1.0 INTRODUCTION

PACE Environmental (PACE) was contracted by Aunt Millie's Bakeries to perform a compliance emissions test at their facility located in Plymouth, Michigan. The purpose of this test was to satisfy the requirements found in Section V.1 of the Michigan Department of the Environment, Great Lakes, and Energy (EGLE) Permit to Install dated January 5, 2021 (Permit No. 5-17B).

A CSM Model 90A catalytic oxidizer (CatOx) is in place to control emissions from the bread oven (EU003). The inlet and outlet of the CatOx were sampled simultaneously to demonstrate that the oxidizer was meeting the minimum volatile organic compound destruction efficiency (VOC DE) of 95%. Emission rates of VOC measured as non-methane hydrocarbons as methane (NMHC as CH_4) were determined on a pound per hour (lb/hr) basis at both the inlet and outlet sampling locations to determine the DE.

Three separate one-hour test runs were performed on the inlet duct and outlet stack of the oxidizer while the bread line was operating near maximum normal operating conditions, as defined in the Process Description Section 5.0 of this report. Both the bread oven and CatOx were fired with natural gas.

PACE performed the on-site sampling and prepared this final report.

Table 1.1 Test Results Summary

Permit to Install No.:	**5-17B**		
State Registration No.:	N8040		
Source:	Bread Oven (EU003)		
Control Device:	Catalytic Oxidizer		
Test Date:	11/17/21		
Tested Pollutant	**Average Test Result**	**Emission Limit**	**Compliance Status**
NMHC Destruction Efficiency (%, lb/hr as CH_4 basis)	97.6%	≥95%	Compliant

1.0 INTRODUCTION (Cont'd)

Table 1.2 Test Methodology

Parameter	Method
Volumetric Flowrate (outlet only)	U.S. EPA Method 1, "Sample and Velocity Traverses for Stationary Sources" and U.S. EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"
Oxygen & Carbon Dioxide	U.S. EPA Method 3A, "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources" (Instrumental Analyzer Procedure)
Moisture	U.S. EPA Method 4, "Determination of Moisture Content in Stack Gases"
NMHC (measured as THC minus CH_4)	U.S. EPA Method 25A, "Determination of Total Gaseous Organic Concentrations Using a Flame Ionization Detector"

[1]*Measurements on outlet only.*

2.0 QUALITY ASSURANCE SUMMARY

A compliance test protocol was submitted to EGLE on April 30, 2021 and conditionally approved on June 17, 2021. In this protocol, all field and laboratory methodologies are detailed (see Appendix A).

All calibrations, QA/QC checks, and leak checks conducted were within the acceptable limits established by the U.S. EPA methods used for this sampling. All data supporting these findings can be found in the appendices of the report.

Please see the Technical Discussion for an in-depth explanation of any protocol deviations, sampling, and testing difficulties, etc. that were encountered during the test program.

3.0 SUMMARY OF RESULTS

The results of the test are detailed below in Table 3.1.

Table 3.1 Oxidizer NMHC Emission Results Summary

Run	1	2	3	Average	Permit Requirement
Date	11/17/21	11/17/21	11/17/21		
Time	1020-1120	1220-1320	1345-1518		
Outlet Flow Rate					
dscfm	1,335	1,260	1,325	1,307	-------
THC (as CH_4) Outlet					
ppmv (dry)	3,616.4	1,469.1	1,296.5	2,127.3	-------
Methane Outlet					
ppmv (dry)	3,633.4	1,496.2	1,333.7	2,154.4	-------
NMHC (as CH_4) Outlet					
ppmv (dry), using DL[1]	<50.0	<50.0	<50.0	<50.0	-------
pounds/hour	**<0.167**	**<0.157**	**<0.166**	**<0.163**	-------
Inlet Flow Rate					
dscfm	1,335	1,260	1,325	1,307	-------
THC (as CH_4) Inlet					
ppmv (dry)	3,790.4	3,920.8	3,231.1	3,647.4	-------
Methane Inlet					
ppmv (dry)	1,564.4	1,679.9	1,371.0	1,538.4	-------
NMHC (as CH_4) Inlet					
ppmv (dry)	2,226.1	2,240.9	1,860.1	2,109.0	-------
pounds/hour	**7.42**	**7.05**	**6.16**	**6.88**	-------
Destruction Efficiency					
%, lb/hr NMHC as methane basis	**>97.8**	**>97.8**	**>97.3**	**>97.6**	**>95%**

