2025 COMPLIANCE TEST REPORT OF ONE ROTOR CONCENTRATOR THERMAL OXIDIZER AT MICROCHIP'S GRESHAM FACILITY

ODEQ Permit 26-3240-ST-01

Prepared for:

Microchip Technology, Inc.
21015 Stark Street
Gresham, OR 97030

Date Prepared:
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Source Test Date:
March 26, 2025

Prepared by:

2340 W Braker Lane, Suite A
Austin, TX 78758

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ACRONYMS AND ABBREVIATIONS

acfm	actual cubic feet per minutes
ASTM	American Society for Testing and Materials International
cal	calibration
CO	Carbon monoxide
CO_2	Carbon dioxide
CH_4	Methane
DL	Detection Limit
DRE	Destruction or Removal Efficiency
dscfm	dry standard cubic feet per minute
EPA	U.S. Environmental Protection Agency
^oF	degrees Fahrenheit
FID	Flame Ionization Detector
FTIR	Fourier Transform Infrared Spectroscopy
H_2O	Water or moisture
lb/hr	pounds per hour
lb/day	pounds per day
MDL	Minimum Detection Limit
MDC	Minimum Detectable Concentration
Microchip	Microchip Technology Incorporated
NIST	National Institute of Standards and Technology
NMVOC	Non-methane Volatile Organic Compounds
NMNEVOC	Non-Methane Non-Ethane Volatile Organic Compounds
O_2	Oxygen
ODEQ	Oregon Department of Environmental Quality
ppmv	parts per million by volume
QA/QC	Quality Assurance/Quality Control
RCO	Rotor Concentrator Outlet
RCTO	Rotor Concentrator Thermal Oxidizer
scfm	standard cubic feet per minute
Spectrum	Spectrum Environmental Solutions
THC	Total Hydrocarbon
TO	Thermal Oxidizer
UHP	Ultra High Purity
VOC	Volatile Organic Compound

PROJECT REPORT COMPLIANCE REVIEW

Project Title: COMPLAINCE TEST REPORT for One New Rotor Concentrator Thermal Oxidizer at Microchip's Gresham Facility, Gresham, Oregon ODEQ Permit 26-3240-ST-01

To the best of my knowledge, I certify that all data collected for this project are accurate and authentic and were taken in accordance with the appropriate source test methods. All data have been audited for entry accuracy, and all computer spreadsheets have been validated.

Date: 5/7/25

Alex Bellon
Principal Technical Specialist
Spectrum Environmental Solutions

STATEMENT OF LIMITATIONS

Final Report:
This report is intended for the sole use of Microchip Technology Incorporated. The scope of services performed for this work may not be appropriate to satisfy the needs of other users, and any use or re-use of this document or of the findings, conclusions, or recommendations presented herein is at the sole risk of said user.

1.0 INTRODUCTION

Microchip Technology Incorporated (Microchip) contracted Spectrum Environmental Solutions (Spectrum) to perform compliance testing on one newly installed Rotor Concentrator Thermal Oxidizer (RCTO) located at their Oregon facility in Gresham, Oregon. This compliance testing was completed in accordance with Permit 26-3240-ST-01 and includes Destruction or Removal Efficiency (DRE) determination for volatile organic compounds (VOC) emissions. The compliance testing occurred on March 26, 2025 and consisted of three one-hour runs.

1.1 ANALYTES MONITORED

The RCTO compliance testing required measuring volatile organic compound (VOC) emissions at the RCTO inlet and the two RCTO outlets (thermal oxidizer outlet (TO) and rotor concentrator outlet (RCO)). Since methane and ethane are not considered VOCs per EPA definition[1], the methane and ethane concentrations were subtracted from the total hydrocarbon (THC) concentration measured using a flame ionization analyzer or FID. All THC concentrations were measured as propane in accordance with EPA Reference Method 25A. Methane and ethane were measured at the inlet, TO, and RCO using a Fourier Transform Infrared spectrometer (FTIR) in accordance with ASTM Method D6348-12. All flow measurements were performed in accordance to EPA Methods 1, 2 (or 2F), and a modified EPA Method 3. This testing was performed to demonstrate compliance with the VOC requirements for RCTO units as defined in Permit 26-3240-ST-01. The cumulation of the collected data was used for determination of total emitted concentration, mass emission rate, and VOC DRE. Table 1-1 presents a summary of the monitoring test parameters and methods used for this test program. Additional discussion of the sampling methods and the results are presented in Sections 3.0 and 4.0 of this document.

[1] The EPA definition of VOC excludes methane and ethane per 40 CFR Part 51 Subpart F (s) (1). https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-51/subpart-F/section-51.100

TABLE 1-1. PARAMETERS TESTED

Parameter	Units	Sample Location	Method
Volumetric Flow Rate	dscfm, acfm, scfm	Inlet, RCO and TO	EPA RM 1-2, 2F
Gas Molecular Weight (CO_2/O_2)	Percent by volume	Inlet, RCO and TO	EPA RM2, Modified EPA RM 3A
Total Hydrocarbon (THC)	ppmv, ppmvd, lb/hr	Inlet, RCO and TO	EPA RM 25a
Methane and Ethane	ppmv	Inlet, RCO, and TO	FTIR by ASTM D6348-12
Moisture	Percent by Volume	Inlet, RCO, and TO	FTIR by ASTM D6348-12
Carbon Dioxide (CO_2)	ppmv	TO	FTIR by ASTM D6348-12

RM – Reference Method
dscfm – dry standard cubic feet per minute
acfm – actual cubic feet per minute
scfm – standard cubic feet per minute
lb/hr – pounds per hour
ppmv – parts per million by volume

1.2 APPLICABLE PERMIT REGULATIONS

Microchip operates under air Permit 26-3240-ST-01 originally issued in 2019 and modified in April 2024. The cumulation of data was used to determine compliance with Microchip's air permit criteria as follows:

- 90% destruction or removal efficiency (DRE) of VOCs when inlet loading to the RCTO is ≥ 90 ppmv (as propane) or
- A total outlet, flow-weighted[2] VOC concentration of ≤ 10 ppmv (as propane) or less when inlet loading to the RCTO is less than 90 ppmv (as propane).

The following are applicable excerpts from the permit pertinent to the RCTO compliance testing.

This data will be used for the limitations prescribed in the Microchip Technology Standard Air Contaminant Discharge Permit (ACDP), Permit 26-3240-ST-01 Section 3.1 of the 2023 permit modification, which states:

3.1. VOC Emissions

The permittee must control Volatile Organic Compound (VOC) emissions from Building 1 and Building 2 manufacturing operations with rotor concentrator thermal oxidizers (RCTOs) that must each achieve a minimum 90% destruction removal efficiency (DRE) of VOCs entering the RCTOs when the inlet VOC concentration (measured as propane) is 90

[2] VOC outlet concentration weighted using flows from both outlets

ppmv or greater. If/when the inlet VOC concentration falls below 90 ppmv, the outlet VOC concentration (measured as propane) must not exceed 10 ppmv.

The operation of the facility and the RCTO unit as well as the RCTO unit parameters to be collected during the compliance testing are listed in Microchip's 2023 permit modification, Section 6.1 (c), (e)(i)(ii)(iii)(v), (f), (g), (h), (i), and (j) which state:

6.1. Testing Requirements

The permittee must conduct a source test of the control devices as specified below: [OAR 340-212-0120]

c. Source testing must be conducted while the facility is operating within 90% its normal operating capacity at the time of the test. Sampling must take place under worst case operating conditions observed during normal operations (i.e., redundant control devices should not be operating during testing);

e. During each source test the following parameters must be monitored and recorded:

i. RCTO oxidizer and desorption chamber temperatures;

ii. Pressure drop across concentrator wheel of the RCTO;

iii. RCTO natural gas usage;

v. Other facility/process operating parameters identified prior to the test.

f. Only regular operating staff may adjust the combustion system or production processes and emission control parameters during the source test and within two hours prior to the tests. Any operating adjustments made during the source test, which are a result of consultation during the tests with source testing personnel, equipment vendors or consultants, may render the source test invalid;

g. A pretest plan for each source test required above must be submitted for approval to DEQ's Source Test Coordinator at the ODEQ Northwest Regional Office, at least 30 days prior to testing;

h. The reference test methods identified in the table below must be utilized in the source tests identified above. A test method modification/variance or substitution of an alternative test method must be pre-approved by the DEQ's Source Test Coordinator and

i. All tests must be conducted in accordance with the DEQ's Source Sampling Manual and with the pretest plan. All test data and results must be submitted to the Source Test Coordinator for review within 60 days after completion of the testing cycle unless an alternate submission date or extension is approved by DEQ.

j.

Reference Test Method	***Tested pollutant/parameter***
EPA 1&2	*Flow Rate*
EPA 3	*Dry Molecular Weight*
EPA 4 or ODEQ Method	*Moisture*
EPA 25A	*Total VOC*
EPA 26, 26A, 320 or ASTM D6348-12	*HF & HCl*

1.3 PROJECT LEADS

Table 1-2 summarizes the responsible parties involved with this test campaign.

TABLE 1-2. TEST PROGRAM SUMMARY

Category	Description
Project Name	Compliance Testing of Microchip's 1 New RCTO Unit
Equipment Owner	Microchip Technology Incorporation 21015 Stark Street Gresham, OR 97030
Facility Contact	Becky Kim Environmental Engineer Microchip Technology, Inc. 21015 Stark Street Gresham, OR 97030 (971)-266-7887
Equipment Tested	One Munters RCTO Unit
Equipment Location	Microchip Technology Inc. 21015 Stark Street Gresham, OR 97030
Regulatory Agency	ODEQ
ODEQ Permit No.	26-3240-ST-01
Source Test Firm	Spectrum Environmental Solutions 2340 West Braker Lane, Suite A Austin, TX 78758
Source Testing Project Manager	Steve Hall Phone (512) 587-1386 steve@spectrumenvsoln.com

1.4 SOURCE TEST PROTOCOL

A source test protocol was submitted, reviewed by, and approved by ODEQ ahead of the onsite testing. Appendix E contains the protocol and documentation regarding the approval process and notification.

There are no limitations on the results reported herein that would prohibit them from use for compliance with applicable parts of Microchip's Air Contaminant Discharge Permit. No deviations to the mentioned reference methods or the Test Protocol that were not discussed with ODEQ and agreed upon were required.

2.0 EQUIPMENT AND PROCESS DESCRIPTION

2.1 FACILITY DESCRIPTION

Microchip's facility conducts semiconductor manufacturing operations and processes. Three newly installed RCTO units are used to abate VOCs from process exhaust streams. RCTO 2 and 3 were tested in 2024 before RCTO 4 was brought online. The RCTOs are equipped with a single zeolite concentrator and thermal oxidizer operated concurrently. Microchip operates its facilities and RCTOs on a 365 x 24 schedule

2.2 SOURCE DESCRIPTION

The RCTOs are equipped with a single zeolite concentrator wheel followed by a thermal oxidizer. The RCTO Make/Model and other pertinent information is presented in Table 2-1. Figure 2-1 depicts normal operation of an RCTO unit.

The process operates as follows:

- Solvent-laden air is drawn through the rotor wheel where VOCs are removed from the air stream by adsorption onto the hydrophobic zeolite. After passing through the rotor, the cleaned air is discharged into the atmosphere through the rotor concentrator outlet stack.

- The Zeolite rotor turns continuously and transports the adsorbed VOCs into a regeneration zone. In that zone, the VOCs are removed by a small heated air stream and the regenerated zeolite is then rotated back into the process air stream.

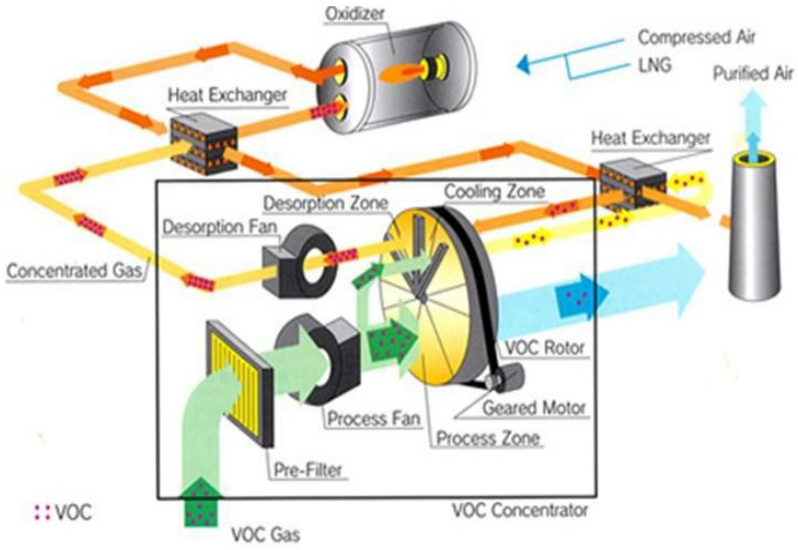
- The heated air is then passed into the thermal oxidizer combustion chamber, where it is further heated to approximately 1,400 °F (1,375 °F minimum), oxidizing the VOCs.

- The treated air is forwarded to the TO exhaust stack where it is discharged into the atmosphere.

TABLE 2-1. RCTO UNITS TESTED

Unit Name	Identification	Make	Model	Mfd Date	Capacity
RCTO 4	RCTO	Munters	IZS-3546-TH	05/16/2024	34,000 CFM

Figure 2-1. Basic Design of Rotor Concentrator Thermal Oxidizer



2.3 SUMMARY OF UNIT OPERATING PARAMETERS

The RCTO operated in normal operating conditions during the compliance testing. Per the Microchip permit, several RCTO operational parameters are required to be monitored during the compliance testing to demonstrate the RCTO was operating in a normal fashion. These were submitted with the test protocol and Table 2-2 summarizes the average operating data for the unit during the performance testing. A complete minute-by-minute listing of the operations data for the tests is presented in Appendix F.

Per Condition 6.1. of Microchip's Standard ACDP, compliance testing must be conducted while the facility is operating within 90% of its normal operating capacity at the time of the test. As part of a previous compliance testing campaign, Microchip verified with Oregon DEQ that a 12-month rolling period of production could be used to represent normal operating capacity. Due to business conditions, Microchip anticipated operating at less than 90% of its normal operating capacity. During pre-test discussions, Microchip confirmed with DEQ that achieving a 90% DRE would be more challenging at reduced flow levels, and this operating level was approved.

TABLE 2-2. RCTO OPERATING PARAMETERS

RCTO ID	Date	Run	Pressure Differential ("H2O)	Natural Gas Usage (scf)	Desorption Chamber Temperature (°F)	Oxidizer Temperature (°F)
RCTO 4	3/26/25	1	0.803	1,661.7	390	1400
		2	0.793	1,661.7	390	1400
		3	0.857	1,661.7	390	1400
	Average		**0.818**	**1,661.7**	**390**	**1400**

2.4 TEST CHRONOLOGY

Table 2-3 presents the sampling times for collection of all samples during the compliance test runs performed at the RCTO unit.

