



PARTICULATE EMISSIONS TEST PROGRAM

Performed At The

**Occidental Chemical Company
Calcium Chloride Production Facility
EUPELLETCDRY, S-501/S-701 Pellet C Dryer Scrubber
Ludington, Michigan**

Test Dates

November 5 and 6, 2019

Report No.

TRC Environmental Corporation Report 349822.COMP

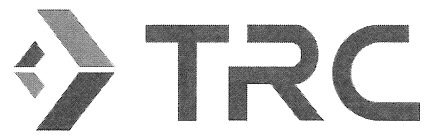
Report Submittal Date

December 12, 2019

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AIR QUALITY DIVISION**

TRC Environmental Corporation
7521 Brush Hill Road
Burr Ridge, Illinois 60527
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Report Certification

I certify that to the best of my knowledge:

- Testing data and all corresponding information have been checked for accuracy and completeness.
- Sampling and analysis have been conducted in accordance with the approved protocol and applicable reference methods (as applicable).
- All deviations, method modifications, or sampling and analytical anomalies are summarized in the appropriate report narrative(s).

A handwritten signature in black ink, appearing to read "D. Ryan", written over a horizontal line.

Douglas M. Ryan
AMS Group Manager

December 12, 2019
Date

TRC was operating in conformance with the requirements of ASTM D7036-04 during this test program.

A handwritten signature in black ink, appearing to read "B. Randall", written over a horizontal line.

Bruce Randall
TRC Emission Testing Technical Director



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PARTICULATE EMISSIONS TEST PROGRAM

1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed a particulate emission compliance test program on the dry calcium chloride process pellet C dryer (EUPELLETCDRY) scrubber system (stack ID# SV06052) at the Ludington Facility, located in the Dry Calcium Chloride Production plant, owned and operated by Occidental Chemical Corporation, Calcium Chloride Operations, Ludington, Michigan. Testing was performed on November 5 and 6, 2019. The tests were authorized by and performed for OxyChem.

1.1 Project Contact Information

Participants		
Test Facility	Occidental Chemical Company Ludington Plant 1600 S. Madison Ludington, Michigan 49431	Ms. Macie Sticker Process Engineer (231) 845 - 4386 (phone) MacieLeigh_Sticker@oxy.com Mr. Randy Haight Analytical Specialist (231) 845 - 4500 (phone) Randolph_Haight@oxy.com Mr. Steve Jones Environmental Manager (231) 845 - 4390 (phone) Steven_W_Jones@oxy.com
Air Emissions Testing Body (AETB)	TRC Environmental Corporation 7521 Brush Hill Road Burr Ridge, Illinois 60527	Mr. Chris Miller Field Team Leader (815) 341-1883 (phone) (312) 533-2070 (fax) cmiller@trccompanies.com

The tests were conducted by Chris Miller and Deshawn Benn of TRC. Documentation of the on-site ASTM D7036-04 Qualified Individual (QI) can be located in the appendix to this report.



2.0 SUMMARY OF RESULTS

Complete test results of this test program are detailed in Section 6.0.

Parameter	Average Measured Emissions
Particulate Matter lb/1000 lb of exhaust gas, dry basis	0.02

The table below summarizes the test methods used, as well as the number and duration of each test:

Unit ID/ Sample Location	Parameter Measured	Test Method	No. of Runs	Run Duration
S-701 / SV06052	Particulate Matter	USEPA Method 5	3	168 min

3.0 DISCUSSION OF RESULTS

No problems were encountered with the testing equipment during the test program.

Source operation appeared normal during the first two emissions test runs performed on November 6, 2019. The process went down after run number two and OxyChem was not able to resume operations. As a result, TRC was unable to conduct a third compliance test run. After consulting representatives from MDEQ, it was decided that the compliance report would be completed using results from the two compliance test runs, along with the 168-minute engineering test run performed on November 5, 2019 (Eng. Run 2). Engineering Run 2 was conducted in complete accordance with USEPA Method 5.