[1]*Outlet NMHC results are reported above as being less than the detection limit (DL) of the analyzer. See the Technical Discussion on the following page for details.*

4.0 TECHNICAL DISCUSSION

The inlet sampling location is accessible by a lift, which was used on the day prior to the test for equipment set up, stack measurements, cyclonic flow checks, etc. On the day of the test, the lift battery was depleted and could not be used. A ladder was too dangerous. Since the inlet ports were no longer accessible, it was determined on site to set the inlet flow rate equal to the measured outlet flow rate. The inlet stratification check was also unable to be completed, so sampling on the inlet occurred at a single point at the centroid of the inlet duct.

There was a brief pause in Run 3 due to a break in the process. All data collection was paused during the break and resumed with production. The Run 3 sampling time was extended to collect 60 minutes of test data.

The outlet NMHC concentrations were calculated for each run by subtracting the average methane result from the THC as CH_4 result, which produced a slightly negative NMHC result. The detection limit of the analyzer was used to calculate the outlet mass emissions in lb/hr. The analyzer detection limit is determined to be 1% of the calibration span, which was 5,000 ppm making the detection limit for the NMHC analyzer 50 ppm.

The slightly negative NMHC results can be explained by reviewing the calibration responses of the outlet analyzer. All pre- and post- calibration and drift checks demonstrate that the THC channel was responding low to the calibration gas while the CH_4 channel was responding high. This causes a slight low-bias to the THC concentration and a slight high-bias to the CH_4 concentration, which explains the difference of the two being negative. Please note that all analyzer calibration responses were within the allowable limits established by the EPA reference methods.

No other technical difficulties or protocol deviations occurred during this test program.

5.0 PROCESS DESCRIPTION

Aunt Millie's Bakeries operates an industrial bread baking process at their facility in Plymouth, MI. The CSM Model 90A Catalytic Oxidizer is in place to control emissions from the bread oven (EU003). The production rates of the last twelve months show an average production rate of 9,984 lbs/hr and a maximum production rate of 12,491 lbs./hr. Testing was performed while the plant baked 22 oz. Deluxe White Bread straight-doughs. Both the bread oven and CatOx are operated using natural gas.

The testing was performed during maximum normal operating conditions as documented in the process data. All process parameters were recorded in fifteen-minute intervals where possible.

Table 5.1 below provides a summary of the operational test parameter data collected. All process and operational data provided by the facility can be found in Appendix G.

Table 5.1 Process Parameter Summary

Run Number	1	2	3	Averages
Test Date	11/17/21	11/17/21	11/17/21	
Test Time	1020-1120	1220-1320	1345-1518	
Process/Control Device Data Summary				
Bread Production Rate (cuts/min)	146	146	146	146
Dough Piece Weight (oz.)	22	22	22	22
Catalyst Inlet Temperature (°F)	665	700	700	688
Catalyst Outlet Temperature (°F)	765	807	808	793
Catalyst Inlet Pressure ("H_2O)	5.3	5.3	5.3	5.3
Oven Zone #1 Temperature (°F)	425	425	425	425
Oven Zone #2 Temperature (°F)	425	425	425	425
Oven Zone #3 Temperature (°F)	425	425	425	425
Oven Zone #4 Temperature (°F)	425	425	425	425
Oven Zone #5 Temperature (°F)	380	380	380	380
Oven Zone #6 Temperature (°F)	380	380	380	380

6.0 PERSONNEL AND CERTIFICATIONS

Field Sampling on this Project was performed by:

Timothy Beam, Dustin Roberts, and Logan Pennypacker

Calculations and Report Preparation were performed by:

Erica L. Bolek

Testing Observed by:

Lindsey Wells- EGLE

CERTIFICATION STATEMENT:
I certify, that "to the best of my knowledge" the source test report has been checked for completeness, and that the results presented therein are accurate, error-free, legible, and representative of the actual emissions measured during testing.

Submitted by:

Erica L. Bolek
QA/QC Manager

Reviewed by:

John Donnelly
Member

Project/Field Personnel:

Timothy Beam
Project Manager

RESPONSIBLE-OFFICIAL CERTIFICATION

The below certification is for the compliance stack test performed on the inlet and outlet of the Catalytic Oxidizer located at Aunt Millie's Bakeries in Plymouth, Michigan on November 17, 2021.

