3)	64.97	63.8	65.1	64.6
Sample Volume (Vm-Std m3)	1.84	1.81	1.84	1.83
Condensate Volume (Vw-std)	7.063	6.766	6.219	6.683
Gas Density (Ps(std) lbs/ft3) (wet)	0.0751	0.0751	0.0755	0.0753
Gas Density (Ps(std) lbs/ft3) (dry)	0.0782	0.0782	0.0783	0.0782
Total weight of sampled gas (m g lbs) (wet)	5.41	5.31	5.39	5.37
Total weight of sampled gas (m g lbs) (dry)	5.08	4.99	5.10	5.06
<b>Stack Data</b>				
Average Stack Temperature - Ts (F)	270.2	270.0	265.0	268.4
Molecular Weight Stack Gas- dry (Md)	30.3	30.2	30.3	30.3
Molecular Weight Stack Gas-wet (Ms)	29.1	29.1	29.2	29.1
Stack Gas Specific Gravity (Gs)	1.004	1.004	1.009	1.006
Percent Moisture (Bws)	9.81	9.58	8.72	9.37
Water Vapor Volume (fraction)	0.0981	0.0958	0.0872	0.0937
Pressure - Ps ("Hg)	29.3	29.2	29.5	29.3
Area of Stack (ft2)	201.0	201.0	201.0	201.0
Oxygen (%)	6.89	7.28	6.84	7.00
Carbon Dioxide (%)	12.48	12.23	12.65	12.45
<b>Total HCl Weight (ug)</b>				
Sample Catch	4172.00	3812.00	4191.00	4058.33
Blank correction	0.00	0.00	0.00	0.00
Total	4172.00	3812.00	4191.00	4058.33
<b>Total HCl Concentration</b>				
lb/1000 lb (wet)	0.002	0.002	0.002	0.002
lb/1000 lb (dry)	0.002	0.002	0.002	0.002
mg/dscm (dry)	2.3	2.1	2.3	2.2
lb/dscf	1.42E-07	1.32E-07	1.42E-07	1.38E-07
<b>Total HCl Emission Rate</b>				
lb/MMBtu (using eq 19-6)	0.0020	0.0019	0.0020	0.0020



**Figure No. 1**

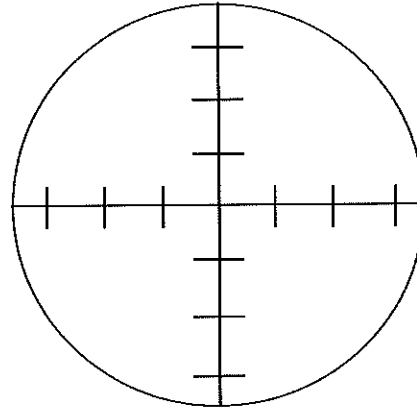
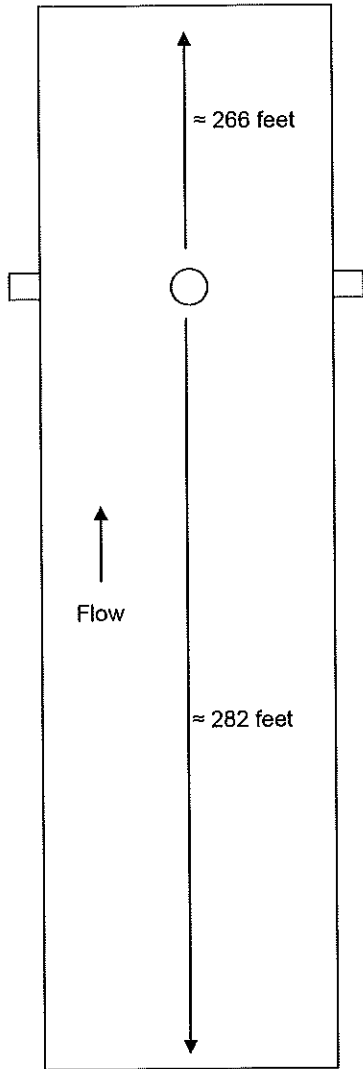
Sampling Date:  
March 29-30, 2018

BT Environmental Consulting, Inc.  
4949 Fernlee Avenue  
Royal Oak, Michigan 48073

Site:  
USEPA Method 26  
DTE Energy SCPP  
East China, MI



diameter = 192 inches



Not to Scale

Points	Distance "
1	8.4
2	28.0
3	56.8
4	135.2
5	164.0
6	183.6

Figure No. 2

Site:  
Unit 7  
DTE Energy SCPP  
East China, MI

Sampling Date:  
March 29-30, 2018

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