NOTE: On the appended chain of custody records, samples are incorrectly identified as runs 1, 2 and 3 (based on the intended compliance use). In order to maintain document integrity, the original (unedited) records have been appended. The following table provides correct descriptions for each sample:

Sample ID	Date Sampled	Description on Chain of Custody	Correct Description
349822-98	11/5/19	S701-Stack-M5-Run 1-Container 1	S701-Stack-M5-Eng. Run 2-Container 1
349822-99	11/5/19	S701-Stack-M5-Run 1-Container 2	S701-Stack-M5-Eng. Run 2-Container 1
349822-100	11/6/19	S701-Stack-M5-Run 2-Container 1	S701-Stack-M5-Run 1-Container 1
349822-101	11/6/19	S701-Stack-M5-Run 2-Container 2	S701-Stack-M5-Run 1-Container 2
349822-102	11/6/19	S701-Stack-M5-Run 3-Container 1	S701-Stack-M5-Run 2-Container 1
349822-103	11/6/19	S701-Stack-M5-Run 3-Container 2	S701-Stack-M5-Run 2-Container 2



Unit operating data was recorded by plant personnel and is appended to this report. Laboratory analysis of samples was performed by OxyChem personnel and is appended.

4.0 SAMPLING AND ANALYSIS PROCEDURES

All testing, sampling, analytical, and calibration procedures used for this test program were performed in accordance with the methods presented in the following sections. Where applicable, the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994 was used to supplement procedures.

4.1 Determination of Sample Point Locations by USEPA Method 1

This method is applicable to gas streams flowing in ducts, stacks, and flues and is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rates from stationary sources. In order to qualify as an acceptable sample location, it must be located at a position at least two stack or duct equivalent diameters downstream and a half equivalent diameter upstream from any flow disturbance.

The cross-section of the measurement site was divided into a number of equal areas, and the traverse points were then located in the center of these areas. The minimum number of points were determined from Figure 1-1 (particulate) of USEPA Method 1.

4.2 Volumetric Flow Rate Determination by USEPA Method 2

This method is applicable for the determination of the average velocity and the volumetric flow rate of a gas stream.

The gas velocity head (ΔP) and temperature were measured at traverse points defined by USEPA Method 1. The velocity head was measured with a Type S (Stausscheibe or reverse type) pitot tube and oil-filled manometer; and the gas temperature was measured with a Type K thermocouple. The average gas velocity in the flue was calculated based on: the gas density (as determined by USEPA Methods 3 and 4); the flue gas pressure; the average of the square roots of the velocity heads at each traverse point, and the average flue gas temperature.

4.3 CO₂ and O₂ Determination by USEPA Method 3

This method is applicable for the determination of CO₂ and O₂ concentrations and dry molecular weight of a sample from an effluent gas stream of a fossil-fuel combustion process or other process.

Gas samples were extracted from the stack by grab sampling during each test and analyzed for percent CO₂ and percent O₂ using a Fyrite.



4.4 Filterable PM Determination by USEPA Method 5

This method is applicable for the determination of PM emissions from stationary sources. USEPA Methods 2-4 were performed concurrently with, and as an integral part of, these determinations.

Flue gas was withdrawn isokinetically from the source at traverse points determined per USEPA Method 1, and PM was collected in the nozzle, probe liner, and on a glass fiber filter. The probe liner and filter were maintained at a temperature of $120 \pm 14^{\circ}\text{C}$ ($248 \pm 25^{\circ}\text{F}$) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. The PM mass, which included any material that condensed at or above the filtration temperature, was determined gravimetrically after the removal of uncombined water, by OxyChem personnel.

5.0 QUALITY ASSURANCE PROCEDURES

TRC integrates our Quality Management System (QMS) into every aspect of our testing service. We follow the procedures specified in current published versions of the test Method(s) referenced in this report. Any modifications or deviations are specifically identified in the body of the report. We routinely participate in independent, third party audits of our activities, and maintain:

- Louisiana Environmental Lab Accreditation Program (LELAP) accreditation;
- Accreditation from the Stack Testing Accreditation Council (STAC) and the American Association for Laboratory Accreditation (A2LA) that our operations conform with the requirements of ASTM D 7036 as an Air Emission Testing Body (AETB).

These accreditations demonstrate that our systems for training, equipment maintenance and calibration, document control and project management will fully ensure that project objectives are achieved in a timely and efficient manner with a strict commitment to quality.