TABLE 2-3. SUMMARY OF SAMPLE COLLECTION TIMES

RCTO ID	Date	Run	RCTO VOC Sample Times
RCTO 4	3/26/25	Run 1	8:10 – 9:10
		Run 2	9:20 – 10:20
		Run 3	10:30 – 11:30

2.5 SAMPLING LOCATION DESCRIPTIONS

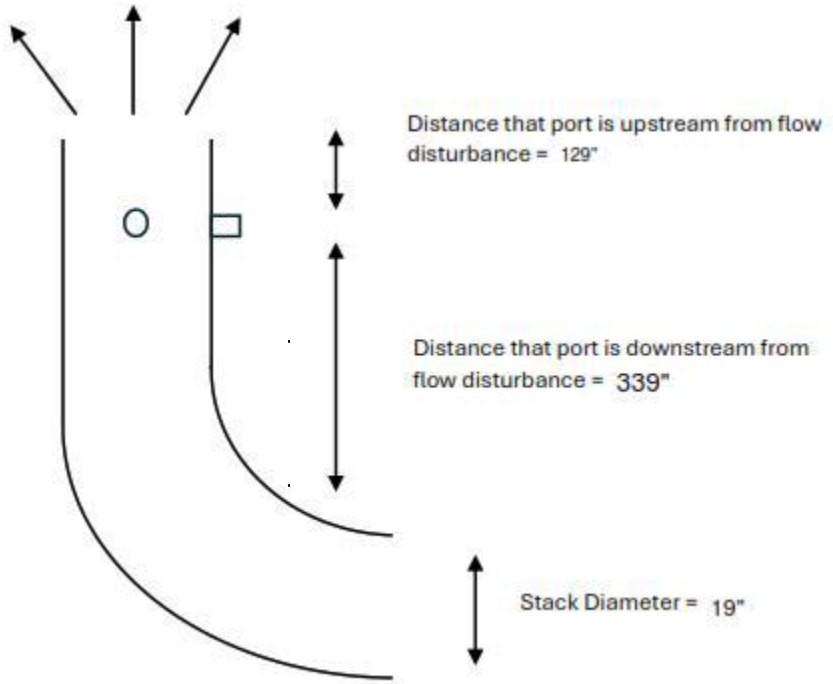
Table 2-4 lists the EPA Method 1 measurements used to determine the flow traverse points. A 16-point traverse was performed at each inlet and TO outlet for volumetric flow. Due to the location of the sampling ports relative to flow disturbances for each RCO outlet, a 3-dimensional probe was used in accordance with Section 11.5 of EPA Method 1, and a 40-point traverse was performed for volumetric flow.

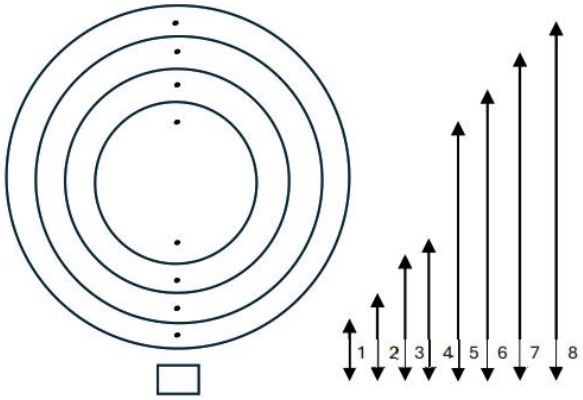
Figure 2-2, presents an example schematic of the sampling locations and traverse points for a TO source.

TABLE 2-4. SUMMARY OF RCTO SOURCE MEASUREMENTS

Port Location	Internal Diameter (inches)	Cross Sectional Area (square inches)	Upstream Distance		Downstream Distance	
			Inches	Equivalent Diameter	Inches	Equivalent Diameter
Inlet	44	1520.5	70.02	1.59	151.94	3.45
RCO	44	1520.5	81.91	1.86	33.91	0.77
TO	19	283.5	128.96	6.79	339.19	17.89

Figure 2-2. RCTO TO Sampling Locations and Traverse Points





Traverse Point	Distance from Wall (in.)
1	5/8"
2	2"
3	3 5/8"
4	6 1/8"
5	12 7/8"
6	15 2/8"
7	17"
8	18 3/8"

2.6 SAMPLING EQUIPMENT DESCRIPTIONS

This section provides additional detail on the sampling and analytical systems used for the compliance testing. It should be noted that the THC and FTIR analyzers, at each independent location, shared the same sample extractive system. The THC and FTIR were positioned in series as related to the sample flow path. Figure 2-3 depicts the RCTO sampling system. A portion of the extracted sample was delivered to each analyzer. Since the THC analyzers only require a small volume of flow, the larger proportion of the extracted sample gas was delivered to the FTIR.

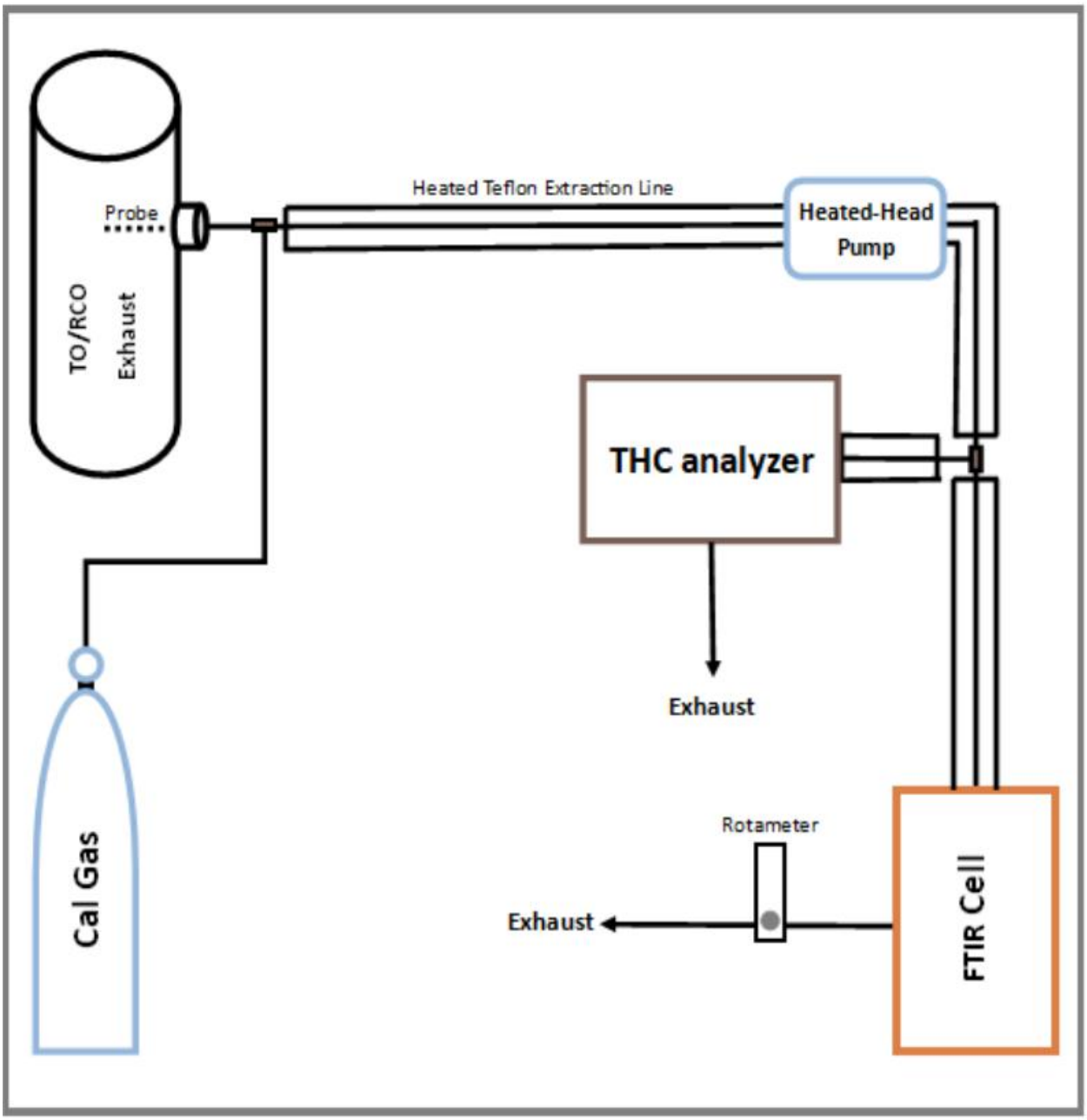
2.6.1 EXTRACTIVE SAMPLING SYSTEMS

Sample gas was continuously pulled at ~5 lpm through a heated sample system using heated-head diaphragm pumps. Three extraction systems were employed for the testing each comprised of the flowing parts ordered in the flow-path the gas traversed through the systems:

- Unheated 3/8" OD stainless steel sample probe,
- Unheated 3/8" OD spike/calibration "T",
- Heated (≥250 °F) 3/8" OD Teflon™ sample extraction line (150-200'),
- Heated-head (≥250 °F) sample pump,
- Heated (≥250 °F) 3/8" OD Teflon™ jumper line (6'),
- Insulated tee at the back of the THC analyzer,
- 2nd heated (≥250 °F) 3/8" OD 6' Teflon™ jumper line,
- Heated (150 °C) FTIR sample cell,
- Unheated rotameter, and
- Unheated exhaust line.

All wetted parts of the heated sample system were constructed using Teflon™ tubing and stainless-steel fittings. The sample probe was connected to a calibration/spiking "T" to which the calibration line and the heated extraction line were also connected. This allowed for the propane calibration gases to be delivered to each THC analyzer as well as the spike gas and CTS (calibration transfer standard) gas to be delivered to the FTIRs. The FTIRs at the inlet, TO, and RCO provided moisture, carbon dioxide, methane, and ethane concentration and a THC analyzer provided a total hydrocarbon concentration from each location.

Figure 2-3. Inlet, TO, and RCO Extractive Sampling System



2.6.2 GAS VELOCITY MONITORING EQUIPMENT

The flow monitoring equipment for each location consisted of an S-Type Pitot tube connected to an electronic manometer and a K-type thermocouple. The gas velocity was measured as a pressure differential on the manometer at each traverse point. Since the thermocouple probe was positioned at the Pitot tubes, the gas temperature was also recorded at each traverse point. The gas velocity measurements for the inlet, TO, and RCO were conducted once per each run for a total of three measurements per unit (six measurements in total). It should be noted that a 3-dimensional probe was used for the RCO flow measurements. Additionally, a barometric pressure measurement was also required as it is used in the flow calculation. The barometric pressure sensor was manufactured by Traceable (MarketLab model) and is NIST traceable. The applicable calibration documentation is presented in Appendix G.

2.6.3 THC MONITORS

The inlet, TO, and RCO exhausts were analyzed for THC concentration using three VIG Industries Model 20/2 THC analyzers. A slip-stream of the sample was pulled through each analyzer using the analyzer's internal pump. These instruments are based on the principal of the flame ionization detection (FID) where the number of ions produced in a flame is proportional to the number of reduced carbon atoms in the sample. UHP Hydrogen was supplied to each THC analyzer to fuel the FIDs and oxygen (from ambient air) was provided using a 2nd internal pump. The THC analyzers were calibrated using appropriate propane gas standards suitable for the expected concentration range for each location. All propane calibrations gas standards were EPA Protocol 1 quality gas standards and the certifications can be found in Appendix G. Although calibrated with propane, the analyzers may have differing responses to unsaturated or cyclic carbons commonly found in semiconductor exhausts; however, the THC analyzers are a good overall tool for estimating the total hydrocarbon number as they have strong linear responses to alkanes/alkenes/alkynes and aromatics. Additional information regarding the operation of the VIG THC analyzers can be found at the vendor website.[3]

A Data Acquisition System was used to record the THC instrument response/concentration results in one (1) minute averages. The data was continuously stored as a tab delimited text file format on

[3] https://www.vigindustries.com/model-20-2

the hard drive of the onsite computer. At the completion of testing, the data was also saved to the Spectrum server. All data was reviewed by the Field Team Leader before leaving the facility.

2.6.4 FTIR SPECTROMETER

Three Spectrum Environmental Solutions produced WaveRunner™-EXT FTIRs containing fixed-path 10 m heated (150°C) sample cells were employed to quantify the concentration of methane, ethane, water, and carbon dioxide at the inlet, TO, and RCO outlets. Since the gas samples were delivered to the FTIR sample cell at levels slightly above ambient pressure, cell pressure was continuously recorded during measurement periods using a pressure sensor calibrated over the 0 – 1000 torr range. These pressures, along with the cell temperature as read by a K-Type thermocouple were used in the quantification of each spectrum collected.

An infrared spectrum analysis is performed by matching the features of an observed spectrum to those of reference standards. If more than one feature is present in the same region, a linear combination of references is used to match the compound features. The standards are scaled to match the observed band intensities; this scaling also matches the unknown concentrations.

The scaled references are added together to produce a composite that represents the best match with the sample. A classical least squares mathematical technique is used to match the reference standards' absorption profiles with those of the observed sample spectrum in specified spectral regions. Compounds of interest and any known compounds expected to present spectral interference (water for this data set) are included in the analysis regions. The analysis method for this sampling was optimized for methane and ethane analysis during sampling and later refined to best fit the interferences within the sample matrix.

3.0 SAMPLING AND ANALYTICAL PROCEDURES

All compliance testing was performed in accordance with the approved Test Protocol. Compliance testing was performed over three one-hour runs.

Sample gas was extracted and delivered to the THC and FTIR analyzers on a continuous basis at approximately 5 lpm. The FTIR and THC analyzers produced concentration results at a 1-minute frequency and each 1-minute data point is the average of several individual concentration measurements collected (co-added) at much shorter frequencies. Since mass emissions rates were required to determine the DRE of the RCTO, the total volumetric flowrate at the inlet, RCO, and TO was also measured.

3.1 TOTAL VOLUMETRIC FLOW MEASUREMENTS

Flow measurements were performed once per run at the inlet, RCO, and TO locations concurrent with the FTIR measurements. Sections 3.1.1 through 3.1.4 describe in detail all the measurements performed for the volumetric flow calculations.

