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Comprehensive Emissions Test Report

Capital Region International Airport
Particulate, HCl, CO, NO_x, SO_2
Compliance Testing

Testing Date(s): July 20 and 21, 2021
Report Date: September 16, 2021
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ACCREDITED
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Subject Facility:

Capital Region International Airport
4100 Capital City Boulevard
Lansing, MI 48906

Subject Emission Sources:
Incinerator

Test Locations:
Stack

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Pace Project No. 21-04821

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Regulatory Summary

Subject Facility: Capital Region International Airport
Plant Address: 4100 Capital City Boulevard
Lansing, MI 48906

Regulations: 40 CFR Part 60 Subpart DDDD

Emission Unit IDs	Emission Unit Name	Regulated Constituent	Regulatory Citations	Regulatory Limit	Average Test Result
	Incinerator	Particulate Matter	40 CFR Part 60 Subpart DDDD, Table 6	≤34 mg/dscm @ 7% O_2	56.4 mg/dscm @ 7% O_2
		Hydrogen Chloride		≤29 PPM, dry @ 7% O_2	29.7 PPMv, dry @ 7% O_2
		Fugitive Ash		≤5%	0%
		Cadmium		≤0.0026 mg/dscm @ 7% O_2	Testing not completed
		Carbon Monoxide		≤17 PPM, dry @ 7% O_2	1.06 PPM, dry @ 7% O_2
		Dioxins/Furans (total mass basis)		≤4.6 ng/dscm @ 7% O_2	Testing not completed
		Dioxins/Furans (TEQ)		≤0.13 ng/dscm @ 7% O_2	Testing not completed
		Lead		≤0.015 mg/dscm @ 7% O_2	Testing not completed
		Mercury		≤0.0048 mg/dscm @ 7% O_2	Testing not completed
		Nitrogen Oxides		≤53 PPM, dry @ 7% O_2	58.6 PPM, dry @ 7% O_2
		Sulfur Dioxide		≤11 PPM, dry @ 7% O_2	1.06 PPM, dry @ 7% O_2

Introduction

Pace Analytical Services, LLC personnel conducted particulate, hydrogen chloride (HCl), carbon monoxide (CO), nitrogen oxides (NO_x), and sulfur dioxide (SO_2) emission compliance testing on the Incinerator Stack at the Capital Region International Airport located in Lansing, Michigan. Matt McDermott, Zack Eckstrom, Lucas Ruhland, and Andrew Radabaugh performed on-site testing activities on July 20 and 21, 2021. Terry Borgerding provided administrative project management. Laura Lambert with Environmental Resources Group (ERG) coordinated plant activities during testing. Pace Analytical Services, LLC prepared a comprehensive test protocol that was submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) prior to testing. Mark Dziadosz with EGLE was on-site to witness testing. On-site activities consisted of the following measurements:

- Particulate and HCl, four independent one-hour samplings.
- Carbon monoxide (CO), and nitrogen oxides (NO_x), four independent one-hour monitoring periods.
- Sulfur dioxide (SO_2) five independent one-hour monitoring periods.
- Gas composition (O_2/CO_2), five independent one-hour monitoring periods.
- Volumetric airflow, measurements collected in conjunction with isokinetic testing.
- Fugitive emissions, observations performed during ash handling operations.

The project objectives were to quantify particulate, HCl, CO, NO_x, and SO_2 emission constituents and compare them to applicable air emissions regulations stipulated by 40 CFR Part 60 Subpart DDDDD. These measurements were performed at normal process operations. Quality protocols comply with regulatory compliance testing requirements.

Subsequent sections summarize the test results and provide descriptions of the process and test methods. Supporting information and raw data are in the appendices.

Results Summary

Results of particulate determinations are summarized in Table 1. The particulate emission concentration averaged 56.4 mg/dscm @ 7% O_2. The particulate emission limit for this source is 34 mg/dscm @ 7% O_2.

Results of HCl determinations are summarized in Table 2. The HCl emission concentration averaged 29.7 PPM, dry @ 7% O_2. The HCl emission limit for this source is 29 PPM, dry @ 7% O_2.

Results of CO, NO_x, and SO_2 determinations are summarized in Table 3. The CO emission concentration averaged 1.06 PPM, dry @ 7% O_2. The CO emission limit for this source is 17 PPM, dry @ 7% O_2. The NO_x emission concentration averaged 58.6 PPM, dry @ 7% O_2. The NO_x emission limit for this source is 53 PPM, dry @ 7% O_2. The SO_2 emission concentration averaged 1.06 PPM, dry @ 7% O_2. The SO_2 emission limit for this source is 11 PPM, dry @ 7% O_2. Subsequent tables provide expanded detail of the testing results.