All calibrations are performed in accordance with the test Method(s) identified in this report. If a Method allows for more than one calibration approach, or if approved alternatives are available, the calibration documentation in the appendices specifies which approach was used. All measurement devices are calibrated or verified at set intervals against standards traceable to the National Institute of Standards and Technology (NIST). NIST traceability information is available upon request.



ASTM D7036-04 specifies that: *“AETBs shall have and shall apply procedures for estimating the uncertainty of measurement. Conformance with this section may be demonstrated by the use of approved test protocols for all tests. When such protocols are used, reference shall be made to published literature, when available, where estimates of uncertainty for test methods may be found.”* TRC conforms with this section by using approved test protocols for all tests.



6.0 TEST RESULTS SUMMARY



PARTICULATE TEST RESULTS SUMMARY

Company: Oxy Chemical
 Plant: Ludington, Michigan
 Unit: S-701 Pellet C
 Location: Dry Scrubber

Test Number:	Eng. Run 2	1	2	Average
Source Condition:	Normal	Normal	Normal	
Date:	11/5/2019	11/6/2019	11/6/2019	
Start Time:	8:30	9:30	14:20	
End Time:	11:41	13:22	17:28	
Sample Duration (min):	168.0	168.0	168.0	168.0
Average Gas Temp, T _s , (°F):	207.7	207.0	206.2	206.9
Fractional Gas Moisture Content, B _{ws} :	0.189	0.194	0.192	0.19
Gas CO ₂ Content (%vol):	1.5	1.5	2.0	1.7
Gas O ₂ Content (%vol):	19.0	19.0	19.5	19.2
Gas Wet MW, M _s , (lb/lbmole-mole):	26.923	26.868	26.972	26.921
Gas Dry MW, M _d , (lb/lbmole-mole):	29.000	29.000	29.100	29.033
Average Gas Velocity, V _s , (ft/sec):	35.51	33.87	34.24	34.54
Measured Volumetric Flow Rate:				
Q (actual ft ³ /min):	202,475	193,137	195,245	196,953
Q _{std} (std ft ³ /min):	157,534	151,195	153,026	153,918
Q _{std(dry)} (dry std ft ³ /min):	127,785	121,887	123,683	124,452
Sample Volume, V _{m(std)} , (dry std ft ³):	116.696	113.264	113.460	114.473
PM Collected, m _n , (mg):				
Filterable	112.40	92.20	91.90	98.83
PM Concentration, C _s , (gr/dscf):				
Filterable	0.0149	0.0126	0.0125	0.0133
PM Emission Rate, ER _{M2} , (lb/hr based on measured volumetric flow rate):				
Filterable:	16.278	13.123	13.250	14.217
PM Emission Rate, ERM2, (lb/1000 lb dry basis):				
Filterable:	0.028	0.024	0.024	0.025
Isokinetic Variance (I)	95.5	97.2	95.9	96.2

English Units: Standard conditions of 29.92 inHg and 68° F
 Metric Units: Standard conditions of 760 mmHg and 20° C

APPENDIX



AETB and QI Information Summary

Facility Name:	Occidental Chemical Company
Location:	S701 Scrubber Stack (EUPELLETCDRY)
Test Date:	November 5 and 6, 2019

Test Parameters:	Method 1, 2, 3 & 5
QI Last Name:	Miller
QI First Name:	Chris
QI Middle Initial:	---
AETB Name:	TRC Environmental Corporation
AETB Phone No:	815-341-1883
AETB Email:	cmiller@trccompanies.com
Group 1 Exam Date:	03-27-2015
Provider Name:	Source Evaluation Society
Provider Email:	gstiprogram@gmail.com

This is to Certify that:

Christopher Miller

Is a Qualified Individual as defined in Section 8.3 of ASTM D7036-04 for the following test methods:

EPA Methods 1, 1A, 2, 2A, 2C, 2D, 2F, 2G, 2H, 3, 3B, 4, 5, 5A, 5B, 5D, 5E, 5F, 5i, 17, 19, 201A, and 202.

The individual has met the minimum experience requirements defined in Section 8.3.4.2 of ASTM D7036-04 and has successfully passed a comprehensive examination for the test methods designated above.

This certification is effective until: 03-27-2020



Date of Issue: 04-03-2015

Certificate Number: 00775

Edward J MacKinnon

Air Measurements Practice Quality Manager



This certificate is the exclusive property of TRC and is non-transferable.

