



S-50 Scrubber Emissions Test Report

Prepared for:

Occidental Chemical Corporation

Ludington, Michigan

Oxychem
1600 S. Madison Street
Ludington, MI 49431

RECEIVED

JUN 26 2018

AIR QUALITY DIVISION

Project No. 049AS-370896.01
June 4, 2018

BT Environmental Consulting, Inc.
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EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by Occidental Chemical Corporation (OxyChem) to evaluate particulate matter (PM) concentrations and emission rates from the exhaust of Flake D-Bulk S-50 Scrubber (EUFLAKEDBULK) at OxyChem in Ludington, MI. The emissions test program was conducted on May 3-4, 2018.

Testing of the scrubber consisted of triplicate 160-minute test runs. The emissions test program was required by MDEQ Air Quality Division Renewable Operating Permit (ROP) No. MI-ROP-B1846-2014. The results of the emission test program are summarized by Table I.

Table I
S-50 Scrubber Overall Emission Summary
Test Date: May 3-4, 2018

Source	Permit Limit	Average Test Result
S-50 Scrubber	0.1 lb / 1,000 lb exhaust gas	0.001 lb / 1,000 lb exhaust gas

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1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Occidental Chemical Corporation (OxyChem) to evaluate particulate matter (PM) concentrations and emission rates from the exhaust of Flake D-Bulk S-50 Scrubber (EUFLAKEDBULK) at OxyChem in Ludington, MI. The emissions test program was conducted on May 3-4, 2018.

Testing of the scrubber consisted of triplicate 160-minute test runs. The emissions test program was required by MDEQ Air Quality Division Renewable Operating Permit (ROP) No. MI-ROP-B1846-2014. The results of the emission test program are summarized by Table I. All testing was performed in accordance with BTEC test plan 049AS-370896.01.

AQD has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (March 2018). 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 May 3-4, 2018 at the OxyChem plant in Ludington, MI. The test program included evaluation of particulate matter emissions from the exhaust stack of S-50 Scrubber.

1.b Purpose of Testing

Testing was performed to demonstrate compliance with the PM emission limits as described in the AQD issued Renewable Operating Permit No. MI-ROP-B1846-2014. This ROP limits PM emissions from EUFLAKEDBULK to not more than 0.1 pounds per 1,000 pounds of dry exhaust gas.

1.c Source Description

EUFLAKEDBULK unit consists of three (3) product hoppers, truck and railcar load stations, a reclaim system to transfer calcium chloride from rail car to product hopper, and a pneumatic transport system to convey calcium chloride to the feed hopper for the dry calcium chloride process. A detailed process summary is included in Section 3.a.



1.d Test Program Contacts

The contact for the source and test report is:

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Names and affiliations for personnel who were present during the testing program are summarized by Table 1.

**Table 1
Test Personnel**

Name and Title	Affiliation	Telephone
Ms. Macie Sticker Process Engineer	Oxy Chemical 1600 S. Madison Street Ludington, MI 49431	(231) 845-4286
Mr. Mason Sakshaug Field Technician	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(989) 323-0355
Mr. David Trahan Field Technician	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Jeremy Howe Environmental Quality Analyst	MDEQ Air Quality Division	(231) 876-6687
Mr. Rob Dickman Environmental Quality Analyst	MDEQ Air Quality Division	(231) 775-4050

2. Summary of Results

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

2.a Operating Data

Process data monitored during the emissions test program included liquid flowrate and venturi differential pressure.

2.b Applicable Permit

The applicable permit for this emissions test program is Renewable Operating Permit (ROP) No. MI-ROP-B1846-2014. The S-50 Scrubber unit ID is EUFLAKEDBULK.

2.c Results

The overall results of the emission test program are summarized by Table 2 (see Section 5.a).