During Run 1 of testing performed on July 20, 2021, the process incinerator afterburner inadvertently shut down at approximately 51 minutes of the 60-minute test run. As this was not typical of normal process conditions, Run 1 was omitted and Runs 2, 3, and 4 were used to determine emissions for PM, HCl, NO_x, and CO. The Run 2 post run bias calibration did not meet method criteria for SO_2. Run 2 was omitted for SO_2. A new linearity and system bias calibration was performed and Runs 3, 4, and 5 were used to determine SO_2 emissions.

Fugitive emission observations were performed on the incinerator building vents during waste loading, ash raking, and ash unloading operations. Eleven separate observation periods totaling 108 minutes were completed. No fugitive emissions were observed during this time. EPA Method 22 Field Data Sheets are included in Appendix A.

Testing for metals and dioxin/furans was started on July 21, 2021 but could not be completed due to non-contact breakage in the quartz probe liners for each sample train. The emission gas stream temperature sometimes exceeded the recommended temperature rating of 1,600°F for quartz probes and caused the liners to fail. Testing has been tentatively scheduled for October 2021 to complete the test program.

Testing on this source was originally scheduled for October of 2020. At that time, borosilicate glass probes and nozzles were used. The borosilicate glass nozzles deformed in the gas stream and testing was suspended and rescheduled. The gas monitoring log from this attempted testing is included in Appendix B.

EPA audit samples for HCl were obtained from audit provider ERA. Audit samples were analyzed with this project and the analytical results are included in the laboratory report in Appendix B. Audit sample analytical results were reviewed and compared against the true value of the audit samples by the audit provider (ERA). All of the audit sample analytical results were within acceptable limits (pass). This document is included in Appendix D.

The data in this report are indicative of emission characteristics of the measured sources for process conditions at the time of the test. Representations to other sources and test conditions are beyond the scope of this report.

Summary Tables

Capital Region International Airport

Lansing, MI
Pace Project No. 21-04821

Table 1

Particulate Results Summary
Incinerator Stack
Test 1

Parameter	**Run 2**	**Run 3**	**Run 4**	**Average**
Date of Run	7/20/21	7/20/21	7/20/21	
Time of Run	1211-1316	1536-1647	1737-1847	
Volumetric Flow Rate (Rounded to 1 CFM)				
ACFM	1,869	1,886	2,111	1,955
DSCFM	501	479	470	483
Gas Temperature, °F	1230	1316	1548	1365
Gas Moisture Content, %v/v	11.8	12.1	12.8	12.2
Gas Composition, %v/v, dry				
Carbon Dioxide, CO_2	5.4	6.0	5.8	5.7
Oxygen, O_2	12.1	11.1	11.8	11.6
Nitrogen, N_2 (by difference)	82.5	82.9	82.4	82.6
Particulate Mass Rate, LB/HR				
Filterable Particulate	0.1307	0.0375	0.0344	0.0676
Particulate Concentration, GR/DSCF				
Filterable Particulate	0.0305	0.0091	0.0085	0.0160
Regulatory Units, mg/dscm @ 7% O2				
Filterable Particulate	109.80	29.57	29.86	56.41

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Table 2

Halide Results Summary
Incinerator Stack
Test 1

Parameter	Run 2	Run 3	Run 4	Average
Date of Run	7/20/21	7/20/21	7/20/21	
Time of Run	1211-1316	1536-1647	1737-1847	
Volumetric Flow Rate (Rounded to 1 CFM)				
ACFM	1,869	1,886	2,111	1,955
DSCFM	501	479	470	483
Gas Temperature, °F	1230	1316	1548	1365
Gas Moisture Content, %v/v	11.8	12.1	12.8	12.2
Gas Composition, %v/v, dry				
Carbon Dioxide, CO_2	5.4	6.0	5.8	5.7
Oxygen, O_2	12.1	11.1	11.8	11.6
Nitrogen, N_2 (by difference)	82.5	82.9	82.4	82.6
Halide Concentration, mg/dscm				
Hydrogen Chloride	53.2	11.7	22.6	29.2
Halide Concentration, PPMv, dry				
Hydrogen Chloride	35.1	7.74	14.9	19.2
Corrected Concentration, PPMv @ 7% O2				
Hydrogen Chloride	55.3	11.0	22.7	29.7