S-701 Stack Test Process Data Summary

Run	Time	Venturi dP [in H2O]	Venturi Scrubbing Fluid [GPM]	Natural Gas Flow to "C" Dryer [SCFM]
Eng Run 2	11/5/19 8:30-11:41	23.6	1549	1595
Comp Run 1	11/6/19 9:30-13:22	23.6	1549	1636
Comp Run 2	11/6/19 14:20-17:28	23.6	1551	1630

Run	Time	Venturi dP [in H2O]	Venturi Scrubbing Fluid [GPM]	Natural Gas Flow to "C" Dryer [SCFM]
Eng Run 2	05-Nov-19 08:30:00	23.9	1545	1590
Eng Run 2	05-Nov-19 08:40:00	23.6	1543	1596
Eng Run 2	05-Nov-19 08:50:00	23.1	1564	1594
Eng Run 2	05-Nov-19 09:00:00	23.8	1551	1589
Eng Run 2	05-Nov-19 09:10:00	23.8	1548	1592
Eng Run 2	05-Nov-19 09:20:00	23.9	1543	1591
Eng Run 2	05-Nov-19 09:30:00	23.2	1556	1593
Eng Run 2	05-Nov-19 09:40:00	23.7	1561	1593
Eng Run 2	05-Nov-19 09:50:00	23.7	1545	1595
Eng Run 2	05-Nov-19 10:00:00	23.7	1544	1594
Eng Run 2	05-Nov-19 10:10:00	23.8	1551	1592
Eng Run 2	05-Nov-19 10:20:00	23.5	1550	1593
Eng Run 2	05-Nov-19 10:30:00	23.7	1543	1597
Eng Run 2	05-Nov-19 10:40:00	23.8	1549	1597
Eng Run 2	05-Nov-19 10:50:00	23.2	1542	1598
Eng Run 2	05-Nov-19 11:00:00	23.7	1552	1599
Eng Run 2	05-Nov-19 11:10:00	23.7	1553	1602
Eng Run 2	05-Nov-19 11:20:00	23.5	1550	1598
Eng Run 2	05-Nov-19 11:30:00	23.4	1547	1601
Eng Run 2	05-Nov-19 11:40:00	23.7	1553	1602

Comp Run 1	06-Nov-19 09:30:00	23.6	1549	1637
Comp Run 1	06-Nov-19 09:40:00	23.6	1542	1635
Comp Run 1	06-Nov-19 09:50:00	23.3	1548	1644
Comp Run 1	06-Nov-19 10:00:00	23.3	1551	1638
Comp Run 1	06-Nov-19 10:10:00	23.5	1552	1638
Comp Run 1	06-Nov-19 10:20:00	23.6	1556	1638
Comp Run 1	06-Nov-19 10:30:00	23.6	1544	1639
Comp Run 1	06-Nov-19 10:40:00	23.9	1543	1636
Comp Run 1	06-Nov-19 10:50:00	23.4	1557	1635
Comp Run 1	06-Nov-19 11:00:00	23.3	1545	1634
Comp Run 1	06-Nov-19 11:10:00	23.2	1542	1634
Comp Run 1	06-Nov-19 11:20:00	23.5	1553	1631
Comp Run 1	06-Nov-19 11:30:00	23.6	1557	1635
Comp Run 1	06-Nov-19 11:40:00	23.4	1544	1635
Comp Run 1	06-Nov-19 11:50:00	23.7	1543	1638
Comp Run 1	06-Nov-19 12:00:00	23.9	1550	1641

Comp Run 1	06-Nov-19 12:10:00	23.7	1553	1638
Comp Run 1	06-Nov-19 12:20:00	24.0	1563	1642
Comp Run 1	06-Nov-19 12:30:00	23.7	1537	1638
Comp Run 1	06-Nov-19 12:40:00	23.7	1552	1637
Comp Run 1	06-Nov-19 12:50:00	23.7	1552	1632
Comp Run 1	06-Nov-19 13:00:00	23.7	1557	1630
Comp Run 1	06-Nov-19 13:10:00	23.6	1539	1632
Comp Run 1	06-Nov-19 13:20:00	23.5	1548	1633