3. Source Description

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

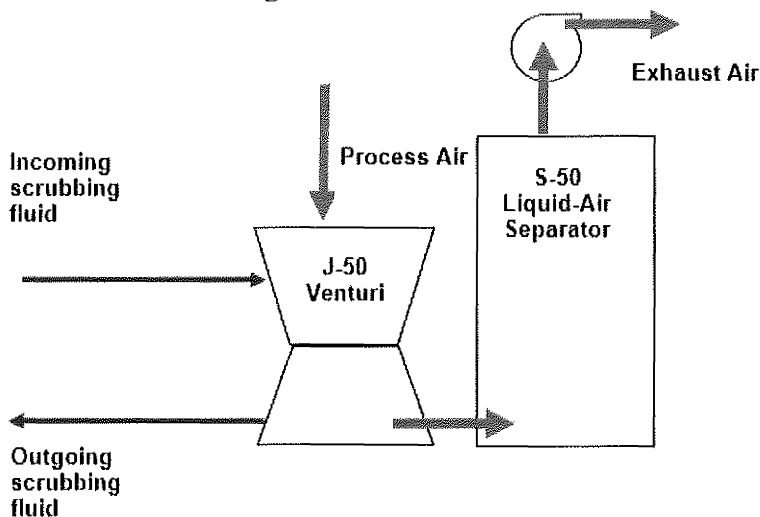
3.a Process Description

EUFLAKEDBULK unit consists of three (3) product hoppers, truck and railcar load stations, a reclaim system to transfer calcium chloride from rail car to product hopper, and a pneumatic transport system to convey calcium chloride to the feed hopper for the dry calcium chloride process.

A slight negative pressure is maintained on the material handling equipment to induce a draft in order to collect the dust generated during handling operations.

The exhaust air from EUFLAKEDBULK process is controlled by a venturi scrubber, S-50, followed by a liquid-air separator to remove contaminants before being vented. The venturi pressure drop and flow rate are monitored and controlled above the preset minimum. The liquid-air separator portion of the scrubber removes excess droplets by gravity due to lower air velocity. The air passes through a mist elimination section before being exhausted through the vent.

3.b Process Flow Diagram



3.c Raw and Finished Materials

The raw material used is calcium chloride.

3.d Process Capacity

The PM testing was performed at maximum normal scrubber load to demonstrate worst case vent emissions. Maximum normal scrubber load was achieved by railcar loading, pneumatic transporter operation, as well as operation of the reclaim system.

3.e Process Instrumentation

Process data monitored during the emissions test program included scrubber liquid flow rate and differential pressure.

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

The emissions test program utilized 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 3 - "Determination of Molecular Weight of Dry Stack Gas"(Fyrite)
- Method 4 - "Determination of Moisture Content in Stack Gases"
- Method 5 - "Determination of Particulate Matter Emissions from stationary sources"

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Method 1 and Method 2. S-type pitot tubes with thermocouple assemblies, calibrated in accordance with Method 2, Section 4.1.1, were used to measure exhaust gas velocity pressures (using a manometer) and temperatures during testing. The S-type pitot tube dimensions outlined in Sections 2-6 through 2-8 are within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) is assigned. A diagram of the sample points is provided in Figure 2.

Cyclonic flow checks were performed at each sampling location. The existence of cyclonic flow is determined by measuring the flow angle at each sample point. The flow angle is the angle between the direction of flow and the axis of the stack. If the average of the absolute values of the flow angles is greater than 20 degrees, cyclonic flow exists. Oxygen and carbon dioxide were determined using fyrite.

Exhaust gas was extracted as part of the Method 5 sampling train. Exhaust gas moisture content was determined gravimetrically.

40 CFR 60, Appendix A, Method 5, *"Determination of Particulate Emissions from*

Stationary Sources” was used to measure PM concentrations and calculate PM emission rates (see Figure 1 for a schematic of the sampling train).

BTEC’s Nutech® Model 2010 modular isokinetic stack sampling system consists of (1) a steel nozzle, (2) a glass probe, (3) a heated filter holder containing a pre weighed glass fiber filter (4) a Teflon connecting line to the impingers, (5) a set of four Greenburg-Smith (GS) impingers with the first two with 100 ml of deionized water (ii) an empty impinger, (iii) and an impinger filled with approximately 300 grams of silica gel. (6) a length of sample line, and (7) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice.

Upon completion of the final leak test for each test run, the filter was recovered, and the nozzle, probe, and the front half of the filter holder assembly were brushed and triple rinsed with acetone which was collected in a pre-cleaned sample container.

BTEC labeled each container with the test number, test location, and test date, then marked the level of liquid on the outside of the container. Blank samples of the filter and acetone were collected. BTEC personnel hand delivered all samples to the OxyChem lab for sample analysis.

4.b Recovery and Analytical Procedures

See section 4.a.

4.c Sampling Ports

A diagram of the stack showing sampling ports in relation to upstream and downstream disturbances is included as Figure 2.

4.d Traverse Points

A diagram of the stack indicating traverse point locations and stack dimensions is 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 2. Detailed results for the emissions test program are summarized by Table 3.

Table 2
S-50 Scrubber Overall Emission Summary
Test Date: May 3-4, 2018

Source	Permit Limit	Average Test Result
S-50 Scrubber	0.1 lb / 1,000 lb exhaust gas	0.001 lb / 1,000 lb exhaust gas

5.b Discussion of Results

The overall results of the emission test program are summarized by Table 2 (see Section 5.a). PM emissions from the scrubber were 0.001 lb / 1,000 lb exhaust gas, which is less than the permit limit of 0.1 lb / 1,000 lb exhaust gas.