3.1.1 EPA METHOD 1: SAMPLING AND VELOCITY TRAVERSE POINT LOCATIONS

EPA Method 1, "Sampling and Velocity Traverse Point Locations," was used to determine the number and position of the traverse points within the inlet, TO and RCO ducts. Figure 1-2 and Table 1-2 of the EPA Method 1 were followed to determine the number and location of each traverse point for each sample location of the RCTO. The complete data sheets are in Appendix B.

It was determined prior to testing that each unit's RCO duct sample ports did not meet the Method 1 criteria for positioning relative to flow disturbances. Therefore, Methd 2F was performed at those locations for gas velocity measurements in lieu of Method 2.

Each inlet and TO sample location was checked for the absence of cyclonic flow per EPA Method 1. In summary, the Pitot tube was placed at each traverse point perpendicular to the flow then rotated into and out of the flow until a null reading of differential pressure was measured. The angle of rotation (yaw angle) was then recorded for each traverse point and the absolute average of the yaw angles was calculated. An average of less than 20° is verification that the flow is not cyclonic and EPA Method 2 can be used. Each inlet and TO sample location demonstrated an average yaw angle less than 20°, allowing for the use of EPA Method 2. Documentation of the cyclonic flow checks at each sample location can be found in Appendix B.

3.1.2 EPA METHOD 2: DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

The stack gas velocity at each inlet and TO exhaust outlet and was determined in accordance to EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (S-Type Pitot Tube)". An S-Type Pitot tube was positioned parallel to the gas flow at each traverse point and the pressure differential was read using an electronic manometer and transcribed onto a flow data sheet. The temperature was also read (using a K-Type thermocouple) at each point during the velocity traverse and recorded on the velocity data sheet. The Pitot tube used for this testing was assigned the default correction factor of 0.84. The flow-associated data sheets are presented in Appendix B.

The barometric pressure was measured using a handheld barometric pressure sensor. The sensor reports the barometric pressure in inHg (inches of mercury) and was read and written on the data sheet at the time of the flow measurement.

3.1.3 EPA METHOD 2F: DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE WITH THREE-DIMENSIONAL PROBE

The gas velocity at the RCO exhaust outlet was determined in accordance to EPA Method 2F, "Determination of Stack Gas Velocity and Volumetric Flow Rate with Three-Dimensional Probe". A 3-D probe (5-hole prism-shaped/DAT probe) was positioned parallel to the gas flow at each traverse point and determined the velocity pressure and the yaw and pitch angles of the duct. The pressure differentials were read and recorded using an electric manometer and transcribed onto a flow data sheet. The yaw angle was directly measured by rotating the probe and the pitch angle was calculated using the probe-specific calibration curves. These values were recorded into the flow velocity data sheet. The average axial velocity of the stack gas was calculated and was used to determine the average gas volumetric flow rate in the stack. The temperature was also read at each point during the velocity traverse and recorded onto the velocity data sheet. The flow-associated data sheets are presented in Appendix B.

3.1.4 MOLECULAR WEIGHT – OXYGEN AND CARBON DIOXIDE CONCENTRATIONS

Oxygen (O_2) and Carbon Dioxide (CO_2) concentrations were used for molecular weight determination of the TO outlet. The CO_2 concentrations were measured by FTIR and were used to calculate the oxygen (O_2) level stoichiometrically using natural gas combustion as a basis. For the inlet and RCO sources, an assumed dry molecular weight of 29.0 g/mol was used as stated in EPA Method 2, Section 8.6: "For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0". These approaches were approved by ODEQ in the Test Plan Approval dated February 5, 2025. A copy of the approval is in Appendix E.

3.2 EPA METHOD 25A: TOTAL GASEOUS ORGANIC COMPOUNDS

All total hydrocarbon measurements were performed in accordance with EPA Method 25a *"Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer"*. Since neither methane or ethane are considered a VOC by EPA definition, they were subtracted (as measured by FTIR) from the total hydrocarbon concentration (as measured by 25a).

Stack gas was extracted from the center of each source duct through a stainless-steel probe and heated sample line and delivered to the three THC analyzers. The RCTO exhaust source (TO and RCO) THC analyzers were calibrated over a 0-12 ppm range (as propane) whereas the inlet THC analyzer was calibrated over a 0-225 ppm range (as propane). Prior to testing each THC analyzer was calibrated using EPA Protocol 1 propane gas standards. Three calibration gas standards and a zero (UHP nitrogen) were used and the concentrations of the propane standards (low, mid and high) met the criteria specified by Method 25a. Upon completing the calibration, the system bias and drift (zero and appropriate calibration gas) were checked after each run. All THC concentration data were simultaneously and continuously recorded by the data acquisition system. Although each analyzer collected data nearly instantaneously, data were averaged into 1-minute data points as specified in the Test Protocol. All THC data can be found in Appendix C and a log of the activities and calibrations is located in Appendix B. Additionally, the gas certification for all propane calibration gases used are located in Appendix G.

3.3 ASTM METHOD D6348-12: FTIR DETERMINATION OF METHANE, ETHANE. CO_2 AND MOISTURE CONCENTRATION

The CO_2, methane, ethane, and moisture concentrations were determined at each RCTO outlet exhaust in accordance with ASTM D6348-12 *"Standard Test Method for Determination of Gaseous Compounds by Direct Interface Fourier Transform Infrared (FTIR) Spectroscopy".* Per the accepted source test protocol, methane was the analyte chosen for the analyte spiking and served as a surrogate for CO_2, ethane and water. A quality assurance matrix spike (QA Spike) was performed prior to testing to qualify the FTIRs for the testing. A further detailed description of the QA Spike procedure and the spike results are presented in Section 5.1.

A WaveRunIR™-EXT FTIR continuously measured (data point every ~1 minute) an extracted sample from the center of the inlet, TO outlet, and RCO outlet. Prior to sampling, the FTIR was aligned and optimized as a function of signal throughput, resolution, and laser signal. The integrity of the FTIR cell and sample system was leak-checked as part of the mechanical response challenges by flowing the CTS gas up to the spike "T" (essentially flooding the T and probe) and extracting it back through the sample system. A low concentration measurement of the CTS analyte (R22) indicates a leak in the system. The CTS gas was injected at a rate that was greater

than the sample pump draw, yet not so significant that it changed the sample pressure of the system (as read from the cell pressure). A passing CTS is indicative of a leak-free system.

The FTIR analytical analysis method used for the performance testing was optimized for methane, carbon dioxide, ethane and water detection in this particular sample matrix. Methane was selected as the analyte to perform ASTM QA spiking as it was to be subtracted from the THC concentrations.

The FTIR references used to build the analysis method were commercially available. A linear combination of individual references was incorporated to develop the calibration ranges for each analyte monitored. These references have been used reliably on many other test campaigns.

The averaged VOC and methane FTIR results are presented in Table 4-3. Ethane was never detected throughout testing. The entirety of the FTIR data is presented in Appendix C.

4.0 RCTO EFFLUENT EMISSIONS AND DRE TEST RESULTS

4.1 TEST RESULTS SUMMARY

All the run and test results reported in this section were collected and analyzed compliant with the approved Test Protocol and are deemed suitable for demonstration of compliance with Microchip's permitted VOC levels. No deviations from the approved Test Protocol or reference methods were required. The tables below summarize the data results for this compliance test. Table 4-1 displays the emissions and DRE results as it relates to the Microchip's applicable permit limit(s). Tables 4-2 and 4-3 present the individual and averaged results for each run at each location. The compliance test results successfully demonstrated compliance with Microchip's permitted levels.

TABLE 4-1. RCTO 4 INLET VOC RESULTS

	Run 1	**Run 2**	**Run 3**	**Average**
Date	3/26/25	3/26/25	3/26/25	
Time	8:10 – 9:10	9:20 – 10:20	10:30 – 11:30	
Flow Rate (dscfm)	26,873	28,372	29,847	28,364
THC (ppmvd as propane)	32.0	36.4	30.0	32.8
Methane (ppmvd)	2.04	1.96	2.00	2.00
Ethane (ppmvd)	BDL	BDL	BDL	BDL
VOC (ppmvd as propane)	31.3	35.7	29.3	32.1
VOC Input Rate (lb/hr as propane)	**5.78**	**6.96**	**6.02**	**6.25**

BDL – Below Detection Limit

TABLE 4-2. RCTO 4 OUTLET VOC RESULTS

	Run 1		Run 2		Run 3		Average	
Date	3/26/25		3/26/25		3/26/25			
Time	8:10 – 9:10		9:20 – 10:20		10:30 – 11:30			
RCTO Stream	TO	RCO	TO	RCO	TO	RCO	TO	RCO
Flow Rate (dscfm)	2,735	23,410	2,632	22,935	2,657	24,440	2,675	23,595
THC (ppmvd as propane)	4.13	0.97	4.22	1.03	3.96	1.09	4.11	1.03
Methane (ppmvd)	1.44	1.96	1.64	1.83	1.42	1.81	1.50	1.87
Ethane (ppmvd)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
VOC (ppmvd as propane)	3.65	0.32	3.68	0.42	3.49	0.49	3.61	0.41
Combined Outlet VOC (ppmvd as propane)	**0.67**		**0.76**		**0.78**		**0.74**	
Combined VOC Emission Rate (lb/hr as propane)	**0.120**		**0.133**		**0.146**		**0.133**	

BDL – Below Detection Limit

TABLE 4-3. SUMMARY OF RCTO 4 VOC DRE

	Run 1	Run 2	Run 3	Average	Permit Limit
Date	3/26/25	3/26/25	3/26/25		
Time	8:10 – 9:10	9:20 – 10:20	10:30 – 11:30		
Inlet VOC Conc. (ppmvd, as propane)	31.30	35.72	29.34	32.12	NA
VOC Input Rate (lb/hr)	5.78	6.96	6.02	6.25	NA
Combined Outlet VOC Conc. (ppmvd, as propane)	**0.67**	**0.76**	**0.78**	**0.74**	**<10**
VOC Emission Rate (lb/hr)	0.12	0.13	0.15	0.13	NA
VOC DRE (%)	**97.9**	**98.1**	**97.6**	**97.9**	**>90**

[1]Dependent on inlet loading – 90 ppm or less triggers a flow weighted outlet concentration limit of <10ppmv. If inlet loading is > 90 ppmv then DRE must be 90% or greater.

4.1.1 CALCULATIONS

This section presents the calculations used in generating the finalized data sets.

The O_2 concentration of the outlet gas based on measured CO_2 concentration and the stochiometric maximum CO_2 concentration was calculated as:

$$O_2 = 20.95 - \left(\frac{CO_2 - CO_{2\,bkg}}{\frac{CO_{2\,Max}}{20.95}} \right)$$

Where:

O_2 = Calculated Oxygen concentration (%, dry);
20.95 = Ambient air oxygen concentration (%);
CO_2 = Measured Carbon Dioxide concentration (%, dry);
$CO_{2\,bkg}$ = 0.04%
$CO_{2\,Max}$ = Stoichiometric maximum concentration of Carbon Dioxide based on natural gas fuel (11.737%, dry).

The actual velocity of the outlet gas based on EPA Method 2 was calculated as:

$$v_s = K_p \times C_p \times \sqrt{\frac{\Delta P_{avg} \times T_s}{P_s \times M_s}}$$

Where:

V_S = Velocity of the outlet duct (ft/sec);
ΔP = Root mean square average differential pressure measured by S-Type pitot (in. H_2O);
T_s = Average gas temperature in duct (^oR);
P_s = Absolute duct pressure (in. Hg);
M_w = Wet gas molecular weight (lb/lb-mole); and
C_p = Type-S pitot correction factor (0.84).

The volumetric flow rate of the outlet duct at actual conditions based on EPA Method 2 was calculated as:

$$Q_{ac} = 60\ (V_s)(A)$$

Where:

Q_{ac} = Actual volumetric flowrate (acfm);
V_s = Velocity of the outlet gas (ft/sec);
A = Cross-sectional area of the outlet duct (ft^2); and
60 = Conversion from second to minutes.

The volumetric flow rate of the outlet duct at standard conditions based on EPA Method 2 was calculated as:

$$\mathbf{Q_s = (Q_{ac})\left(\frac{528}{T_s}\right)\left(\frac{P_s}{29.92}\right)}$$

Where:

Q_s	=	Dry volumetric flowrate at standard conditions (scfm);
Q_{ac}	=	Actual volumetric flowrate (acfm);
528	=	Standard temperature (^oR);
T_s	=	Average gas temperature in outlet duct (^oR);
29.92	=	Standard pressure (in. Hg); and
P_s	=	Absolute stack pressure (in. Hg).

The mass emission rate (MER) of total NMVOCs, in pounds per hour was calculated as follows:

$$\mathbf{MER_{NMVOC} = NMVOC_{ppmv} \times Q_s\left(\frac{44.1 \times 60}{1{,}000{,}000 \times 385.24}\right)}$$

Where:

$NMVOC_{ppmv}$	= NMVOC Concentration in ppm by volume;
Q_s	= Volumetric flowrate at standard conditions (scfm);
1,000,000	= Conversion from ppm;
44.1	= Molecular weight of propane;
60	= Conversion from hours to minutes; and
385.24	= molar volume in standard cubic feet per lb-mole.

The flow-weighted outlet concentration for the combined VOC concentration of the RCTO outlets was calculated as follows:

$$\mathbf{FWAC} = \frac{(\boldsymbol{F_T \times C_T}) + (\boldsymbol{F_R \times C_R})}{(\boldsymbol{F_T + F_R})} \times \mathbf{100}$$

Where:

FWAC	= flow-weighted outlet VOC concentration (ppmv)
F_T	= Thermal oxidizer flow rate (scfm)
C_T	= Thermal oxidizer VOC concentration (ppm, as propane)
F_R	= Rotor concentrator flow rate (scfm)
C_R	= Rotor concentrator VOC concentration (ppm, as propane)

The destruction or removal efficiency (DRE) for Microchip's permit compliance was calculated as follows:

$$\mathbf{DRE} = \frac{\mathbf{I} - \mathbf{O}}{\mathbf{I}} \times \mathbf{100}$$

Where:

DRE = Destruction or removal efficiency (%)
I = Inlet emission rate (lb/hr)
O = Outlet Emission rate (lb/hr)

4.2 TEST CRITIQUE

All calculations are performed using unrounded data. The results presented in these tables are rounded to present meaningful levels of uncertainty. To reproduce values exactly may require using the raw data presented in the appendices.

All reported data are within method guidelines unless otherwise noted. The data herein are considered to be usable for the intended purpose of demonstrating ongoing compliance with the emission limits listed in the Microchip Permit 26-3240-ST-01.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

5.1 ASTM D6348-12 QA/QC

As part of quality assurance procedures of the FTIR ASTM methodology, system recovery checks or QA spikes of the target analyte (CH_4) were performed. The methane QA spikes also acted as a surrogate for moisture, CO_2 and ethane analysis by FTIR. The ASTM Method requires this once per source type. These QA spikes challenge the instrumentation for accuracy of target analyte quantification while simultaneously verifying that the extractive system and analyzer are unreactive with the target compound(s). The spiking procedure for the system recovery is described in detail in the ASTM FTIR method and summarized as follows.