Comp Run 2	06-Nov-19 14:20:00	23.7	1557	1635
Comp Run 2	06-Nov-19 14:30:00	23.7	1545	1636
Comp Run 2	06-Nov-19 14:40:00	23.7	1548	1629
Comp Run 2	06-Nov-19 14:50:00	23.5	1553	1633
Comp Run 2	06-Nov-19 15:00:00	23.9	1556	1629
Comp Run 2	06-Nov-19 15:10:00	23.5	1542	1630
Comp Run 2	06-Nov-19 15:20:00	23.2	1547	1627
Comp Run 2	06-Nov-19 15:30:00	23.6	1556	1627
Comp Run 2	06-Nov-19 15:40:00	23.6	1558	1626
Comp Run 2	06-Nov-19 15:50:00	23.6	1558	1630
Comp Run 2	06-Nov-19 16:00:00	23.6	1543	1629
Comp Run 2	06-Nov-19 16:10:00	23.6	1552	1629
Comp Run 2	06-Nov-19 16:20:00	23.6	1554	1625
Comp Run 2	06-Nov-19 16:30:00	23.6	1549	1625
Comp Run 2	06-Nov-19 16:40:00	23.5	1546	1628
Comp Run 2	06-Nov-19 16:50:00	23.6	1556	1629
Comp Run 2	06-Nov-19 17:00:00	23.5	1556	1633
Comp Run 2	06-Nov-19 17:10:00	23.6	1540	1630
Comp Run 2	06-Nov-19 17:20:00	23.7	1547	1630

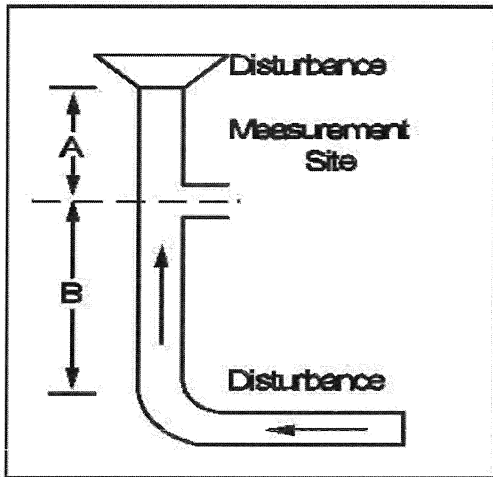
Sample Location Information for Isokinetic Sampling - Round Ducts

Project #: 219921
 Company: Occidental Chemical
 Plant: Ludington, Michigan
 Unit ID: EUPELLETCDRY
 Sample Location: Scrubber S-701

Duct Diameter: 11.00 feet
 # of Ports Used: 2
 # of Points/Diameter: 12
 Sample Plane: Horizontal
 Port Type: Flange
 Port Length: 7.0 inches
 Port Inside Diameter: 3.0 inches

Distance A: 43.33 Feet, 3.94 Duct diameters
 Distance B: 31.00 Feet, 2.82 Duct diameters
 Meets Method 1 criteria

Traverse Point Locations



Point	% of diameter	Inches from wall	Inches from port edge
1	2.1	2.8	9.8
2	6.7	8.8	15.8
3	11.8	15.6	22.6
4	17.7	23.4	30.4
5	25.0	33.0	40.0
6	35.6	47.0	54.0
7	64.4	85.0	92.0
8	75.0	99.0	106.0
9	82.3	108.6	115.6
10	88.2	116.4	123.4
11	93.3	123.2	130.2
12	97.9	129.2	136.2

Pre-cyclonic flow check conducted? Yes No Conducted Previously

Pre-Test Cyclonic Flow Check Data

Point #	Port:			Port:			Port:			Port:		
	ΔP ("H2O)	Ts (°F)	a (°)	ΔP ("H2O)	Ts (°F)	a (°)	ΔP ("H2O)	Ts (°F)	a (°)	ΔP ("H2O)	Ts (°F)	a (°)
1	-	-	10	-	-	5	-	-	-	-	-	-
2	-	-	15	-	-	5	-	-	-	-	-	-
3	-	-	15	-	-	0	-	-	-	-	-	-
4	-	-	10	-	-	10	-	-	-	-	-	-
5	-	-	10	-	-	10	-	-	-	-	-	-
6	-	-	0	-	-	10	-	-	-	-	-	-
7	-	-	5	-	-	10	-	-	-	-	-	-
8	-	-	5	-	-	10	-	-	-	-	-	-
9	-	-	10	-	-	5	-	-	-	-	-	-
10	-	-	15	-	-	5	-	-	-	-	-	-
11	-	-	25	-	-	5	-	-	-	-	-	-
12	-	-	40	-	-	15	-	-	-	-	-	-