I certify, that "to the best of my knowledge" the source test report has been checked for completeness, and that the results presented therein are accurate, error-free, legible, and representative of the actual emissions measured during testing.

Ken Habig

Signature

Ken Habig

Name

Sr Director of Engineering

Title

1/13/2022

Date

7.0 SAMPLE LOCATION

EPA METHOD 1

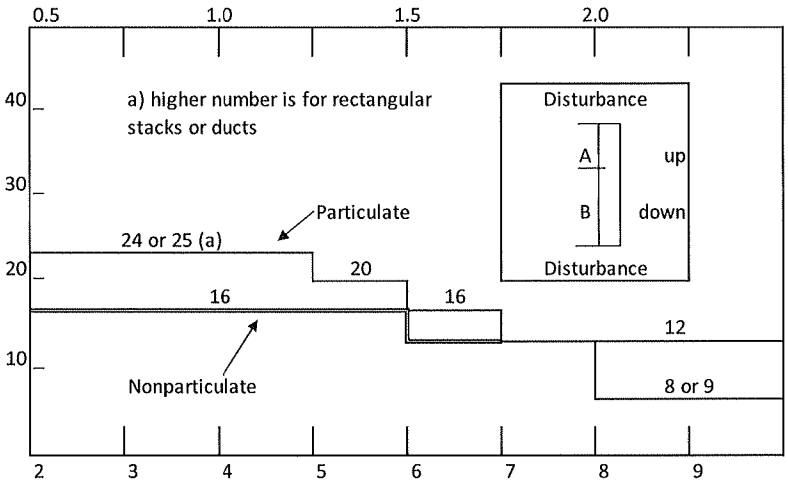
Sample and Velocity Traverses for Stationary Sources

Customer	Aunt Millie's Bakeries
Facility	Industrial Bakery
City, State	Plymouth, MI
Test Date	11/17/21
Test Location	Catalytic Oxidizer Inlet
Diameter of Stack	20 inches

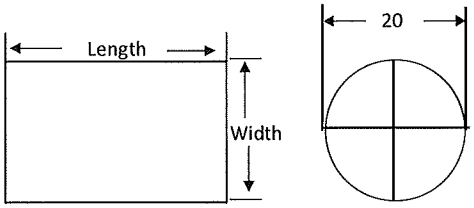
Diameters Upstream of Disturbance (A)	>4
Diameters Downstream of Disturbance (B)	>4
Total No. of Traverse Points Required	16
Number of Ports	2
Traverse Points per Port	8
Traverse (Horizontal or Vertical)	V

MINIMUM NUMBER OF TRAVERSE POINTS FOR PARTICULATE AND NONPARTICULATE TRAVERSES

Duct Diameters Upstream from flow disturbances (Disturbance A)



Duct Diameters Downstream from flow disturbances (Disturbance B)



$$Deq = \frac{2LW}{L+W} =$$

CROSS-SECTIONAL LAYOUT FOR RECTANGULAR STACKS	
Total Travese Points	Matrix
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

Point Number On A Diameter	(Percent of stack diameter from inside wall to traverse point) Number of Traverse Points on a Diameter				
	4	6	8	10	12
1	6.7	4.4	3.2	2.6	2.1
2	25.0	14.6	10.5	8.2	6.7
3	75.0	29.6	19.4	14.6	11.8
4	93.3	70.4	32.3	22.6	17.7
5		85.4	67.7	34.2	25.0
6		95.6	80.6	65.8	35.6
7			89.5	77.4	64.4
8			96.8	85.4	75.0
9				91.8	82.3
10				97.4	88.2
11					93.3
12					97.9

TRAVERSE POINT LOCATIONS

Number	Distance from Wall (inches)	Port Depth (inches)	Total Distance (inches)
1	0.6	4.0	4.6
2	2.1	4.0	6.1
3	3.9	4.0	7.9
4	6.5	4.0	10.5
5	13.5	4.0	17.5
6	16.1	4.0	20.1
7	17.9	4.0	21.9
8	19.4	4.0	23.4
9			
10			
11			
12			