A direct inject test (DI) was performed. This is a once-only test in which the gas standard is introduced directly into the heated sample cell (bypassing the extractive assembly). In addition to the target analyte, the gas cylinder also contained a spectroscopic tracer (a broad, strong IR absorber which behaves linearly over a large concentration range) used to calculate the dilution factor. Chlorodifluoromethane (R22) was the tracer contained in the QA spike gas cylinder. After the cell was sufficiently purged with the gas standard, the analysis method returned values ($R22_{cylinder}$ & $CH_{4\ cylinder}$) which represent the concentration of R22 and CH_4 in the gas cylinder as measured by the FTIR.

The gas standard was then injected into the spiking "T" downstream of the probe as the stack effluent was drawn through the extractive and FTIR systems. The gas standard injection flow was maintained at a constant rate using the cylinder regulator and a metering valve. After the FTIR cell was sufficiently purged with the gas standard/stack effluent mix, the FTIR analysis produced a stable tracer concentration which represents the concentration of R22 after dilution by the stack effluent ($R22_{sample}$). The dilution factor (DF) was determined by dividing the $R22_{sample}$ by the $R22_{direct}$.

The expected concentration of CH_4 ($CH_{4\ Theoretical}$) was calculated using the DF as well. The contribution from the cylinder was calculated as the product of the DF and the DI $CH_{4\ direct}$ and the contribution from the native gas stream calculated as (1-DF) times the native concentration. The equation used to calculate the expected CH_4 concentration is as follows:

$$CH_{4\ Theoretical} = \left(\frac{R22\ sample}{R22\ direct}\right)(CH_{4\ direct}) + \left[1 - \left(\frac{R22\ sample}{R22\ direct}\right)\right](CH_{4\ Stack})$$

Where:

$CH_{4\ Theoretical}$ = Expected CH_4 concentration (ppm);

$R22_{sample}$ = R22 concentration (ppm) as seen by the FTIR during QA spiking;

$R22_{direct}$ = R22 concentration (ppm) recorded during direct injection of the QA standard gas into the FTIR cell;

$CH_{4\ direct}$ = CH_4 concentration (ppm) recorded during direct injection of the QA standard gas into the FTIR cell; and

$CH_{4\ stack}$ = Methane concentration (ppm) of the stack gas during stable conditions.

The criterion for a successful recovery, per the ASTM D6348-12, is a measured concentration within 0.7-1.3 times the calculated theoretical concentration. Table 5-1 presents the direct inject results for both FTIRs used as well as the certified concentration of the cylinder. All QA CH_4 spikes passed and Table 5-2 summarizes the results of the ASTM D6348-12 QA recovery spikes performed. All the raw concentration data is presented in Appendix H and the QA standard certificate of analysis in in Appendix G.

TABLE 5-1. SUMMARY OF DIRECT INJECTION RESULTS

Date	RCTO Source	Cylinder Certificated Concentration: CC105191		Direct Inject FTIR Concentration Result	
		R22 (ppm)	CH_4 (ppm)	R22 (ppm)	CH_4 (ppm)
3/26/25	Inlet	20.24	20.56	20.20	19.64
	RCO			21.18	20.59
	TO			21.18	20.72

TABLE 5-2. SUMMARY OF CH_4 ASTM D6348-12 QA SPIKES

Unit ID	Date	RCTO Source	Dilution Factor	CH_4 Observed Spike (ppmv)	CH_4 Expected Spike (ppmv)	Percent Recovery (%)	Comment
RCTO 4	3/26/25	Inlet	0.058	2.47	2.67	92.8	Pass
		RCO	0.058	2.60	2.58	100.7	Pass
		TO	0.095	3.94	3.81	103.5	Pass

5.1.1 ASTM CTS Challenges

ASTM D6348-12 also requires a calibration transfer standard (CTS) challenge to be performed daily, at a minimum. The CTS challenge was performed before and after the RCTO was tested.

This was performed by flowing the CTS gas (R22) in excess to the spike "T" and pulling it to the FTIR cell via diaphragm pump. This test also provides a method valid leak check of the system as any significant leak would bias the CTS results low. Table 5-3 presents the results of the CTS challenge results. All CTS challenges passed and the raw data are presented in Appendix H.

TABLE 5-3. SUMMARY OF CTS RESULTS

Cylinder No. CC105191			R22		
			Certified Value (ppmv)	Measured Value (ppmv)	Difference (%)[1]
RCTO 4	Inlet	Pre-Test	20.24	20.75	**2.52**
		Post Test		20.78	**2.68**
	RCO	Pre-Test		21.22	**4.86**
		Post Test		21.17	**4.60**
	TO	Pre-Test		21.04	**3.95**
		Post Test		21.05	**4.00**

[1]< 5% is considered acceptable by ASTM 6348

5.1.2 FTIR Mechanical and Equilibrium Response Checks

Two response time checks are required per the ASTM method:

1. A Mechanical Response Time determination in which the CTS (R22) is injected through the system and the time to reach 95% of bottle value is determined.
2. An Equilibrium Response Time determination in which the time to reach 95% of spike analyte is determined.

These response time checks were performed simultaneously since both the CTS and spike analytes were contained in the same calibration gas. The calibration gas was injected into the spike tee at a rate slightly greater than the sample pump was pulling gas thereby flooding the probe and tee. The time it took to reach 95% of the bottle value was recorded and the results are as follows:

- Mechanical response time for the TO and RCO systems = <1 minute.
- Equilibrium response time for the TO and RCO systems was also <1 minute.

The response time raw FTIR data is presented in Appendix H and is the same data as the CTS results.

5.1.3 FTIR Background or Zero Spectra

A background spectrum of each FTIR is collected by purging UHP nitrogen through the system. Since nitrogen does not absorb IR radiation (is IR inactive), the collected background provides a

system zero and is subtracted from each sample or QA spectra. The FTIR cell was first purged with UHP nitrogen to take a background.

5.2 EPA Reference Method 25A QA/QC

Three THC monitors (one for each exhaust stream and the third for the inlet stream) were operated and calibrated in accordance with EPA Method 25A. For the two outlet streams, analyzers with a range of 0-12 ppm as propane were used. The inlet THC analyzer used a 0-225 ppm range as propane. The analyzers were calibrated using a four-point (including a zero gas) calibration procedure performed before testing. All calibration gases used we EPA Protocol 1 certified propane standards. System bias and drift checks were performed between each run, on each Method 25a analyzer to ensure that the measuring systems remained within required performance specifications. This consisted of directing the zero gas and the mid-point propane calibration through the system and verifying the response was within method tolerance. All method performance specifications (drift checks and calibration error) were met. Additionally, a system, negative pressure leak check was performed on each THC analyzer. All QA results are documented in Appendix H. EPA Protocol 1 gas certification documentation for cylinders used during this testing are also included in Appendix G.

5.2.1 THC Analyzer Calibration Error Test

The THC analyzer was calibrated at the onset of testing of the RCTO and as needed thereafter. The calibration procedure is as follows:

1. The zero-concentration gas was introduced through the entire sampling system to the analyzer. After adjusting the analyzer to the zero-concentration gas and once the analyzer reading was stable, the analyzer value was recorded.
2. This process was repeated for the high-level concentration gas.
3. Calibration Error Test: zero, low, mid, and high-level calibration gases were sequentially introduced through sampling system to the analyzer and recorded. All values were within the Method 25a required 5.0% of the bottle value.

5.2.2 THC Analyzer Measurement Response Time and initial system bias

The measurement response time and initial system bias data were performed at the start of testing. The measurement response time procedure is as follow:

1. Mid-level gas was introduced at the probe and the time required for the analyzer reading to reach 95 percent of the gas concentration was recorded. The analyzer reading was observed until it reached a stable value and this value was recorded.
2. Next, zero-level gas was introduced at the probe and the time required for the analyzer reading to decrease to a value within 5.0% of the upscale gas concentration was recorded.

The analyzer reading was observed until it reached a stable value and this value was recorded.

5.2.3 THC Analyzer Calibration Drift Test

The drift determination test was performed to ensure the THC analyzers did not exceed the drift limits set in Method 25A between each run and at the end of testing. The calibration drift test procedure is as follows:

1. Mid-level gas was introduced at the probe through the sampling system to the analyzer. The analyzer reading was observed until it reached a stable value, and this value was recorded. The value was within 3% of span of the calibration error value.
2. Next, zero-level gas was introduced at the probe through the sampling system. The analyzer reading was observed until it reached a stable value and this value was recorded. The value was within 3% of span of the calibration error value.

5.3 Calibrations and Documentation

Emissions testing was conducted on the RCTO streams consistent with the applicable requirements of ODEQ Permit and the approved Test Protocol. This test was conducted under the ODEQ Permit No. 26-3240-ST-01 which is presented in Appendix D.

To ensure accurate and defensible results, strict quality assurance and control measures were followed. All testing was performed following the Test Protocol and standard EPA or ASTM reference methods. All test criteria were thoroughly documented and checked for completeness.

6.0 REFERENCES

1. EPA Title 40, Code of Federal Regulations, Part 60 ”Standards of Performance New Stationary Sources”, Appendix A to Part 60 “Test Methods”

2. EPA-600/R93/224, “EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards”

3. ASTM Method 6348-03 Standard Test Method for Determination of Gaseous Compounds by Extractive Direct Interface Fourier Transform Infrared (FTIR) Spectroscopy

4. Source Sampling Manual, ODEQ “https://www.oregon.gov/deq/FilterDocs/SSMI.pdf”

Appendix A

Summary Data and Calculations

Volumetric Flow Rate Example Calculations

Client: Spectrum Environmental Solutions LLC.
Facility: Microchip Technology - Fab 4
Test Location: RCTO#4
Run: 1
Test Date: 3/26/2025

Moisture Content

Bws = 0.013

Dry Molecular Weight

Md = 29.00

Wet Molecular Weight

Ms = Md x (1-Bws) + (18.0 x Bws)

Md = 29.00 Bws = 0.013

Ms = 28.86

Single Point Axial Velocity

$$V_{a(i)} = K_p \times F_{2(i)} \sqrt{\frac{(P_1 - P_2)_{(i)}(460 + T_{s(i)})}{P_s \times M_s}} (\cos\theta_{y(i)})(\cos\theta_{p(i)})$$

Kp = 85.49 F_2 = #REF!
$(P_1 - P_2)$ = 0.17 Cos(θy)= 0.9909832
Ts = 290.927778 Cos(θp)= 0.9507204
Ps = 29.14 Ms = 28.86

Va = 44.42

Average Axial Velocity

$$V_{a(avg)} = \frac{\sum_{i=1}^{n} V_{a(i)}}{n}$$

Va (avg)= 38.23

Volumetric Flow Rate

Q (Actual Basis)= Vs x A x 60

Vs = 24.21 A = 10.580

Q = 24267 acfm

$$Qs \text{ (Standard Basis)} = 17.647 \times Q \times \frac{Ps}{460 + Ts\ (avg)}$$

Q = 24267 Ps = 29.14 Ts (avg) = 70.2

Qs = 23713 scfm

Qs (Standard Basis)= scfm x 60 min/hr

Qs = 1422794 scfh

Volumetric Flow Rate Example Calculations

Client: Spectrum Environmental Solutions LLC.
Facility: Microchip Technology - Fab 4
Test Location: RCTO#4
Run: 1
Test Date: 3/26/2025

Site Acceptability

$$R_i = arc\ cosine[(cosine Y_i)(cosine P_i)]$$

Yi=	9	Cos(Yi)=	-0.91113
Pi=	18.32	Cos(Pi)=	0.8623268
Ri=	20.34		

$$R_{avg} = \frac{\sum R_i}{n}$$

n=	40
Ravg=	18.75

$$S_d = \sqrt{\frac{\sum_{i=1}^{n}(R_i - R_{avg})^2}{(n-1)}}$$

Sd=	6.00

Client:	Spectrum Environmental Solutions LLC.	
Facility:	Microchip Technology - Fab 4	
Test Location:	RCTO #4	
Project #:	M251308	
Test Method:	2F (RATA)	
Test Engineer:	RMF	
Test Technician:	JD	
Temp ID:		
Meter ID:	3D-1	
Probe ID:	DAT 1228	
Probe Type:	3D	
Pitot Tube Coefficient:	N/A	
Probe Length:	6.5	**ft**
Sample Plane:	Horizontal	
Port Length:	4.00	**in.**
Port Size (diameter):	3.50	**in.**
Port Type:	Nipple	
Duct Shape:	Circular	
Diameter:	3.67	**ft**
Duct Area:	10.58	**Sq. Ft.**
Upstream Diameters:	1.860	
Downstream Diameters:	0.770	
Number of Ports Sampled:	2	
Number of Points per Port:	20	
Total Number of Traverse Points:	40	
Operating Level:	Normal	

Point Markings (including port length):

Point #	Inches
1	4.573
2	5.718
3	6.951
4	8.272
5	9.681
6	11.267
7	12.984
8	15.010
9	17.476
10	17.873
11	30.952
12	34.564
13	37.030
14	39.056
15	40.773
16	42.359
17	43.768
18	45.089
19	46.322
20	47.467

Probe Type:	**DAT**		
Probe ID:	**DAT1228**		
	yyyy	**mm**	**dd**
Probe Cal Date:	**2023**	**07**	**06**
Probe Cal Velocities:	**60 & 90 fps**		

Calibration Polynomials (60-90 fps)

Pitch Angle vs F1 $\Theta p_{(i)} = A(F1_{(i)})^5 + B(F1_{(i)})^4 + C(F1_{(i)})^3 + D(F1_{(i)})^2 + E(F1_{(i)}) + F$

F2 vs Pitch Angle $F2_{(i)} = G(\Theta p_{(i)})^5 + H(\Theta p_{(i)})^4 + I(\Theta p_{(i)})^3 + J(\Theta p_{(i)})^2 + K(\Theta p_{(i)}) + L$

Coefficients

			2.822E-11
A=	4.889E+01	**G=**	-5.433E-10
B=	4.207E+00	**H=**	-7.160E-08
C=	-2.228E+01	**I=**	2.715E-06
D=	-5.700E-01	**J=**	8.922E-05
E=	3.434E+01	**K=**	-3.751E-03
F=	8.100E+00	**L=**	1.015E+00