Average a: 10.4 (°) Average Ts: _____ (°F) Average ΔP: _____ ("H2O)
 Status: Pass Avg of sqrt ΔP: _____

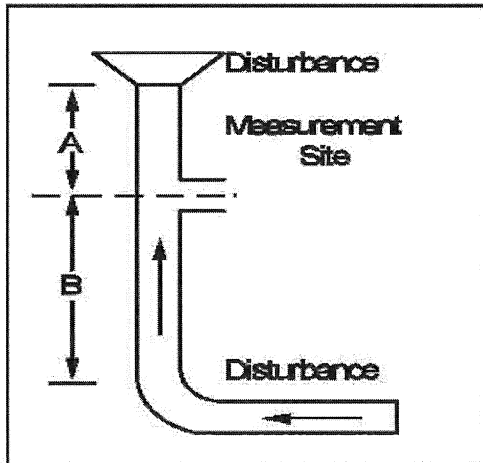
Sample Location Information for Isokinetic Sampling - Round Ducts

Project #: 349822.COMP
 Company: Oxy Chemical
 Plant: Ludington, Michigan
 Unit ID: S-701 Pellet C
 Sample Location: Dry Scrubber

Duct Diameter: 132 inches 11.00 feet
 # of Ports Used: 1
 # of Points/Diameter: 12
 Sample Plane: Horizontal
 Port Type: Flange
 Port Length: 7.0 inches
 Port Inside Diameter: 3.0 inches

Distance A: 43.40 Feet, 3.95 Duct diameters
 Distance B: 31.00 Feet, 2.82 Duct diameters
 Meets Method 1 criteria

Traverse Point Locations



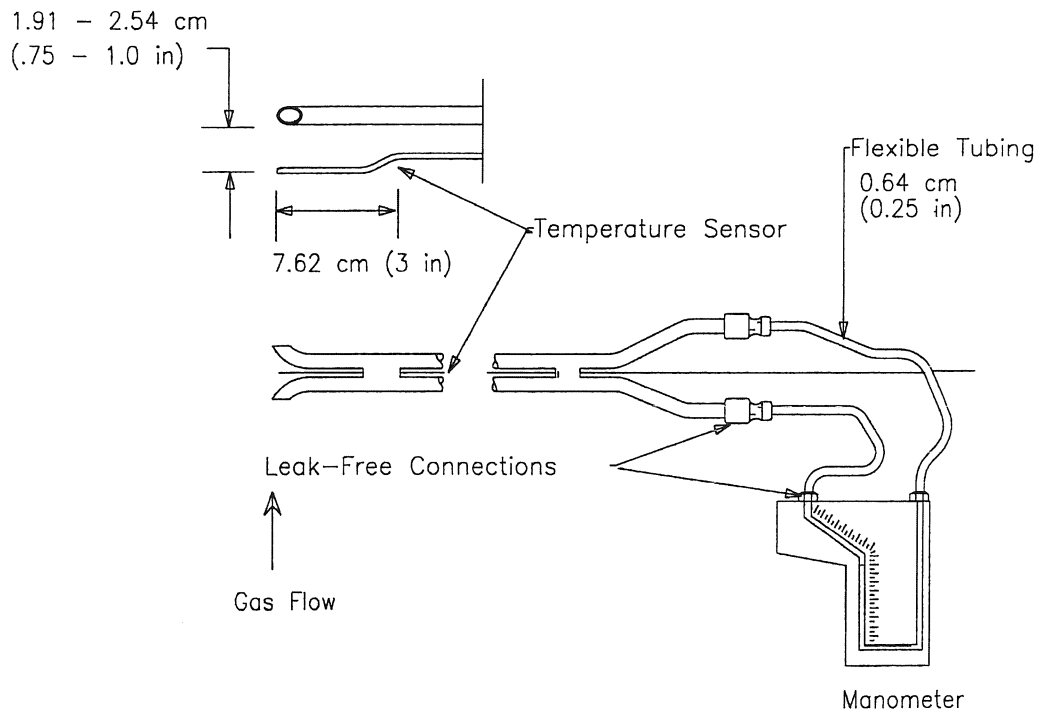
Point	% of diameter	Inches from wall	Inches from port edge
1	2.1	2.8	9.8
2	6.7	8.8	15.8
3	11.8	15.6	22.6
4	17.7	23.4	30.4
5	25.0	33.0	40.0
6	35.6	47.0	54.0
7	64.4	85.0	92.0
8	75.0	99.0	106.0
9	82.3	108.6	115.6
10	88.2	116.4	123.4
11	93.3	123.2	130.2
12	97.9	129.2	136.2