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Table 3

Gas Monitoring Results
Incinerator Stack
Test 1

Parameter	Run 2	Run 3	Run 4	Run 5	Average
Date of Run	7/20/21	7/20/21	7/20/21	7/21/21	
Time of Run	1214-1314	1539-1639	1740-1840	0939-1039	
Sample Duration (Minutes)	60	60	60	60	
Stack Temperature (°F)	1230	1316	1548	1325	1355
Duct Moisture Content (%v/v)	11.8	12.1	12.8	10.0	11.7
Volumetric Flow Rate (Rounded to 1 CFM)					
ACFM	1,869	1,886	2,111	2,032	1,974
SCFM	568	545	539	585	559
DSCFM	501	479	470	526	494
Constituent Concentration, PPMv - Dry					
Nitrogen Oxides as NO2	45.3	36.8	34.4	-	38.83
Carbon Monoxide	0.309	0.868	0.967	-	0.71
Sulfur Dioxide	-	0.44	1.44	0.203	0.70
Corrected Constituent Concentrations, PPM, dry @ 7% Oxygen					
Nitrogen Oxides as NO2	71.4	52.0	52.6	-	58.64
Carbon Monoxide	0.487	1.23	1.48	-	1.06
Sulfur Dioxide	-	0.63	2.20	0.341	1.06

Detail Tables

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Table 4

Major Gases and Moisture Results
Incinerator Stack
Test 1

Parameter	**Run 2**	**Run 3**	**Run 4**
Date of Run	7/20/21	7/20/21	7/20/21
Time of Run	1211-1316	1536-1647	1737-1847
Major Gas Constituents - Instrumental, % v/v			
Dry Basis (as measured)			
Carbon Dioxide	5.37	5.99	5.76
Oxygen	12.08	11.07	11.80
Nitrogen (by difference)	82.55	82.94	82.45
Wet Basis (calculated)			
Carbon Dioxide	4.74	5.26	5.02
Oxygen	10.66	9.74	10.28
Nitrogen	72.83	72.94	71.86
Portable Oxygen Monitor Result			
Time Weighted Average, $\%O_2$	11.9	11.9	10.5
Moisture Collected, ml	81.8	79.2	85.2
Moisture Content, %v/v	11.77	12.06	12.84
Moisture Content if Saturated, %v/v	*NA (>BP)*	*NA (>BP)*	*NA (>BP)*
Relative Humidity, % rH	*NA (>BP)*	*NA (>BP)*	*NA (>BP)*
Molecular Weight of Flue Gas, lb/lb-mole			
Dry	29.34	29.40	29.39
Wet	28.01	28.03	27.93

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Table 5

Particulate Results
Incinerator Stack
Test 1

Parameter	Run 2	Run 3	Run 4
Date of Run	7/20/21	7/20/21	7/20/21
Time of Run	1211-1316	1536-1647	1737-1847
Sample Duration, Minutes	60	60	60
Average Flue Gas Temperature, °F	1229.7	1316.1	1548.0
Moisture Content of Flue Gas, %v/v	11.8	12.1	12.8
Particulate Collected, mg			
Dry Catch	57.0	16.1	15.1
Inorganic Wet Catch	*NR*	*NR*	*NR*
Organic Wet Catch	*NR*	*NR*	*NR*
Volumetric Flow Rate (Rounded to 1 CFM)			
ACFM	1,869	1,886	2,111
SCFM	568	545	539
DSCFM	501	479	470
Sample Volume, Meter Conditions, Ft^3	30.73	29.21	29.29
Sample Volume, Dry Standard, Ft^3	28.87	27.19	27.23
Particulate Concentration, GR/DSCF			
Filterable Particulate	0.0305	0.0091	0.0085
Particulate Emission Rate, LB/HR			
Filterable Particulate	0.13	0.04	0.03

NR=Not required or not requested.

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Table 6

Halide Results
Incinerator Stack
Test 1

Parameter	**Run 2**	**Run 3**	**Run 4**
Date of Run	7/20/21	7/20/21	7/20/21
Time of Run	1211-1316	1536-1647	1737-1847
Sample Duration, Minutes	60	60	60
Average Flue Gas Temperature, °F	1229.7	1316.1	1548.0
Moisture Content of Flue Gas, %v/v	11.8	12.1	12.8
Halide Collected, mg			
Hydrogen Chloride	43.5	9.0	17.4
Volumetric Flow Rate (Rounded to 1 CFM)			
ACFM	1,869	1,886	2,111
SCFM	568	545	539
DSCFM	501	479	470
Sample Volume, Meter Conditions, Ft^3	30.73	29.21	29.29
Sample Volume, Dry Standard, Ft^3	28.87	27.19	27.23
Halide Concentration, mg/dscm			
Hydrogen Chloride	53.2	11.7	22.6
Halide Emission Rate, LB/HR			
Hydrogen Chloride	0.0998	0.0211	0.0397

NR=Not required or not requested.

Process Description

Capital Region International Airport located in Lansing, Michigan installed a natural gas-fired Model 200-CA Destructor Waste Incinerator with a burn rate of 100-200 LB/HR.