METHOD 2F VOLUMETRIC FLOW DATA

Project Number:	M251308	**Operating Level:**	Normal
Client:	Spectrum Environmental Solutions LL(	**Run No.:**	1
Facility:	Microchip Technology - Fab 4	**Test Date:**	3/26/2025
Test Location:	RCTO#4	**Start Time:**	8:10
Probe ID:	DAT 1228	**End Time:**	8:50
Probe Length, Feet:	6.5	**Test Engineer:**	RMF
Port Length, Inches:	4	**Test Technician:**	JD

Port	Point	P1-P2 (in. H_2O)	P4-P5 (in. H_2O)	Temp (^oF)	YAW (θ_Y)	F_1	Pitch (θ_P)	$\cos\theta_Y$	$\cos\theta_P$	F_2	Velocity (V_a)
A	01	0.51	0.16	61.0	9.0	0.3137	18.32	0.9877	0.9493	0.98	44.4246
A	02	0.50	0.12	61.0	4.0	0.2400	16.05	0.9976	0.9610	0.98	44.9706
A	3	0.49	0.06	61.0	3.0	0.1224	12.26	0.9986	0.9772	0.99	45.4089
A	4	0.47	0.09	62.0	0.0	0.1915	14.52	1.0000	0.9681	0.98	44.0912
A	5	0.45	0.09	63.0	3.0	0.2000	14.79	0.9986	0.9669	0.98	43.0664
A	6	0.44	0.06	63.0	0.0	0.1364	12.72	1.0000	0.9755	0.99	43.0768
A	7	0.41	0.09	63.0	2.0	0.2195	15.41	0.9994	0.9641	0.98	41.0107
A	8	0.39	0.07	64.0	3.0	0.1795	14.13	0.9986	0.9697	0.98	40.2625
A	9	0.35	0.06	64.0	0.0	0.1714	13.87	1.0000	0.9708	0.98	38.2432
A	10	0.26	0.06	66.0	3.0	0.2308	15.76	0.9986	0.9624	0.98	32.6675
A	11	0.21	0.13	66.0	0.0	0.6190	28.92	1.0000	0.8753	0.99	26.7942
A	12	0.22	0.15	64.0	0.0	0.6818	32.30	1.0000	0.8453	0.98	26.3157
A	13	0.24	0.19	64.0	0.0	0.7917	40.73	1.0000	0.7578	0.94	23.4956
A	14	0.22	0.08	63.0	4.0	0.3636	19.83	0.9976	0.9407	0.98	29.2706
A	15	0.21	0.10	62.0	0.0	0.4762	23.33	1.0000	0.9182	0.99	27.9956
A	16	0.18	0.07	60.0	8.0	0.3889	20.59	0.9903	0.9361	0.98	26.0862
A	17	0.20	0.09	61.0	10.0	0.4500	22.48	0.9848	0.9240	0.99	27.0391
A	18	0.22	0.10	61.0	-4.0	0.4545	22.63	0.9976	0.9230	0.99	28.6977
A	19	0.13	0.03	60.0	0.0	0.2308	15.76	1.0000	0.9624	0.98	22.9988
A	20	0.11	0.00	60.0	0.0	0.0000	8.10	1.0000	0.9900	0.99	21.9373
B	1	0.70	0.10	66.0	16.0	0.1429	12.93	0.9613	0.9746	0.99	52.3244
B	2	0.66	0.10	66.0	16.0	0.1515	13.22	0.9613	0.9735	0.98	50.7379
B	3	0.65	0.12	66.0	15.0	0.1846	14.30	0.9659	0.9690	0.98	50.3311
B	4	0.68	0.14	66.0	16.0	0.2059	14.98	0.9613	0.9660	0.98	51.0573
B	5	0.61	0.11	66.0	14.0	0.1803	14.16	0.9703	0.9696	0.98	49.0119
B	6	0.59	0.10	66.0	15.0	0.1695	13.81	0.9659	0.9711	0.98	48.0674
B	7	0.53	0.10	67.0	11.0	0.1887	14.43	0.9816	0.9685	0.98	46.2011
B	8	0.39	0.10	67.0	8.0	0.2564	16.56	0.9903	0.9585	0.98	39.5473
B	9	0.24	0.04	67.0	-2.0	0.1667	13.71	0.9994	0.9715	0.98	31.7636
B	10	0.22	0.05	67.0	-7.0	0.2273	15.65	0.9925	0.9629	0.98	29.9119
B	11	0.42	0.10	67.0	8.0	0.2381	15.99	0.9903	0.9613	0.98	41.1624
B	12	0.45	0.09	67.0	8.0	0.2000	14.79	0.9903	0.9669	0.98	42.8688
B	13	0.45	0.15	66.0	8.0	0.3333	18.91	0.9903	0.9460	0.98	41.8982
B	14	0.45	0.12	65.0	9.0	0.2667	16.88	0.9877	0.9569	0.98	42.2187
B	15	0.43	0.11	65.0	9.0	0.2558	16.55	0.9877	0.9586	0.98	41.3431
B	16	0.44	0.11	63.0	8.0	0.2500	16.37	0.9903	0.9595	0.98	41.8900
B	17	0.46	0.14	63.0	9.0	0.3043	18.03	0.9877	0.9509	0.98	42.3386
B	18	0.36	0.09	63.0	4.0	0.2500	16.37	0.9976	0.9595	0.98	38.1701
B	19	0.32	0.06	62.0	5.0	0.1875	14.39	0.9962	0.9686	0.98	36.2659
B	20	0.26	-0.02	61.0	0.0	-0.0769	5.47	1.0000	0.9955	1.00	34.1480

Test Parameters

P_{bar} - Barometric pressure, inches Hg	29.45	% CO_2	1.00	N
P_g - Stack Pressure, inches of H_2O	-6.00	% O_2	21.00	
P_s - Absolute stack pressure, inches Hg	29.01	% N_2	78.00	
t_s - Average stack temperature, ^oF	63.9	Md - dry basis lb/lb mole	29.00	
Duct Shape:	Circular	Ms - wet basis lb/lb mole	28.859	
Diameter, Feet	3.67	Wet Bulb Temp(t'):		
		Dry Bulb Temp(t):		
		Bws - Moisture content fraction		**0.0128**
Cross Sectional Area of Stack, Ft^2	10.58	Moisture determined by wb/db?		N
		Supersaturation Value, Bws:		**0.021**

Method 2F Results

Average Velocity $V_{a(avg)}$	38.228	Q - ACFM	24,267
No WAF Applied to this Test		Qsd - DSCFM	23,410
		Qs - SCFM	23,713
		Qs - SCFH	1,422,794

METHOD 2F VOLUMETRIC FLOW DATA

Project Number:	M251308	**Operating Level:**	Normal
Client:	Spectrum Environmental Solutions LL(	**Run No.:**	2
Facility:	Microchip Technology - Fab 4	**Test Date:**	3/26/2025
Test Location:	RCTO #4	**Start Time:**	9:28
Probe ID:	DAT 1228	**End Time:**	10:08
Probe Length, Feet:	6.5	**Test Engineer:**	RMF
Port Length, Inches:	4	**Test Technician:**	JD

Port	Point	P1-P2 (in. H_2O)	P4-P5 (in. H_2O)	Temp (^oF)	YAW (θ_Y)	F_1	Pitch (θ_P)	$\cos\theta_Y$	$\cos\theta_P$	F_2	Velocity (V_a)
A	01	0.48	0.16	70.0	7.0	0.3333	18.91	0.9925	0.9460	0.98	43.2614
A	02	0.46	0.12	70.0	5.0	0.2609	16.70	0.9962	0.9578	0.98	43.0249
A	3	0.47	0.10	70.0	3.0	0.2128	15.20	0.9986	0.9650	0.98	43.9368
A	4	0.44	0.13	70.0	6.0	0.2955	17.76	0.9945	0.9523	0.98	41.7695
A	5	0.44	0.12	70.0	3.0	0.2727	17.07	0.9986	0.9560	0.98	42.1001
A	6	0.40	0.08	70.0	3.0	0.2000	14.79	0.9986	0.9669	0.98	40.6160
A	7	0.37	0.08	70.0	2.0	0.2162	15.31	0.9994	0.9645	0.98	38.9916
A	8	0.35	0.09	71.0	3.0	0.2571	16.59	0.9986	0.9584	0.98	37.6798
A	9	0.30	0.07	71.0	3.0	0.2333	15.84	0.9986	0.9620	0.98	35.0197
A	10	0.23	0.07	72.0	3.0	0.2991	17.88	0.9986	0.9517	0.98	30.6254
A	11	0.20	0.12	72.0	4.0	0.6000	28.03	0.9976	0.8827	0.99	26.2973
A	12	0.23	0.13	72.0	1.0	0.5652	26.55	0.9998	0.8945	0.99	28.6507
A	13	0.24	0.12	73.0	6.0	0.5000	24.13	0.9945	0.9126	0.99	29.7123
A	14	0.23	0.13	72.0	2.0	0.5652	26.55	0.9994	0.8945	0.99	28.6377
A	15	0.22	0.11	71.0	-9.0	0.5000	24.13	0.9877	0.9126	0.99	28.1988
A	16	0.20	0.10	71.0	3.0	0.5000	24.13	0.9986	0.9126	0.99	27.1844
A	17	0.24	0.10	71.0	-6.0	0.4167	21.44	0.9945	0.9308	0.98	30.2144
A	18	0.18	0.07	70.0	-4.0	0.3889	20.59	0.9976	0.9361	0.98	26.3622
A	19	0.21	0.08	70.0	0.0	0.3810	20.35	1.0000	0.9376	0.98	28.5861
A	20	0.20	0.07	70.0	1.0	0.3500	19.41	0.9998	0.9431	0.98	28.0489
B	1	0.60	0.10	69.0	15.0	0.1667	13.71	0.9659	0.9715	0.98	48.3257
B	2	0.69	0.09	70.0	15.0	0.1304	12.52	0.9659	0.9762	0.99	52.1708
B	3	0.65	0.08	70.0	16.0	0.1231	12.28	0.9613	0.9771	0.99	50.4500
B	4	0.59	0.08	70.0	14.0	0.1356	12.69	0.9703	0.9756	0.99	48.4212
B	5	0.51	0.06	70.0	12.0	0.1176	12.10	0.9781	0.9778	0.99	45.5118
B	6	0.43	0.08	71.0	10.0	0.1860	14.34	0.9848	0.9688	0.98	41.6606
B	7	0.41	0.07	71.0	8.0	0.1707	13.85	0.9903	0.9709	0.98	41.0055
B	8	0.31	0.06	71.0	4.0	0.1935	14.58	0.9976	0.9678	0.98	35.7883
B	9	0.18	0.06	72.0	-8.0	0.3333	18.91	0.9903	0.9460	0.98	26.4811
B	10	0.18	0.05	73.0	-7.0	0.2778	17.22	0.9925	0.9552	0.98	26.8166
B	11	0.44	0.06	73.0	7.0	0.1364	12.72	0.9925	0.9755	0.99	42.8899
B	12	0.39	0.04	73.0	8.0	0.1026	11.59	0.9903	0.9796	0.99	40.5019
B	13	0.45	0.11	73.0	8.0	0.2444	16.19	0.9903	0.9603	0.98	42.5346
B	14	0.48	0.08	74.0	8.0	0.1667	13.71	0.9903	0.9715	0.98	44.5220
B	15	0.48	0.08	73.0	9.0	0.1667	13.71	0.9877	0.9715	0.98	44.3644
B	16	0.42	0.07	73.0	8.0	0.1667	13.71	0.9903	0.9715	0.98	41.6075
B	17	0.39	0.07	73.0	9.0	0.1795	14.13	0.9877	0.9697	0.98	39.9082
B	18	0.42	0.06	72.0	9.0	0.1429	12.93	0.9877	0.9746	0.99	41.6169
B	19	0.25	-0.01	70.0	0.0	-0.0400	6.73	1.0000	0.9931	0.99	33.3779
B	20	0.25	0.01	70.0	2.0	0.0400	9.47	0.9994	0.9864	0.99	32.9539

Test Parameters

P_{bar} - Barometric pressure, inches Hg	29.82	% CO_2	1.00	
P_g - Stack Pressure, inches of H_2O	-6.00	% O_2	21.00	
P_s - Absolute stack pressure, inches Hg	29.38	% N_2	78.00	
t_s - Average stack temperature, ^oF	71.2	Md - dry basis lb/lb mole	29.00	
Duct Shape:	Circular	Ms - wet basis lb/lb mole	28.859	
Diameter, Feet	3.67	Wet Bulb Temp(t'):		
		Dry Bulb Temp(t):		
		Bws - Moisture content fraction		**0.0128**
Cross Sectional Area of Stack, Ft^2	10.58	Moisture determined by wb/db?		N
		Supersaturation Value, Bws:		**0.026**

Method 2F Results

Average Velocity $V_{a(avg)}$	37.496	Q - ACFM	23,802
No WAF Applied to this Test		Qsd - DSCFM	22,935
		Qs - SCFM	23,232
		Qs - SCFH	1,393,922

METHOD 2F VOLUMETRIC FLOW DATA

Project Number:	M251308	**Operating Level:**	Normal
Client:	Spectrum Environmental Solutions LL(	**Run No.:**	3
Facility:	Microchip Technology - Fab 4	**Test Date:**	3/26/2025
Test Location:	RCTO#4	**Start Time:**	10:35
Probe ID:	DAT 1228	**End Time:**	11:17
Probe Length, Feet:	6.5	**Test Engineer:**	RMF
Port Length, Inches:	4	**Test Technician:**	JD