Pre-cyclonic flow check conducted? No Reason: Conducted Previously



Determination of Stack Gas Velocity and Volumetric Flow Rate

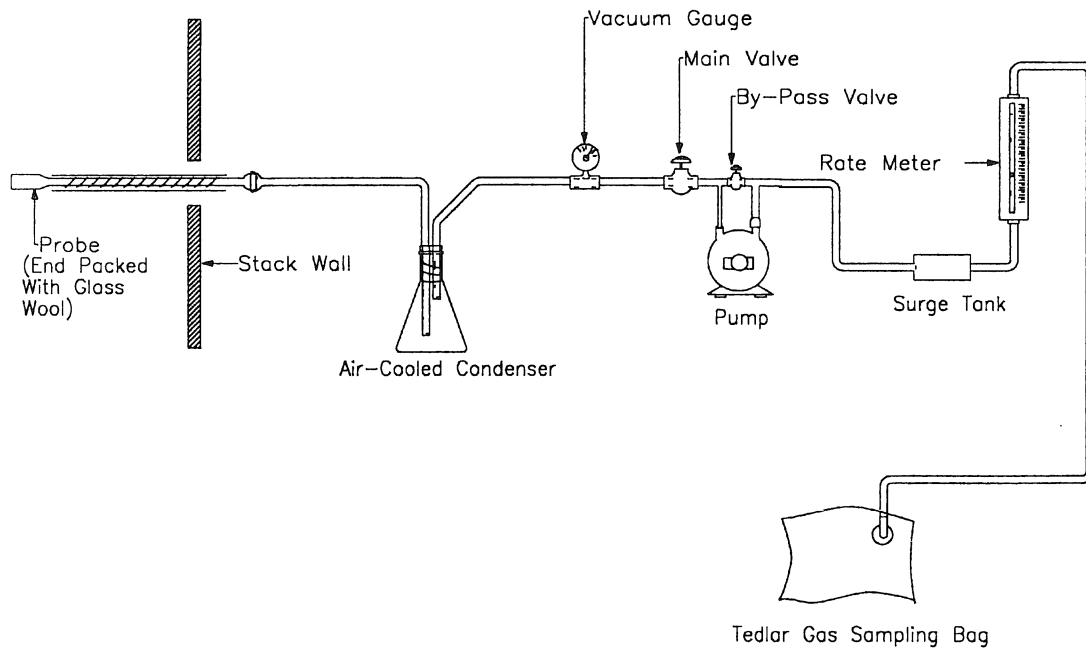
USEPA Promulgated Test Method 2





Gas Analysis for the Determination of Dry Molecular Weight

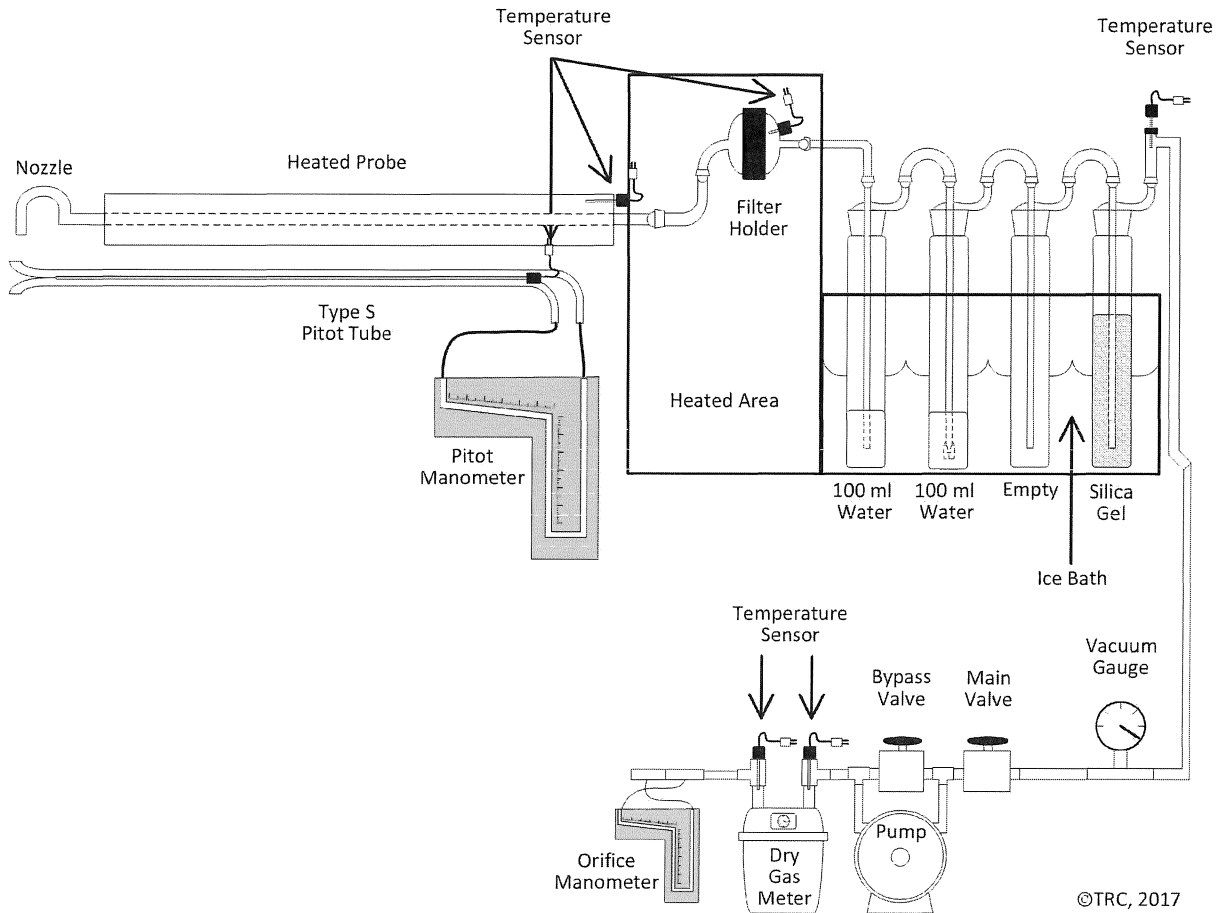
USEPA Promulgated Method 3





Determination of Particulate Emissions From Stationary Sources

USEPA Promulgated Method 5





Filterable Particulate Sample Analysis Summary

Project#: 349822.COMP
 Company: Oxy Chemical
 Plant: Ludington, Michigan

Unit ID: S-701 Pellet C
 Location: Dry Scrubber
 Test Date(s): 11/5/19-11/6/19

Filterable PM	<u>Run 2</u>	<u>Run 1</u>	<u>Run 2</u>	<u>Blank</u>
Filter material collected in acetone rinse?	N	N	N	
Filter final - Filter tare (mg):	107.10	86.70	86.80	
Rinse volume, V_{aw} , (ml):	106.388	132.909	119.646	230.935
Rinse final - Rinse tare, m_a , (mg):	5.30	5.50	5.10	0.00
Rinse blank correction, W_a (mg)**:	0.00	0.00	0.00	
Total rinse mass (mg):	5.30	5.50	5.10	
*Total Filterable PM, m_n, (milligrams):	112.40	92.20	91.90	

* If filter material was recovered in the acetone rinse, and the sum of the filter weight increase and the total rinse mass is \geq zero, subsequent calculations are performed using that value.

* If filter material was recovered in the acetone rinse, and the sum of the filter weight increase and the total rinse mass is $<$ zero, subsequent calculations are performed using a value of 0 mg

* If filter material was not recovered in the acetone rinse, and the result from the lab for either fraction is $<$ zero, subsequent calculations are performed using a value of 0.0 mg for that fraction

** - the maximum allowable blank correction is 0.0079 mg/ml