The waste incineration at this facility is a batch process. The incinerator is heated to the set point, waste is hand loaded, the door is closed, and incineration begins. Incineration lasts approximately one hour and the incinerator is opened and the ash raked down approximately half way through the process. After incineration is complete, ash is again raked and a new batch of waste is loaded. If incineration is completed for the day, ash is removed once it is cooled. Each test run was started within 5-10 minutes after the loading process was completed.

Test related process and operational details were collected by Capital Region International Airport personnel and included in Appendix E.

Test Procedures

EPA Method 1 specifies test location acceptability criteria and defines the minimum number of traverse points for representative sampling. Linear measurements from upstream and downstream flow disturbances and the duct equivalent diameter are compared and the distances related to number of diameters. A flow disturbance can be defined as anything that changes or upsets the direction of flow within the duct including bends, dampers, fans, shape or size transitions, and open flames. Method 1 stipulates that test ports should be located at least eight diameters downstream and two diameters upstream of any flow disturbance. The minimum acceptable criteria are two diameters downstream and 0.5 diameters upstream of flow disturbances. The test location must also be free of cyclonic or multidirectional flow. Once the distances have been determined, the values are used to select the minimum number of traverse points for representative sampling. Shorter distances require a greater number of traverse points. The test site configuration and measurement details are documented on EPA Method 1 Field Data Sheet.

Pace FSD conducts the method as written with no routine deviations.

EPA Method 2 defines procedures used to measure linear velocity and volumetric flow rate of a confined gas stream. Using traverse points determined by EPA Method 1, multiple differential pressure measurements (pitot impact opening versus static pressure) are made using a pitot tube and differential pressure gauge. The individual measurements are averaged and combined with the gas density to calculate the average gas velocity. The velocity and duct cross-sectional area are used to calculate the volumetric flow rate. The volumetric flow rate is expressed as actual cubic feet per minute (ACFM), standard cubic feet per minute (SCFM), and dry standard cubic feet per minute (DSCFM). The technician maintains comprehensive test records on EPA Method 2 Field Data Sheet. Details of the equipment used to measure gas velocity include:

Pitot Tube:	S-Type
Differential Pressure Gauge:	Oil or Electronic Digital Manometer
Temperature Device:	Type K Thermocouple
Barometer Type:	Electronic Digital Barometer
Gas Density Determination:	EPA Method 3
Gas Moisture Determination:	EPA Method 4

Method Defined Quality Control:

- Pitot tubes are verified on an annual basis.
- Temperature device operation is confirmed for single point temperature and polarity for each test. Temperature devices undergo a full multipoint verification on an annual basis.
- Electronic barometers are verified for accuracy and calibrated on a semi-annual basis. Aneroid barometers are not used.

- Electronic Digital Manometers (EDMs) are verified for accuracy and calibrated on a semi-annual basis. EDMs are operationally confirmed and leak checked for each run.
- Sampling system leak-checks are performed before and after each run and prior to any component change during a run.

Pace FSD conducts the method as written with no routine deviations.

EPA Method 3A defines procedures to measure carbon dioxide (CO_2) and oxygen (O_2) concentrations from stationary sources. A stainless steel sampling probe and a sampling line draw a sample of the gas stream from the duct to a thermo-electric gas conditioner to remove moisture. The conditioned gas stream is delivered to an infrared gas analyzer to quantify CO_2 concentrations and paramagnetic gas analyzer to quantify O_2 concentrations. Zero grade cylinder air or a zero gas generator provides zero gas. Span gases include varying concentrations of EPA Protocol 1 CO_2/O_2 mixed standards specific to the target calibration range. A computerized data acquisition system logs CO_2/O_2 concentrations for one-minute averages. The logged results are integrated to test periods and tabulated with standardized and validated spreadsheets in Microsoft Excel. The operator also maintains comprehensive test records in the electronic Project Results Instrumental Workbook. Equipment used for CO_2/O_2 testing includes:

Probe Material:	Stainless Steel
Moisture Removal:	Thermo-electric
Transfer Line:	Teflon™
Analytical Technique:	Non-dispersive Infrared Detector (CO_2) Paramagnetic Detector (O_2)
Calibration Gas:	EPA Protocol 1

Method Defined Quality Control:

- Sampling system leak-checks are performed before each test and following any component change. Absence of leaks is confirmed through the bias check after each run.
- Calibration gas standards of the highest quality, Protocol 1 or traceable to NIST, are used in calibrations.
- Analyzer calibration error is determined before initial run and after any failed bias or drift test.
- Analyzer bias is verified once per test.
- System bias check is performed before and after each test.
- Calibration drift test is performed after each test run.
- System response time is determined during initial sampling system bias test.
- Stratification test is performed prior to first run.
- Purge time of ≥ 2x the response time observed before starting data collection and recording stratification traverse point values.