Port	Point	P1-P2 (in. H_2O)	P4-P5 (in. H_2O)	Temp (^oF)	YAW (θ_Y)	F_1	Pitch (θ_P)	$\cos\theta_Y$	$\cos\theta_P$	F_2	Velocity (V_a)
A	01	0.53	0.20	71.0	6.0	0.3774	20.24	0.9945	0.9383	0.98	45.2071
A	02	0.57	0.16	71.0	5.0	0.2807	17.31	0.9962	0.9547	0.98	47.7513
A	3	0.54	0.15	71.0	3.0	0.2778	17.22	0.9986	0.9552	0.98	46.6138
A	4	0.51	0.11	71.0	4.0	0.2157	15.29	0.9976	0.9646	0.98	45.7109
A	5	0.49	0.11	71.0	4.0	0.2245	15.57	0.9976	0.9633	0.98	44.7422
A	6	0.47	0.12	71.0	4.0	0.2553	16.53	0.9976	0.9587	0.98	43.6015
A	7	0.44	0.12	72.0	0.0	0.2727	17.07	1.0000	0.9560	0.98	42.2094
A	8	0.39	0.11	72.0	0.0	0.2821	17.35	1.0000	0.9545	0.98	39.6778
A	9	0.35	0.08	73.0	1.0	0.2286	15.70	0.9998	0.9627	0.98	37.9470
A	10	0.26	0.08	73.0	0.0	0.3077	18.14	1.0000	0.9503	0.98	32.2888
A	11	0.28	0.14	74.0	8.0	0.5000	24.13	0.9903	0.9126	0.99	31.9645
A	12	0.26	0.15	74.0	6.0	0.5769	27.03	0.9945	0.8907	0.99	30.2079
A	13	0.24	0.14	74.0	0.0	0.5833	27.30	1.0000	0.8886	0.99	29.1112
A	14	0.23	0.15	74.0	-3.0	0.6522	30.60	0.9986	0.8607	0.98	27.5076
A	15	0.25	0.13	74.0	-6.0	0.5200	24.84	0.9945	0.9075	0.99	30.1712
A	16	0.21	0.12	73.0	-6.0	0.5714	26.81	0.9945	0.8925	0.99	27.1781
A	17	0.21	0.11	72.0	-4.0	0.5238	24.97	0.9976	0.9065	0.99	27.6552
A	18	0.22	0.12	72.0	0.0	0.5455	25.78	1.0000	0.9005	0.99	28.1916
A	19	0.30	0.07	72.0	3.0	0.2333	15.84	0.9986	0.9620	0.98	35.0295
A	20	0.24	0.09	72.0	-2.0	0.3750	20.17	0.9994	0.9387	0.98	30.6120
B	1	0.73	0.10	74.0	16.0	0.1370	12.74	0.9613	0.9754	0.99	53.5128
B	2	0.84	0.09	73.0	17.0	0.1071	11.75	0.9563	0.9791	0.99	57.3226
B	3	0.77	0.09	72.0	15.0	0.1169	12.07	0.9659	0.9779	0.99	55.2975
B	4	0.69	0.09	72.0	16.0	0.1304	12.52	0.9613	0.9762	0.99	51.9823
B	5	0.60	0.10	72.0	11.0	0.1667	13.71	0.9816	0.9715	0.98	49.2177
B	6	0.50	0.08	72.0	11.0	0.1600	13.50	0.9816	0.9724	0.98	44.9769
B	7	0.36	0.09	72.0	6.0	0.2500	16.37	0.9945	0.9595	0.98	38.1120
B	8	0.35	0.06	73.0	3.0	0.1714	13.87	0.9986	0.9708	0.98	38.2487
B	9	0.25	0.04	73.0	-4.0	0.1600	13.50	0.9976	0.9724	0.98	32.3502
B	10	0.24	0.05	74.0	-8.0	0.2083	15.06	0.9903	0.9657	0.98	31.2527
B	11	0.48	0.00	74.0	5.0	0.0000	8.10	0.9962	0.9900	0.99	46.1298
B	12	0.45	0.09	74.0	6.0	0.2000	14.79	0.9945	0.9669	0.98	43.0357
B	13	0.50	0.17	74.0	10.0	0.3400	19.11	0.9848	0.9449	0.98	43.8944
B	14	0.50	0.11	74.0	8.0	0.2200	15.43	0.9903	0.9640	0.98	45.0250
B	15	0.47	0.12	74.0	7.0	0.2553	16.53	0.9925	0.9587	0.98	43.5045
B	16	0.55	0.12	73.0	8.0	0.2182	15.37	0.9903	0.9642	0.98	47.1922
B	17	0.48	0.12	73.0	9.0	0.2500	16.37	0.9877	0.9595	0.98	43.7466
B	18	0.41	0.06	73.0	8.0	0.1463	13.05	0.9903	0.9742	0.98	41.2145
B	19	0.29	-0.02	72.0	1.0	-0.0690	5.74	0.9998	0.9950	1.00	36.1416
B	20	0.28	-0.01	72.0	-2.0	-0.0357	6.87	0.9994	0.9928	0.99	35.3228

Test Parameters

P_{bar} - Barometric pressure, inches Hg	29.82	% CO_2	1.00	
P_g - Stack Pressure, inches of H_2O	-6.00	% O_2	21.00	
P_s - Absolute stack pressure, inches Hg	29.42	% N_2	78.00	
t_s - Average stack temperature, ^oF	72.7	Md - dry basis lb/lb mole	29.00	
Duct Shape:	Circular	Ms - wet basis lb/lb mole	28.857	
Diameter, Feet	3.67	Wet Bulb Temp(t'):		
		Dry Bulb Temp(t):		
		Bws - Moisture content fraction		**0.0130**
Cross Sectional Area of Stack, Ft^2	10.58	Moisture determined by wb/db?		N
		Supersaturation Value, Bws:		**0.028**

Method 2F Results

Average Velocity $V_{a(avg)}$	40.021	Q - ACFM	25,406
No WAF Applied to this Test		Qsd - DSCFM	24,440
		Qs - SCFM	24,762
		Qs - SCFH	1,485,710

RCTO 4 Inlet Flow Summary

Project Name	**Microchip Gresham RCTO Compliance Testing**
Project Number	**225-01-2401M**
Facility	**Gresham**

Sample Type	Flow	Flow	Flow	Averages
Source	RCTO4 Inlet	RCTO4 Inlet	RCTO4 Inlet	
Run	1	2	3	
Date	3/26/2025	3/26/2025	3/26/2025	
Time Start	08:55	09:45	11:15	
Time Stop	09:05	09:55	11:25	
	08:55-09:05	09:45-09:55	11:15-11:25	
Duct Diameter (ft)	3.67	3.67	3.67	
Pitot Tube Correction Factor	0.84	0.84	0.84	
Standard Temperature (°F)	68	68	68	
Barometric Pressure Measured (" Hg)	29.60	29.60	29.50	
Stack Elevation (ft) (relative to Barometer)	0	0	0	
Barometric Pressure ("Hg)	29.6	29.6	29.5	
Average Stack Temperature (°F)	76.0	76.0	75.3	75.8
Test Duration (minutes)	10	10	10	
Static Pressure ("H_2O)	-4.72	-4.64	-4.16	
Carbon Dioxide (CO_2) Content (%)	1.00	1.00	1.00	
Oxygen (O_2) Content (%)	21.00	21.00	21.00	
Nitrogen (N_2) Content (%)	78.00	78.00	78.00	
Average square root of ΔP ($(V\Delta P)_{avg}$)	0.780	0.823	0.866	
Absolute Stack Pressure ("Hg)	29.25	29.26	29.19	
Absolute Stack Temperature (°R)	536.0	536.0	535.3	535.8
Flue Gas Moisture (%)	1.28	1.29	1.31	1.30
Moisture at saturation	3.13	3.13	3.07	
Moisture used in Calculation	1.28	1.29	1.31	1.29
Gas Molecular Weight (Wet) (g/g-mole)	28.86	28.86	28.86	
Average Gas Velocity (ft/sec)	44.61	47.10	49.59	47.10
Avg Flow Rate (acfh)	1,695,850	1,790,317	1,885,165	1,790,444
Avg Flow Rate (acfm)	28,264	29,839	31,419	29,841
Avg Flow Rate (scfh)	1,633,278	1,724,633	1,814,532	1,724,148
Avg Flow Rate (scfm)	27,221	28,744	30,242	28,736
Avg Flow Rate (dscfh)	1,612,351	1,702,322	1,790,817	1,701,830
Avg Flow Rate (dscfm)	26,873	28,372	29,847	28,364

RCTO 4 Inlet Flow Summary

Data Entry Area

Sample Type	Flow	Nozzle Diameter (in)			
Source	RCTO4 Inlet	Std Temp (°F)	68		
Condition		Bar Press ("Hg, meas)	29.6	Entered By (initials)	***arb***
Run	1	Meter Elev (ft) (rel to Brmtr)	0	Checked by (initials)	
Date	26-Mar	Static Press ("H_2O)	-4.724	Corrected by (initials)	
Duct Diameter (ft)	3.667	% CO			
Duct Depth (ft)		% CO_2	1		
Duct Width (ft)		% O_2	21		
Pitot Tube Correction Factor	0.84	% H_2			
DGMCF		% CH_4			

Times		DGM Volumes (as read)		Impinger Catch (g)		
					Initial	Final
start	08:55	start		1		
stop	09:05	stop		2		
start		start		3		
stop		stop		4		
start		start		5		
stop		stop		6		
start		start		7		
stop		stop		8		
start		start		9		
stop		stop		10		
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
				Total Wt Gain		0.0
Duration	10	Total	0.000			

	ΔP ("H_2O)	ΔH ("H_2O)	Stack Temp (°F)	DGM Temp (°F)	$(\sqrt{\Delta P})_{avg}$
Averages	0.620	#DIV/0!	76	#DIV/0!	0.7796
Individual Readings	0.656		76		0.80993827
	0.583		76		0.76354437
	0.456		76		0.67527772
	0.402		76		0.6340347
	0.772		76		0.87863531
	0.671		76		0.8191459
	1.069		76		1.03392456
	0.761		76		0.87235314
	0.671		76		0.8191459
	0.777		76		0.88147603
	0.617		76		0.78549348
	0.428		76		0.65421709
	0.537		76		0.73280284
	0.569		76		0.75432089
	0.654		76		0.808702665
	0.304		76		0.55136195

RCTO 4 Inlet Flow Summary

Data Entry Area

Sample Type	Flow	Nozzle Diameter (in)			
Source	RCTO4 Inlet	Std Temp (°F)	68		
Condition		Bar Press ("Hg, meas)	29.6	Entered By (initials)	*arb*
Run	2	Meter Elev (ft) (rel to Brmtr)	0	Checked by (initials)	
Date	26-Mar	Static Press ("H_2O)	-4.638	Corrected by (initials)	
Duct Diameter (ft)	3.667	% CO			
Duct Depth (ft)		% CO_2	1		
Duct Width (ft)		% O_2	21		
Pitot Tube Correction Factor	0.84	% H_2			
DGMCF		% CH_4			

Times		DGM Volumes (as read)		Impinger Catch (g)		
					Initial	Final
start	09:45	start		1		
stop	09:55	stop		2		
start		start		3		
stop		stop		4		
start		start		5		
stop		stop		6		
start		start		7		
stop		stop		8		
start		start		9		
stop		stop		10		
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
				Total Wt Gain		0.0
Duration	10	Total	0.000			

	ΔP ("H_2O)	ΔH ("H_2O)	Stack Temp (°F)	DGM Temp (°F)	$(\sqrt{\Delta P})_{avg}$
Averages	0.701	#DIV/0!	76	#DIV/0!	0.8231

Individual Readings	0.489	76	0.69928535
	0.600	76	0.77459667
	1.635	76	1.27867119
	0.337	76	0.58051701
	0.647	76	0.8043631
	0.905	76	0.95131488
	0.820	76	0.90553851
	0.669	76	0.8179242
	0.697	76	0.83486526
	0.818	76	0.90443352
	0.775	76	0.88034084
	0.712	76	0.84380092
	0.477	76	0.69065187
	0.520	76	0.72111026
	0.448	76	0.669328021
	0.662	76	0.813633824

RCTO 4 Inlet Flow Summary

Data Entry Area

Sample Type	Flow	Nozzle Diameter (in)	
Source	RCTO4 Inlet	Std Temp (°F)	68
Condition		Bar Press ("Hg, meas)	29.5
Run	3	Meter Elev (ft) (rel to Brmtr)	0
Date	26-Mar	Static Press ("H_2O)	-4.156
Duct Diameter (ft)	3.667	% CO	
Duct Depth (ft)		% CO_2	1
Duct Width (ft)		% O_2	21
Pitot Tube Correction Factor	0.84	% H_2	
DGMCF		% CH_4	

Entered By (initials)	***arb***
Checked by (initials)	
Corrected by (initials)	

Times		DGM Volumes (as read)		Impinger Catch (g)		
					Initial	Final
start	11:15	start		1		
stop	11:25	stop		2		
start		start		3		
stop		stop		4		
start		start		5		
stop		stop		6		
start		start		7		
stop		stop		8		
start		start		9		
stop		stop		10		
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
				Total Wt Gain		0.0
Duration	10	Total	0.000			

	ΔP ("H_2O)	ΔH ("H_2O)	Stack Temp (°F)	DGM Temp (°F)	$(\sqrt{\Delta P})_{avg}$
Averages	0.761	#DIV/0!	75	#DIV/0!	0.8664
Individual Readings	0.993		74		0.99649385
	0.902		74		0.94973681
	0.936		74		0.96747093
	0.788		74		0.88769364
	0.736		75		0.85790442
	0.624		75		0.78993671
	0.729		75		0.85381497
	0.579		75		0.7609205
	0.663		76		0.81424812
	0.660		76		0.81240384
	0.396		76		0.62928531
	0.545		76		0.73824115
	0.991		76		0.99548983
	0.954		76		0.97672924
	0.732		76		0.855569985
	0.953		76		0.976217189

RCTO 4 TO Flow Summary

Project Name	**Microchip Gresham RCTO Compliance Testing**
Project Number	**225-01-2401M**
Facility	**Gresham**

Sample Type	Flow	Flow	Flow	Averages
Source	RCTO4 TO	RCTO4 TO	RCTO4 TO	
Run	1	2	3	
Date	3/26/2025	3/26/2025	3/26/2025	
Time Start	08:35	09:35	10:40	
Time Stop	08:45	09:45	10:50	
	08:35-08:45	09:35-09:45	10:40-10:50	
Duct Diameter (ft)	1.58	1.58	1.58	
Pitot Tube Correction Factor	0.84	0.84	0.84	
Standard Temperature (°F)	68	68	68	
Barometric Pressure Measured (" Hg)	29.60	29.60	29.60	
Stack Elevation (ft) (relative to Barometer)	0	0	0	
Barometric Pressure ("Hg)	29.6	29.6	29.6	
Average Stack Temperature (°F)	839.9	841.1	840.1	840.4
Test Duration (minutes)	10	10	10	
Static Pressure ("H_2O)	0.26	0.33	0.28	
Carbon Dioxide (CO_2) Content (%)	1.99	1.99	1.97	
Oxygen (O_2) Content (%)	17.46	17.47	17.50	
Nitrogen (N_2) Content (%)	80.54	80.54	80.53	
Average square root of ΔP ($(V\Delta P)_{avg}$)	0.683	0.657	0.663	
Absolute Stack Pressure ("Hg)	29.62	29.62	29.62	
Absolute Stack Temperature (°R)	1299.9	1301.1	1300.1	1300.4
Flue Gas Moisture (%)	5.50	5.43	5.43	5.45
Moisture at saturation	N/A	N/A	N/A	
Moisture used in Calculation	5.50	5.43	5.43	5.45
Gas Molecular Weight (Wet) (g/g-mole)	28.41	28.42	28.42	
Average Gas Velocity (ft/sec)	60.93	58.64	59.15	59.57
Avg Flow Rate (acfh)	431,863	415,631	419,271	422,255
Avg Flow Rate (acfm)	7,198	6,927	6,988	7,038
Avg Flow Rate (scfh)	173,646	166,995	168,570	169,737
Avg Flow Rate (scfm)	2,894	2,783	2,809	2,829
Avg Flow Rate (dscfh)	164,091	157,924	159,421	160,479
Avg Flow Rate (dscfm)	2,735	2,632	2,657	2,675