7.0 SAMPLE LOCATION (Cont'd)

EPA METHOD 1

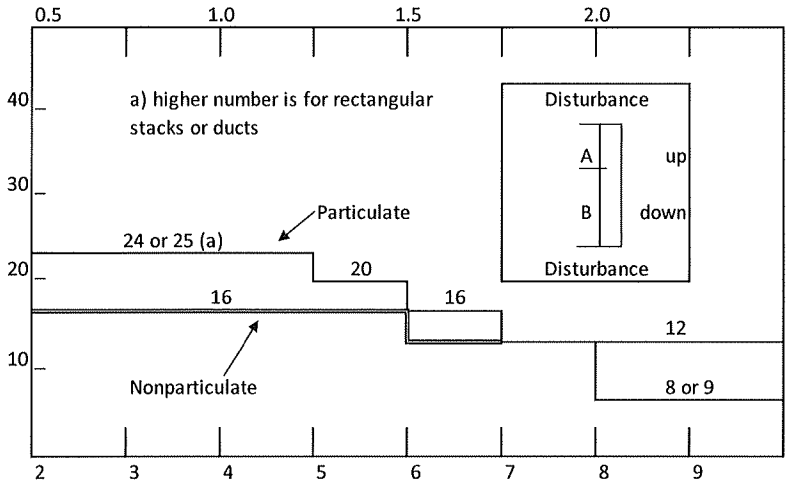
Sample and Velocity Traverses for Stationary Sources

Customer	Aunt Millie's Bakeries
Facility	Industrial Bakery
City, State	Plymouth, MI
Test Date	11/17/21
Test Location	Catalytic Oxidizer Outlet
Diameter of Stack	22 inches

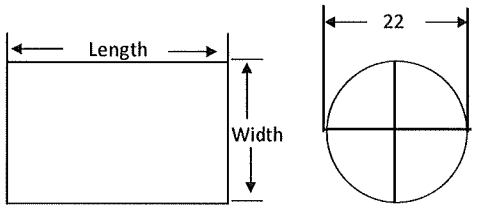
Diameters Upstream of Disturbance (A)	>4
Diameters Downstream of Disturbance (B)	>4
Total No. of Traverse Points Required	16
Number of Ports	2
Traverse Points per Port	8
Traverse (Horizontal or Vertical)	H

MINIMUM NUMBER OF TRAVERSE POINTS FOR PARTICULATE AND NONPARTICULATE TRAVERSES

Duct Diameters Upstream from flow disturbances (Disturbance A)



Duct Diameters Downstream from flow disturbances (Disturbance B)



Deq = 2LW = _____
L+W

CROSS-SECTIONAL LAYOUT FOR RECTANGULAR STACKS	
Total Travese Points	Matrix
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

Point Number On A Diameter	(Percent of stack diameter from inside wall to traverse point) Number of Traverse Points on a Diameter				
	4	6	8	10	12
1	6.7	4.4	3.2	2.6	2.1
2	25.0	14.6	10.5	8.2	6.7
3	75.0	29.6	19.4	14.6	11.8
4	93.3	70.4	32.3	22.6	17.7
5		85.4	67.7	34.2	25.0
6		95.6	80.6	65.8	35.6
7			89.5	77.4	64.4
8			96.8	85.4	75.0
9				91.8	82.3
10				97.4	88.2
11					93.3
12					97.9

TRAVERSE POINT LOCATIONS

Number	Distance from Wall (inches)	Port Depth (inches)	Total Distance (inches)
1	0.7	4.0	4.7
2	2.3	4.0	6.3
3	4.3	4.0	8.3
4	7.1	4.0	11.1
5	14.9	4.0	18.9
6	17.7	4.0	21.7
7	19.7	4.0	23.7
8	21.3	4.0	25.3
9			
10			
11			
12			

8.0 CYCLONIC FLOW

Location:
Inlet

Point	CYCLONIC FLOW	
	Rotation Angle, Degrees	
	Port A	Port B
1	5	5
2	5	7
3	8	7
4	9	10
5	5	9
6	5	10
7	7	7
8	7	7
Average	6.4	7.8
Overall Average	**7.1**	

Location:
Outlet

Point	CYCLONIC FLOW	
	Rotation Angle, Degrees	
	Port A	Port B
1	2	4
2	2	4
3	6	8
4	6	8
5	4	7
6	4	7
7	2	4
8	2	4
Average	3.5	5.8
Overall Average	**4.6**	

The absence of cyclonic flow is verified by an average angle of less than 20°.