Pace FSD conducts the method as written with no routine deviations.

EPA Method 4 - Isokinetic defines procedures to measure the moisture content of emission gas streams from stationary sources. The moisture content of the gas stream is determined in conjunction with an isokinetic sampling train. Collected water condensate is measured from the back half of the isokinetic train. Method 4 equations convert the condensed liquid volume to a gas volume. The water vapor volume compared with the dry standard gas volume collected through the isokinetic train determines the moisture content of the emissions gas stream and is reported in percent by volume. Test records are included on the associated isokinetic method data sheet. Equipment used for measuring moisture content includes:

Probe Material:	Borosilicate glass or Stainless Steel
Filter Media:	Glass or Quartz fiber
Impinger Train Material:	Borosilicate Glass
Desiccant:	Drierite
Condensate Measure:	Graduated Cylinder or Electronic Scale
Desiccant Measure:	Electronic Scale

Method Defined Quality Control:

- Dry gas meters are verified by wet test meter comparison for a three-point "as found" determination and a full five-point calibration every 500 CF, or 90 days (first occurring). The Pace standard "as left" calibration factor is within ± 1% (the method standard is ± 2%).
- Gas meter volumes are verified at each traverse point by calculating the expected gas volume for each interval and comparing the gas volume metered during the interval.
- Sample rate orifices are calibrated every 500 CF, or 90 days (first occurring).
- Temperature device operation is confirmed for single point temperature and polarity for each test. Temperature devices undergo a full multipoint verification on an annual basis.
- Electronic barometers are verified for accuracy and calibrated on a semi-annual basis. Aneroid barometers are not used.
- Sampling system leak-checks are performed before and after each run and prior to any component change during a run.
- Field scales are verified for accuracy over the entire range of use on an annual basis and verified before each use using stainless steel reference weights traceable to national standards maintained by NIST.

The metering system verification cited above is a method QC alternative but considered more rigorous. Pace FSD conducts the method as written with no routine sampling deviations.

EPA Method 5 defines procedures to measure particulate emissions from stationary sources. Using traverse points determined from EPA Method 1 and incorporating procedures from EPA Methods 2, 3, and 4, a sample gas stream is isokinetically drawn from the emission stream. The particulate dry fraction collects in the sampling probe and on a quartz or glass-fiber filter. The probe and filter components of the sampling train are heated to 248°F (±25°F) to prevent moisture condensation and preserve sample integrity. The filtered sample gas stream passes through a series of impingers to condense water vapor and collect gaseous constituents. The first two impingers initially contain deionized water, and the third impinger is empty. A desiccant packed drying column follows the impingers to quantitatively collect the remaining moisture. An ice bath maintains the impinger train temperature (outlet) at 68°F or less. The impinger contents can be discarded or saved for additional analyses. Sample recovery and train clean up are performed after each run using procedures to ensure sample integrity and quantitative recovery. The train operator maintains comprehensive test records on EPA Method 5 Field Data Sheet, Isokinetic Particulate Sampling. Details of particulate testing are outlined below:

Nozzle/Probe Material:	Quartz Glass
Filter Holder Material:	Borosilicate Glass with glass or Teflon support
Filter Media:	Quartz or Glass-fiber, >99.95% efficient at 0.3µm
Impinger Train Material:	Borosilicate Glass
Impinger Reagents:	EPA Method 26A- 0.1 N H2SO4 & 0.1 N NaOH
Recovery Reagents:	Acetone Deionized water
Control Train:	Gas meter, orifice, differential pressure gauges, pump, valves, temperature monitors and controllers
Analytical Techniques:	Gravimetric

Method Defined Quality Control:

- Dry gas meters are verified by wet test meter comparison for a three-point "as found" determination and a full five-point calibration every 500 CF, or 90 days (first occurring). The Pace standard "as left" calibration factor is within ± 1% (the method standard is ± 2%).
- Sample rate orifices are calibrated every 500 CF, or 90 days (first occurring).
- Gas meter volumes are verified at each traverse point by calculating the expected gas volume for each interval and comparing the gas volume metered during the interval.
- Pitot tubes are verified on an annual basis.
- Temperature device operation is confirmed for single point temperature and polarity for each test. Temperature devices undergo a full multipoint verification on an annual basis.