RCTO 4 TO Flow Summary

Data Entry Area

Sample Type	Flow	Nozzle Diameter (in)			
Source	RCTO4 TO	Std Temp (°F)	68		
Condition		Bar Press ("Hg, meas)	29.6	Entered By (initials)	***arb***
Run	1	Meter Elev (ft) (rel to Brmtr)	0	Checked by (initials)	
Date	26-Mar	Static Press ("H_2O)	0.258	Corrected by (initials)	
Duct Diameter (ft)	1.583	% CO			
Duct Depth (ft)		% CO_2	1.99		
Duct Width (ft)		% O_2	17.46		
Pitot Tube Correction Factor	0.84	% H_2			
DGMCF		% CH_4			

Times		DGM Volumes (as read)		Impinger Catch (g)		
					Initial	Final
start	08:35	start		1		
stop	08:45	stop		2		
start		start		3		
stop		stop		4		
start		start		5		
stop		stop		6		
start		start		7		
stop		stop		8		
start		start		9		
stop		stop		10		
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
				Total Wt Gain		0.0
Duration	10	Total	0.000			

	ΔP ("H_2O)	ΔH ("H_2O)	Stack Temp (°F)	DGM Temp (°F)	$(\sqrt{\Delta P})_{avg}$
Averages	0.467	#DIV/0!	840	#DIV/0!	0.6826

Individual Readings	0.474	838	0.68847658
	0.476	841	0.68992753
	0.470	839	0.68556546
	0.350	838	0.59160798
	0.458	840	0.67675697
	0.481	839	0.69354164
	0.541	840	0.73552702
	0.537	842	0.73280284
	0.527	839	0.72594766
	0.443	841	0.66558245
	0.462	842	0.67970582
	0.491	841	0.70071392
	0.405	838	0.6363961
	0.477	842	0.69065187
	0.431	840	0.656505902
	0.452	839	0.672309453

RCTO 4 TO Flow Summary

Data Entry Area

Sample Type	Flow	Nozzle Diameter (in)			
Source	RCTO4 TO	Std Temp (°F)	68		
Condition		Bar Press ("Hg, meas)	29.6	Entered By (initials)	***arb***
Run	2	Meter Elev (ft) (rel to Brmtr)	0	Checked by (initials)	
Date	26-Mar	Static Press ("H_2O)	0.325	Corrected by (initials)	
Duct Diameter (ft)	1.583	% CO			
Duct Depth (ft)		% CO_2	1.99		
Duct Width (ft)		% O_2	17.47		
Pitot Tube Correction Factor	0.84	% H_2			
DGMCF		% CH_4			

Times		DGM Volumes (as read)		Impinger Catch (g)		
					Initial	Final
start	09:35	start		1		
stop	09:45	stop		2		
start		start		3		
stop		stop		4		
start		start		5		
stop		stop		6		
start		start		7		
stop		stop		8		
start		start		9		
stop		stop		10		
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
				Total Wt Gain		0.0
Duration	10	Total	0.000			

	ΔP ("H_2O)	ΔH ("H_2O)	Stack Temp (°F)	DGM Temp (°F)	$(\sqrt{\Delta P})_{avg}$
Averages	0.432	#DIV/0!	841	#DIV/0!	0.6568
Individual Readings	0.385		842		0.62048368
	0.416		841		0.64498062
	0.427		839		0.65345237
	0.395		839		0.62849025
	0.437		840		0.66105976
	0.484		840		0.69570109
	0.463		840		0.68044103
	0.465		840		0.68190908
	0.414		842		0.64342832
	0.428		842		0.65421709
	0.438		842		0.66181568
	0.423		842		0.6503845
	0.412		843		0.64187226
	0.416		843		0.64498062
	0.417		841		0.645755372
	0.490		842		0.7

RCTO 4 TO Flow Summary

Data Entry Area

Sample Type	Flow	Nozzle Diameter (in)			
Source	RCTO4 TO	Std Temp (°F)	68		
Condition		Bar Press ("Hg, meas)	29.6	Entered By (initials)	*arb*
Run	3	Meter Elev (ft) (rel to Brmtr)	0	Checked by (initials)	
Date	26-Mar	Static Press ("H_2O)	0.283	Corrected by (initials)	
Duct Diameter (ft)	1.583	% CO			
Duct Depth (ft)		% CO_2	1.97		
Duct Width (ft)		% O_2	17.50		
Pitot Tube Correction Factor	0.84	% H_2			
DGMCF		% CH_4			

Times		DGM Volumes (as read)		Impinger Catch (g)		
					Initial	Final
start	10:40	start		1		
stop	10:50	stop		2		
start		start		3		
stop		stop		4		
start		start		5		
stop		stop		6		
start		start		7		
stop		stop		8		
start		start		9		
stop		stop		10		
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
start		start				
stop		stop				
				Total Wt Gain		0.0
Duration	10	Total	0.000			

	ΔP ("H_2O)	ΔH ("H_2O)	Stack Temp (°F)	DGM Temp (°F)	$(\sqrt{\Delta P})_{avg}$
Averages	0.441	#DIV/0!	840	#DIV/0!	0.6628
Individual Readings	0.387		836		0.62209324
	0.413		838		0.64265076
	0.430		838		0.65574385
	0.444		840		0.66633325
	0.436		840		0.66030296
	0.457		840		0.67601775
	0.476		841		0.68992753
	0.552		841		0.74296702
	0.327		841		0.57183914
	0.396		841		0.62928531
	0.411		840		0.64109282
	0.477		839		0.69065187
	0.442		842		0.66483081
	0.437		843		0.66105976
	0.434		841		0.658786764
	0.534		841		0.730753036

Appendix B

Field Data Sheets and Site Logbooks

EPA Method 1
Circular Duct – Determination of Traverse Points

Project 225-01-2401M	
Facility Microchip Gresham	
Source **RCTO 4 Inlet**	
Operator **ARB, JD**	
Date 3/26/25	

☒ Velocity Only ☐ Isokinetic Sampling	Upstream Distance (ft/in) _____70"_____ Upstream Distance (diameters) ___1.59_____ ☐ Measurement ☐ Plant Information
Number of Ports to be sampled __2__	
Duct Diameter (in) ___44____ ☒ Measurement ☐ Plant Information	Downstream Distance (ft/in) ____152"_____ Downstream Distance (diameters) ___3.45____ ☐ Measurement ☐ Plant Information

Total number of Traverse Points (from Figure 2 (velocity) or 1 (all isokinetic sampling))	16
Number of traverse points per port	8
Port Depth	4"

Traverse Point	Percent of Diameter	Distance from Wall [1] (in)	Marking Location (in)
1	3.2	1 3/8	5 3/8
2	10.5	4 5/8	8 5/8
3	19.4	8 4/8	12 4/8
4	32.3	14 2/8	18 2/8
5	67.7	29 7/8	33 7/8
6	80.6	35 4/8	39 4/8
7	89.5	39 3/8	43 3/8
8	96.8	42 5/8	49 5/8
9			
10			
11			
12			

Traverse Point	Percent of Diameter	Distance from Wall (in)	Marking Location (in)
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

Prepare a drawing of the source, showing the ports, disturbances, and the distances

[1] According to Method 1, for stacks between 12 and 24", no point may be within ½ inch of the wall. For stacks greater than 24", no point may be within 1 inch of the wall.

Spectrum ENVIRONMENTAL SOLUTIONS

EPA Method 1
Circular Duct – Determination of Traverse Points

Project 225-01-2401M	
Facility Microchip Gresham	
Source	**RCTO** 4 TO
Operator	ARB, JD
Date	3/26/25

☒ Velocity Only □ Isokinetic Sampling	Upstream Distance (ft/in) _____129"_____ Upstream Distance (diameters) ___6.79_____ □ Measurement □ Plant Information
Number of Ports to be sampled __2__	
Duct Diameter (in) ___19____ ☒ Measurement □ Plant Information	Downstream Distance (ft/in) ____339"_____ Downstream Distance (diameters) ___17.84____ □ Measurement □ Plant Information

Total number of Traverse Points (from Figure 2 (velocity) or 1 (all isokinetic sampling))	16
Number of traverse points per port	8
Port Depth	4"

Traverse Point	Percent of Diameter	Distance from Wall [1] (in)	Marking Location (in)
1	3.2	5/8	4 5/8
2	10.5	2	6
3	19.4	3 5/8	7 5/8
4	32.3	6 1/8	10 1/8
5	67.7	12 7/8	16 7/8
6	80.6	15 2/8	19 2/8
7	89.5	17	21
8	96.8	18 3/8	22 3/8
9			
10			
11			
12			

Traverse Point	Percent of Diameter	Distance from Wall (in)	Marking Location (in)
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

Prepare a drawing of the source, showing the ports, disturbances, and the distances

[1] According to Method 1, for stacks between 12 and 24", no point may be within ½ inch of the wall. For stacks greater than 24", no point may be within 1 inch of the wall.

Spectrum ENVIRONMENTAL SOLUTIONS

Determination of Cyclonic Flow
EPA Method 1

Project	Microchip Gresham RCTO 4
Facility	Microchip Gresham
Source	RCTO 4 Inlet
Operator	JAD, ARB, SDS
Date	3/25/2025
Pitot Tube No.	PT-02

Pitot Tube Leak Check ("H_2O@"H_2O)			
Initial (-)	0	@	>3
Initial (+)	0	@	>3
Final (-)	0	@	>3
Final (+)	0	@	>3

Traverse Point	Yaw Angle (°)
1	0
2	3
3	0
4	3
5	3
6	5
7	0
8	0

Traverse Point	Yaw Angle (°)
1	10
2	6
3	0
4	6
5	4
6	10
7	12
8	6

Spectrum
ENVIRONMENTAL SOLUTIONS

Determination of Cyclonic Flow
EPA Method 1

Project	Microchip Gresham RCTO 4
Facility	Microchip Gresham
Source	RCTO 4 Thermal Oxidizer
Operator	JAD, ARB, SDS
Date	3/25/2025
Pitot Tube No.	PT-02

Pitot Tube Leak Check ("H_2O@"H_2O)			
Initial (-)	0	@	>3
Initial (+)	0	@	>3
Final (-)	0	@	>3
Final (+)	0	@	>3

Traverse Point	Yaw Angle (°)
1	5
2	0
3	3
4	0
5	0
6	3
7	3
8	2

Traverse Point	Yaw Angle (°)
1	3
2	0
3	-3
4	0
5	0
6	0
7	0
8	0

Spectrum
ENVIRONMENTAL SOLUTIONS

Three Dimensional Volumetric Flow Rate Determination Field Data Sheet

Project Number: M25130F
Client: Spectrum Environmental Solutions
Test Location: Micropac Technologies RCTO4
Source Condition: Normal
Test Engineer: RMF

Date: 3-26-25
Test Number: 1
Start Time: 8:10
End Time: 8:50
Test Tech: JD

Duct Diameter 9.67 ft
Flue Area 10.58 ft²
Port Length 4.00 "
P_{bar} 29.45 "Hg
Static -6.00 "H_2O
Static ____ "Hg
P_s 29.01 "Hg

RMF 3-26-25
CO_2 % ~~0.1~~
O_2 % ~~21~~ 21
N_2 % ~~99.75~~ 78.00
Meter ID 3D-1

Upstream Disturbance, Diameters 1.760
Downstream Disturbance, Diameters .770
Probe ID DAT 1225
Wet Bulb Temp ____
Dry Bulb Temp ____
B_{ws} .0178
Umbilical ID ____

Leak Checks Passed @
Pre 3.5 Inches H_2O
Post 4.0 Inches H_2O

Port/Point	P_1-P_2	P_4-P_5	Stack Temp.	Yaw Angle
1-1	.51	.16	61	9.0
1-2	.50	.12	61	4.0
1-3	.49	.06	61	3.0
1-4	.47	.09	62	6.0
1-5	.43	.09	63	3.0
1-6	.44	.06	63	0.0
1-7	.41	.09	63	2.0
1-8	.39	.07	64	3.0
1-9	.35	.06	64	6.0
1-10	.26	.06	66	3.0
1-11	.21	.13	66	0.0
1-12	.22	.10	64	0.0
1-13	.24	.19	64	0.0
1-14	.22	.08	63	4.0
1-15	.21	.10	62	0.0
1-16	.18	.07	60	8.0
1-17	.20	.09	61	10.0
1-18	.22	.16	61	-4.0
1-19	.13	.03	60	0.0
1-20	.11	0.00	60	0.0

SCFH _____

PT2

Three Dimensional Volumetric Flow Rate Determination Field Data Sheet

Project Number: MD51308
Client: Spectrum Environmental Solutions
Test Location: Microchip Tech RCTO4
Source Condition: Normal
Test Engineer: RMF

Date: 3-26-25
Test Number: 1
Start Time: 8:10
End Time: 8:50
Test Tech: JD

Duct Diameter 3.67 ft
Flue Area 10.58 ft²
Port Length 4.00"
P_{bar} 29.43 "Hg
Static -6.00 H_2O
Static ____ "Hg
P_s 27.01 "Hg

RMF 3-26-25

CO_2 % 21
O_2 % 21
N_2 % ~~78~~ 79.00
Meter ID 2D-1

Upstream Disturbance, Diameters 1.860
Downstream Disturbance, Diameters 1770
Probe ID DAT 12ft
Wet Bulb Temp ____
Dry Bulb Temp ____
B_{ws} .012
Umbilical ID ____

Leak Checks Passed @
Pre 3.5 Inches H_2O
Post 4.0 Inches H_2O

Port/Point	P_1-P_2	P_4-P_5	Stack Temp.	Yaw Angle
2-1	.70	.10	66	16.0
2-2	.66	.10	66	16.0
2-3	.65	.12	66	15.0
2-4	.68	.14	66	16.0
2-5	.61	.11	66	14.0
2-6	.54	.10	66	15.0
2-7	.53	.10	67	11.0
2-8	.37	.10	67	8.0
2-9	.24	.04	67	-2.0
2-10	.22	.05	67	-7.0
2-11	.42	.10	67	8.0
2-12	.45	.09	66	8.0
2-13	.45	.15	66	8.0
2-14	.45	.12	65	9.0
2-15	.43	.11	65	9.0
2-16	.47	.11	63	5.0
2-17	.46	.14	63	9.0
2-18	.36	.09	63	4.0
2-19	.32	.06	62	5.0
2-20	.26	-.02	61	0.0