5.c Sampling Procedure Variations

There were no sampling variations used during the emission compliance test program.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

There was no control equipment maintenance performed during the emissions test program.

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 are available in Appendix D.

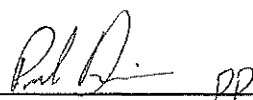
MEASUREMENT UNCERTAINTY STATEMENT

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 Oxychem. BTEC will not distribute or publish this report without Oxychem'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:

Mason Sakshaug
Field Technician

This report was reviewed by:

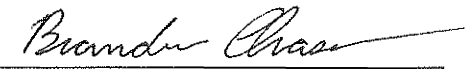
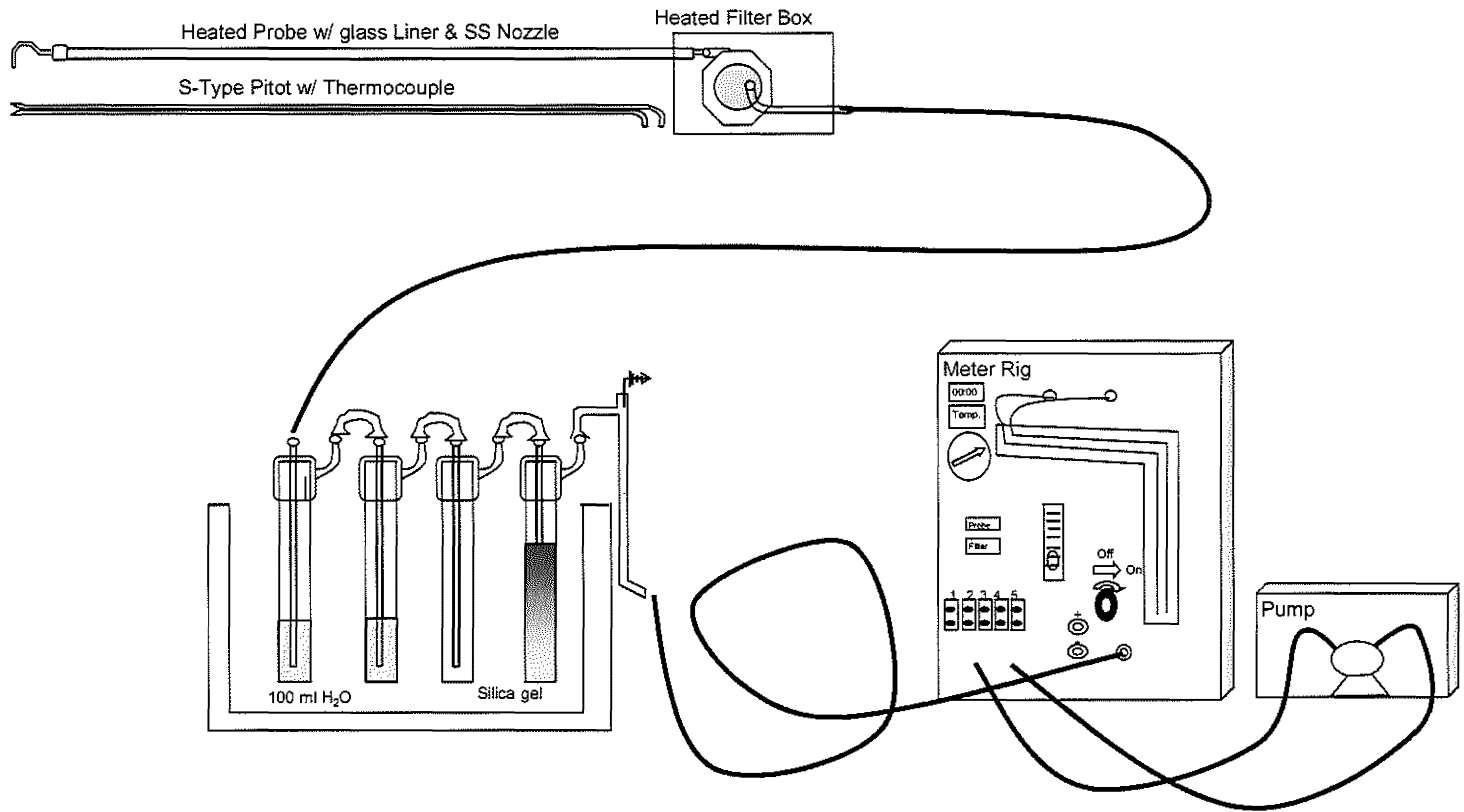
Brandon Chase
QA/QC Manager