- Electronic barometers are verified for accuracy and calibrated on a semi-annual basis. Aneroid barometers are not used.
- Electronic Digital Manometers (EDMs) are verified for accuracy and calibrated on a semi-annual basis. EDMs are operationally confirmed and leak checked for each run.
- Sampling system leak-checks are performed before and after each run and prior to any component change during a run.
- Sampling is performed at an isokinetic rate between 90 and 110%.
- A field blank is collected to verify site conditions to be non-contaminating.
- Sampling and recovery reagents are reagent grade or better.
- Analytical balances are calibrated and certified on an annual basis by an external service provider and verified before each use using stainless steel reference weights traceable to national standards maintained by NIST.
- Field scales are verified for accuracy over the entire range of use on an annual basis and verified before each use using stainless steel reference weights traceable to national standards maintained by NIST.

The metering system verification cited above is a method QC alternative but considered more rigorous. Pace FSD conducts the method as written with no routine sampling deviations.
For this source EPA Method 5 was performed in conjunction with EPA Method 26A.

EPA Method 6C defines procedures to measure sulfur dioxide (SO_2) from stationary sources. A stainless steel sampling probe and a heat-traced Teflon™ sampling line draw a sample of the gas stream from the duct to a thermo-electric gas conditioner to remove moisture. The sample gas stream is delivered to a fluorescence gas analyzer to quantify SO_2 emissions. Zero grade cylinder air or a zero gas generator provides zero gas. Span gases include varying concentrations of EPA Protocol 1 SO_2 standards specific to the target calibration range. A computerized data acquisition system logs SO_2 concentrations for one-minute averages. The logged results are integrated to test periods and tabulated with standardized and validated spreadsheets in Microsoft Excel. The operator also maintains comprehensive test records on the electronic Project Results Instrumental Workbook. Equipment used for SO_2 testing includes:

Probe Material:	Stainless Steel
Moisture Removal:	Thermo-electric
Transfer Line:	Teflon™
Analytical Technique:	Fluorescence Detector
Calibration Gas:	EPA Protocol 1

Method Defined Quality Control:

- Sampling system leak-checks are performed before each test and following any component change. Absence of leaks is confirmed through the bias check after each run.
- Calibration gas standards of the highest quality, Protocol 1 or traceable to NIST, are used in calibrations.
- Analyzer calibration error is determined before initial run and after any failed bias or drift test.
- System bias check is performed before and after each test.
- Analyzer bias is verified once per test.
- Calibration drift test is performed after each test run.
- System response time is determined during initial sampling system bias test.
- Stratification test is performed prior to first run.
- Purge time of ≥ 2x the response time observed before starting data collection and recording stratification traverse point values.

Pace FSD conducts the method as written with no routine deviations.

EPA Method 7E defines procedures to measure nitrogen oxide (NO_x) emissions from stationary sources. A stainless steel sampling probe and a heat-traced Teflon™ sampling line draw a sample of the gas stream from the duct to a thermo-electric gas conditioner to remove moisture. The sample gas stream is delivered to a chemiluminescence NO-NO_2-NO_x analyzer to quantify NO_x emissions. Zero grade cylinder air or a zero gas generator provides zero gas. Span gases include varying concentrations of EPA NO_x standards specific to the target calibration range. A computerized data acquisition system logs NO_x concentrations for one-minute averages. The logged results are integrated to test periods and tabulated with standardized and validated spreadsheets in Microsoft Excel. The operator also maintains comprehensive test records in the electronic Project Results Instrumental Workbook. Equipment used for NO_x testing includes:

Probe Material:	Stainless Steel
Moisture Removal:	Thermo-electric
Transfer Line:	Teflon™
Analytical Technique:	Chemiluminescence
Calibration Gas:	EPA Protocol 1

Method Defined Quality Control:

- Sampling system leak-checks are performed before each test and following any component change. Absence of leaks is confirmed through the bias check after each run.
- Calibration gas standards of the highest quality, Protocol 1 or traceable to NIST, are used in calibrations.
- Analyzer calibration error is determined before initial run and after any failed bias or drift test.

- Analyzer bias is verified once per test.
- System bias check is performed before and after each test.
- Calibration drift test is performed after each test run.
- System response time is determined during initial sampling system bias test.
- Stratification test is performed prior to first run.
- Purge time of ≥ 2x the response time observed before starting data collection and recording stratification traverse point values.
- NO2 to NO converter efficiency verified ≥ 90% before or after each test.

Pace FSD conducts the method as written with no routine deviations.

In-Stack Method: Method 10 defines procedures to measure carbon monoxide (CO) emissions from stationary sources. A stainless steel sampling probe and a heat-traced Teflon™ sampling line draw a sample of the gas stream from the duct to a thermo-electric gas conditioner to remove moisture. The sample gas stream is delivered to a gas filter correlation non-dispersive infrared analyzer to quantify CO concentrations. Zero grade cylinder air or a zero gas generator provides zero gas. Span gases include varying concentrations of EPA Protocol 1 CO standards specific to the target calibration range. A computerized data acquisition system logs CO concentrations for one-minute averages. The logged results are integrated to test periods and tabulated with standardized and validated spreadsheets in Microsoft Excel. The operator also maintains comprehensive test records in the electronic Project Results Instrumental Workbook. Equipment used to conduct Method 10 stack method testing includes:

Probe Material:	Stainless Steel
Moisture Removal:	Thermo-electric
Transfer Line:	Teflon™
Analytical Technique:	Non-dispersive Infrared
Calibration Gas:	EPA Protocol 1

Method Defined Quality Control:

- Sampling system leak-checks are performed before each test and following any component change. Absence of leaks is confirmed through the bias check after each run.
- Calibration gas standards of the highest quality, Protocol 1 or traceable to NIST, are used in calibrations.
- Analyzer calibration error is determined before initial run and after any failed bias or drift test.
- System bias check is performed before and after each test.
- Analyzer bias is verified once per test.
- Calibration drift test is performed after each test run.
- System response time is determined during initial sampling system bias test.

- Stratification test is performed prior to first run.
- Purge time of ≥ 2x the response time observed before starting data collection and recording stratification traverse point values.

Pace FSD conducts the method as written with no routine deviations.

Reference Standards. Pace implements a comprehensive program to verify and validate reference standards to further enhance and support method standards. Primary reference standards are directly comparable to a reference base. The National Institute of Standards and Technology (NIST) maintains primary reference materials or very closely traceable secondary standards. These materials are then used to certify secondary or transfer standards for use in quality management programs. Secondary reference standards are calibrated with primary standards using a high precision comparator. Materials that have a documented path to the primary standard are often referred to as traceable to NIST or NIST traceable. Where commercially and feasibly available, Pace uses primary reference standards to perform calibrations and verifications. In other cases, Pace maintains traceable secondary reference standards. Primary and secondary reference standards are used to calibrate and verify equipment and materials. Pace reference standards are calibrated by external vendors that have a formal, registered quality system. Calibrations are performed with equipment and materials that are traceable to NIST.

Quality Controls (not defined in test methods):

- Sampling/Recovery Reagents are Reagent Grade or better.
- Reference Temperature Simulator is calibrated annually.
- Reference Pressure Transducer is calibrated annually.
- Reference DryCal airflow meter is calibrated annually.
- Mercury Barometer is a primary reference standard.
- Liquid Manometers are primary reference standards.
- Angle Blocks, Gauge Blocks, and Measuring Rods are verified every five years.
- Angle Gauges are verified each day of use.
- Calipers are verified annually.
- Stainless steel reference weights are verified every five years.
- Analytical balances are calibrated annually and verified at each use.
- Field balances are calibrated annually and verified at each use.

Quality Management System. To produce data that is complete, representative, and of known precision and accuracy, Pace Analytical Field Services Division has designed and implemented a rigorous and innovative quality management system. The system was initially based on the USEPA Quality Assurance Handbook for Air Pollution Measurement Systems and continually developed as procedural complexities and standards progressed. The Field Services Division Quality Management System (Pace FSD QMS) is now accredited by the American Association of Laboratory Accreditation (A2LA) to comply with three national accreditation standards:

- ASTM D7036 - Standard Practice for Competence of Air Emission Testing Bodies (AETB).
- ISO 17025 - General Requirements for the Competence of Testing and Calibration Laboratories
- The NELAC Institute - General Requirements for Field Sampling and Measurement Organizations (FSMO)