Table 2
S-50 Scrubber Particulate Matter Emission Rates

Company				
		OxyChem		
Source Designation				
		S-50		
Test Date				
		5/3/2018	5/3/2018	5/4/2018
Meter/Nozzle Information				
	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	61.6	76.9	64.8	67.8
Meter Pressure - Pm (in. Hg)	29.5	29.4	29.1	29.3
Measured Sample Volume (Vm)	135.1	132.5	134.7	134.1
Sample Volume (Vm-Std ft3)	133.7	127.4	130.9	130.7
Sample Volume (Vm-Std m3)	3.79	3.61	3.71	3.70
Condensate Volume (Vw-std)	2.527	2.697	2.183	2.469
Gas Density (Ps(std) lbs/ft3) (wet)	0.0740	0.0740	0.0741	0.0740
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	10.08	9.62	9.86	9.85
Total weight of sampled gas (m g lbs) (dry)	9.97	9.49	9.76	9.74
Nozzle Size - An (sq. ft.)	0.000507	0.000507	0.000507	0.000507
Isokinetic Variation - I	99.9	100.0	99.7	99.9
Stack Data				
Average Stack Temperature - Ts (F)	57.8	73.1	64.3	65.0
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.6	28.6	28.7	28.6
Stack Gas Specific Gravity (Gs)	0.989	0.988	0.990	0.989
Percent Moisture (Bws)	1.85	2.07	1.64	1.86
Water Vapor Volume (fraction)	0.0185	0.0207	0.0164	0.0186
Pressure - Ps ("Hg)	29.3	29.3	28.9	29.2
Average Stack Velocity -Vs (ft/sec)	28.0	27.5	28.1	27.9
Area of Stack (ft2)	4.7	4.7	4.7	4.7
Exhaust Gas Flowrate				
Flowrate ft ³ (Actual)	7,984	7,834	8,005	7,941
Flowrate ft ³ (Standard Wet)	7,973	7,598	7,800	7,790
Flowrate ft ³ (Standard Dry)	7,825	7,441	7,672	7,646
Flowrate m ³ (standard dry)	222	211	217	217
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	3.9	4.2	5.5	4.6
Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.001	0.001	0.001
mg/dscm (dry)	1.0	1.2	1.5	1.3
gr/dscf	0.0005	0.0005	0.0006	0.0005
Total Particulate Emission Rate				
lb/ hr	0.03	0.03	0.04	0.04

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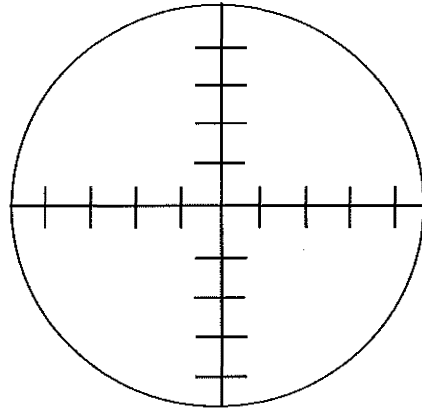
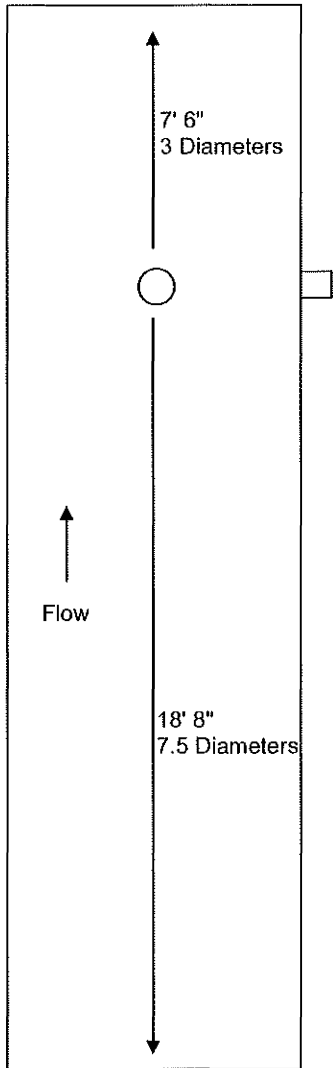
Site:
USEPA Method 5 independent
OxyChem
Ludington, MI

Sampling Date:
May 3-4, 2018

BT Environmental Consulting, Inc.
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diameter = 29.5 inches



Not to Scale

Points	Distance "
1	1.0
2	3.1
3	5.7
4	9.5
5	20.0
6	23.8
7	26.4
8	28.5

Figure No. 2

Site:
S-50
OxyChem
Ludington, MI

Sampling Date:
May 3-4, 2018

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