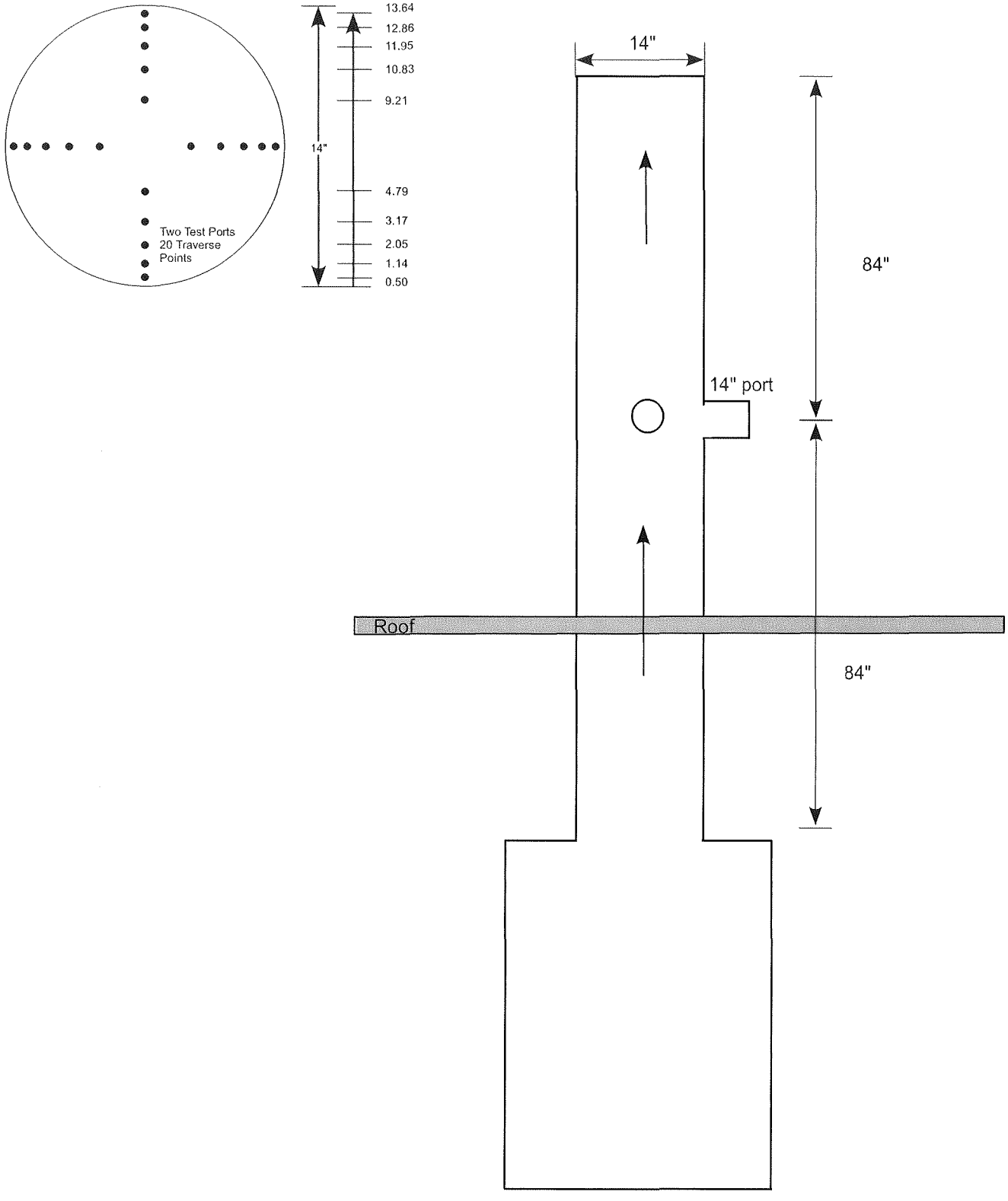
The Pace FSD QMS includes:

- Quality Programs
  - Ethics policy and training.
  - Corrective Action and Preventative Action (CAPA).
  - Continuous Process Improvement.
  - Documented Demonstrations of Capability.
  - Internal and third party proficiency testing.
  - Qualified Individual program (QI)
  - Internal and external audits.
  - Annual management reviews.
- Documentation and Traceability
  - High quality traceable standards and reagents.
  - Reagent tracking and management system.
  - Use of matrix spikes, duplicate analysis, internal standards, and blanks.
  - Validated workbooks for data collection and results reporting.
  - Electronic quality, training, and safety documents available in-field.
  - Sample security and preservation procedures.
  - Chain of custody maintained from sample collection through laboratory analysis.
- Equipment Calibration
  - Full time staff dedicated to equipment maintenance and calibration.

All equipment and instruments are calibrated by trained personnel on a frequency that meets or exceeds method requirements.

Pace Analytical
Field Services Division

Figure 1
Capital Region International Airport
Lansing MI
Incinerator Stack
CAA \ 07/21



Report Signatures

Field Testing and Reporting Performed by: Pace Analytical Services, LLC
Field Services Division
1700 Elm Street, Suite 200
Minneapolis, MN 55414

Field Testing Affirmation

All field testing was performed in accordance with stated test methods subject to modifications and deviations listed herein. Raw field data presented in this report accurately reflects results and information as recorded at the time of tests or otherwise noted.

Date 8/20/21

Mathew A. McDermott, QSTI
Team Lead

Report Affirmation

To the best of my knowledge, this report accurately represents the compiled field and laboratory information with no material omissions, alterations or misrepresentations.

Date 8/20/2021

Beth Kelm
Project Manager

Responsible Charge Affirmation

I have reviewed the information herein and it is approved for distribution.

Date 8/20/21

Terence J. Borgerding, QSTI
Operations Manager, Air