SCFH ____

Three Dimensional Volumetric Flow Rate Determination Field Data Sheet

Project Number: M251305
Client: Steelhead Environmental Solutions
Test Location: Nucor RCT04
Source Condition: Normal
Test Engineer: RMF

Date: 3-26-25
Test Number: 2
Start Time: 9:28
End Time: 10:08
Test Tech: JD

Duct Diameter 3.67 ft
Flue Area 10.58 ft²
Port Length 4.8 "
P_{bar} 29.82 "Hg
Static -6.0 "H_2O
Static ____ "Hg
P_s 29.38 "Hg

CO_2 % 1
O_2 % 21
N_2 % 78
Meter ID 30-1

Upstream Disturbance, Diameters 1.860
Downstream Disturbance, Diameters 1.70
Probe ID DAT 1256
Wet Bulb Temp ____
Dry Bulb Temp ____
B_{ws} 0.12

Leak Checks Passed @
Pre 3.4 Inches H_2O
Post 3.8 Inches H_2O

Port/Point	P_1-P_2	P_4-P_5	Stack Temp.	Yaw Angle
1-1	.48	.11	70	1.0
1-2	.46	.13	70	5.0
1-3	.47	.10	70	3.6
1-4	.44	.13	70	6.0
1-5	.44	.12	70	3.0
1-6	.40	.08	70	5.0
1-7	.37	.08	70	2.0
1-8	.35	.09	71	3.0
1-9	.30	.07	71	3.0
1-10	.23	.07	72	3.0
1-11	.20	.12	72	4.0
1-12	.27	.13	72	1.0
1-13	.24	.12	73	6.6
1-14	.23	.13	72	2.0
1-15	.22	.11	71	-4.0
1-16	.20	.10	71	3.0
1-17	.24	.10	71	-4.0
1-18	.18	.07	70	-4.0
1-19	.21	.08	70	0.6
1-20	.20	.07	70	1.0

SCFH ____

Pt 2

Three Dimensional Volumetric Flow Rate Determination Field Data Sheet

Project Number: M25|308
Client: Spectrum Environmental Solutions
Test Location: Microchip RCTO1
Source Condition: Normal
Test Engineer: RMF

Date: 3-26-25
Test Number: 2
Start Time: 9:28
End Time: 10:08
Test Tech: JD

Duct Diameter 3.67 ft
Flue Area 10.58 ft²
Port Length 14.0"
P_{bar} 29.85 "Hg
Static -6.0 "H_2O
Static ____ "Hg
P_s 29.30 "Hg

CO_2 % 1
O_2 % 21
N_2 % 78
Meter ID 3D-1

Upstream Disturbance, Diameters 1.8-60
Downstream Disturbance, Diameters 1.770
Probe ID DA11258
Wet Bulb Temp ____
Dry Bulb Temp ____
B_{ws} .012
Umbilical ID ____

Leak Checks Passed @
Pre 3.4 Inches H_2O
Post 3.8 Inches H_2O

Port/Point	P_1-P_2	P_4-P_5	Stack Temp.	Yaw Angle
2- 1	.60	.10	69	15.0
2- 2	.64	.09	70	15.0
2- 3	.65	.08	70	16.0
2- 4	.59	.08	70	14.0
2- 5	.51	.06	70	12.0
2- 6	.43	.08	71	10.0
2- 7	.71	.07	71	8.0
2- 8	.31	.06	71	4.0
2- 9	.18	.06	71	-5.0
2- 10	.18	.05	73	-7.0
2- 11	.44	.06	73	7.0
2- 12	.59	.04	73	6.0
2- 13	.45	.11	73	6.0
2- 14	.48	.08	74	8.0
2- 15	.48	.08	73	9.0
2- 16	.42	.07	73	8.0
2- 17	.39	.07	75	9.0
2- 18	.42	.06	72	9.0
2- 19	.25	-.01	70	6.0
2- 20	.25	.01	70	2.0

SCFH _____

Px1

Three Dimensional Volumetric Flow Rate Determination Field Data Sheet

Project Number: M251308
Client: Spectrum Environmental Solutions
Test Location: Microchip RCTO4
Source Condition: Normal
Test Engineer: BMF

Date: 5-26-25
Test Number: 3
Start Time: 10:35
End Time: 11:17
Test Tech: JD

Duct Diameter 3.67 ft
Flue Area 10.58 ft²
Port Length 11.0 "
P_{bar} 29.82 "Hg
Static -6.00 "H_2O
Static ____ "Hg
P_s 29.42 "Hg

CO_2 % 1.0
O_2 % 21.0
N_2 % 78.0
Meter ID TD-1

Upstream Disturbance, Diameters 1.160
Downstream Disturbance, Diameters .770
Probe ID PAT 1288
Wet Bulb Temp ____
Dry Bulb Temp ____
B_{ws} .013
Umbilical ID ____

Leak Checks Passed @
Pre 3.6 Inches H_2O
Post 4.1 Inches H_2O

Port/Point	P_1-P_2	P_4-P_5	Stack Temp.	Yaw Angle
1- 1	.57	.20	71	6.0
1- 2	.57	.16	71	5.0
1- 3	.54	.15	71	3.0
1- 4	.51	.14	71	4.0
1- 5	.49	.11	71	4.0
1- 6	.47	.12	71	4.0
1- 7	.44	.12	72	0.0
1- 8	.39	.11	72	0.0
1- 9	.35	.08	73	1.0
1- 10	.26	.08	73	0.0
1- 11	.28	.14	74	0.0
1- 12	.26	.13	74	6.0
1- 13	.29	.14	74	0.0
1- 14	.23	.15	74	-3.0
1- 15	.23	.13	74	-6.0
1- 16	.21	.12	73	-6.0
1- 17	.21	.11	72	-4.0
1- 18	.22	.12	72	0.0
1- 19	.30	.09	72	3.0
1- 20	.24	.09	72	-2.0

SCFH _____

PT 2

Three Dimensional Volumetric Flow Rate Determination Field Data Sheet

Project Number: M25130E
Client: STANTEC ENVIRONMENTAL SOLUTIONS
Test Location: Microchip RC104
Source Condition: normal
Test Engineer: RMF

Date: 5-26-25
Test Number: 3
Start Time: 10:35
End Time: 11:17
Test Tech: JD

Duct Diameter 3.67 ft
Flue Area 10.58 ft²
Port Length 4.0 "
P_{bar} 29.82 "Hg
Static -6.00 "H_2O
Static ____ "Hg
P_s 29.43 "Hg

CO_2 % 1.0
O_2 % 21.0
N_2 % 78.0
Meter ID SD-1

Upstream Disturbance, Diameters 1.86
Downstream Disturbance, Diameters 7.20
Probe ID DA-H228
Wet Bulb Temp ____
Dry Bulb Temp ____
B_{ws} .015
Umbilical ID ____

Leak Checks Passed @
Pre 3.6 Inches H_2O
Post 4.1 Inches H_2O

Port/Point	P_1-P_2	P_4-P_5	Stack Temp.	Yaw Angle
2 - 1	.73	.10	74	16.0
2 - 2	.87	.09	75	17.0
2 - 3	.77	.09	72	15.0
2 - 4	.64	.09	72	16.0
2 - 5	.60	.10	72	11.0
2 - 6	.50	.08	72	11.0
2 - 7	.36	.09	72	6.0
2 - 8	.35	.06	73	3.0
2 - 9	.25	.04	73	-4.0
2 - 10	.24	.05	74	-8.0
2 - 11	.48	.06	74	5.0
2 - 12	.43	.09	74	6.0
2 - 13	.50	.17	74	10.0
2 - 14	.50	.11	74	8.0
2 - 15	.47	.12	74	7.0
2 - 16	.55	.12	73	5.0
2 - 17	.48	.12	73	9.0
2 - 18	.71	.06	73	8.0
2 - 19	.29	-.02	72	1.0
2 - 20	.26	-.01	72	-2.0

SCFH ____

2025 Microchip Gresham RCTO4 Compliance Test

3/24/25 ARB, JD, SS

0830 onsite setting up at RCTO 3: Inlet, RCO, and TO

1535 calibrating RCO and TO

1559 Response time, 10.25 ppm C3 on

1600:30 zero

1602 10.25 ppm C3

1603:30 zero

1605 10.25 pm C3

1606:30 zero

1610 191 ppm C3 to inlet

1612 zero to inlet

1615 N2 for CTS on FTIRs

3/25/25 ARB, JAD, SS RCTO4 Prelim

0847 starting collection for calibration/analyzer adjustment

0849 starting N2 flow to all 3 FIDs

0850 adjusting RCO analyzer zero

0851 adjusting TO analyzer zero, inlet analyzer good

0853 starting high cal gas to RCO and TO

0854 adjusting span for RCO and TO

0856 adjustment complete

0857 starting high cal gas flow to inlet

0859 adjusting inlet analyzer span

0900 adjustment complete, will flow N2 through all three again to ensure zero calibration still good

0902 zero calibration still good, proceeding with calibration error zero

0903

0910 inlet cal error high

0913 RCO and TO cal error mid

0917 back to zero

0930 troubleshooting RCO

1000 zero adjust

1008 Span adjust

1012 RCO TO Cal error zero

1014 10.25 ppm C3

1016 5.98 ppm C3

1019 inlet high 191 ppm C3, adjust

1021 3.586 ppm C3

1026 RCO failing, back to zero to adjust

1029 span adjust

1030 cal error zero

1032 cal error 10.25 ppm C3

1034 5.98 pm C3

1036 116.2 pm C3

1038 3.568 pm C3

1040 69.5 ppm C3

1045 on sample at TO

1115 on sample at RCO and inlet

1140 zero drift

1142 3.568 drift

1145 back on sample

3/26/25 ARB, JD

0700 arrive onsite, setting up for RCTO4 compliance

0730 zero adjust

0743 span adjust

0745 cal error zero

0747 cal error - 10.25 ppm

0750 cal error – 191 ppm

0752 cal error – 5.981 ppm

0755 cal error – 116.2 ppm

0757 cal error – 3.586 ppm

0759 cal error – 69.47 ppm

0810 start run 1

0910 zero drift

0913 3.568 ppm drift

0916 69.47 ppm drift

0920 run 2 start

1020 zero drift

1023 3.568 ppm drift

1026 69.47 ppm drift

1030 run 3 start

1130 zero drift

1134 69.47 ppm drift

1136 3.568 ppm drift

2025 Microchip Gresham RCTO 3 FTIR Log

3/24/25 ARB, JD, SS

0830 onsite setting up at RCTO 3

FTIR and calibration information

TO: 023CFE031QTX

RCO: 019LFE003QTX

Inlet: 023LFE032QTX

CTS Cylinder #: CC105191

CH4 = 20.56 ppm

R22 = 20.24 ppm

1620 new N2 bkgs

1622 CTS through sample system for each FTIR

TO CH4 = 186.6 ppmm = 9.1 m

RCO CH4 = 198.1 ppmm = 9.6 m

Inlet CH4 = 184.9 ppm = 9.8 m

3/25/25 ARB, JD, SS

0830 arrive onsite, setting up for prelims

1430 Response times on all 3

1431 zero on

1433 CTS on

1438 collecting natives for spikes

1446 start CTS gas for spike on all systems

1530 all probes out of stacks, sampling ambient air

3/26/25 ARB, JD

0710 leak check TO, roto to zero

0715 leak check inlet, roto to zero

0720 leak check RCO, roto to zero

0730 new N2 bkgs on all FTIRS

0802 CTS through the sample system on all three units

0805 CTS off, sample stack gas on all three

0810 start run 1

0910 end run 1, THC cals

0920 start run 2

1020 end run 2, THC cals

1030 start run 3

~1045 TO sample line briefly lost heat

1130 end run 3

1132 leak check TO, roto to zero

1134 leak check inlet, roto to zero

1136 leak check RCO, roto to zero

1140 CTS through the sample system on all three units

Appendix C

FTIR Data

RCTO 4 Inlet FTIR Data

	Unitname	Location	Condition	CH4 Summary	H2O Summary	Temp(C) Summary	Press(atm) Summary
	RCTO4	Inlet	Compliance				
Run Length	Run 1	Conc. (ppmv)	Minimum	1.86	12609	150	0.99
60.0 (min)			Maximum	2.15	13022	151	0.99
			(BDL = 1/2MDL) Average	2.01	12813	150	0.99
			MDL	NA	NA	NA	NA
Test Length	Run 2	Conc. (ppmv)	Minimum	1.66	12769	150	0.99
60.0 (min)			Maximum	2.04	13153	151	0.99
			(BDL = 1/2MDL) Average	1.93	12936	150	0.99
			MDL	NA	NA	NA	NA
Test Length	Run 3	Conc. (ppmv)	Minimum	1.90	12926	150	0.99
60.0 (min)			Maximum	2.04	13195	151	0.99
			(BDL = 1/2MDL) Average	1.97	13070	150	0.99
			MDL	NA	NA	NA	NA

	Date	Time	Run	Scan Length	Conc. (ppm) BDL=1/2MDL	Conc. (ppm) BDL=1/2MDL	Conc. (ppm) BDL=1/2MDL	Conc. (ppm) BDL=1/2MDL
	3/26/25	7:51:00		0.97	1.86	11291	151	0.99
	3/26/25	7:52:01		1.02	0.36	278	151	0.99
	3/26/25	7:53:00		0.98	0.16	1032	151	0.99
	3/26/25	7:54:00		1.00	1.81	12411	151	0.99
	3/26/25	7:55:00		1.00	1.67	9310	151	0.99
	3/26/25	7:56:00		1.00	0.16	187	151	0.99
	3/26/25	7:57:00		1.00	0.16	26.6	151	0.99
	3/26/25	7:58:00		1.00	0.39	1561	151	0.99
	3/26/25	7:59:00		1.00	1.83	12550	151	0.99
	3/26/25	8:00:00		1.00	2.01	12804	151	0.99
	3/26/25	8:01:00		1.00	0.81	2764	151	0.99
	3/26/25	8:02:00		1.00	0.70	123	151	0.99
	3/26/25	8:03:00		1.00	19.5	229	150	0.99
	3/26/25	8:04:00		1.00	20.4	26.6	150	0.99
	3/26/25	8:05:02		1.03	20.4	26.6	151	0.99
	3/26/25	8:06:00		0.97	9.03	6458	151	0.99
	3/26/25	8:07:00		1.00	1.80	12731	151	0.99
	3/26/25	8:08:00		1.00	2.04	12698	151	0.99
	3/26/25	8:09:00		1.00	2.02	12691	151	0.99
	3/26/25	8:10:02		1.03	1.97	12700	150	0.99
	3/26/25	8:11:03	1	1.02	1.99	12811	151	0.99
	3/26/25	8:12:03	1	1.00	2.01	12715	150	0.99
	3/26/25	8:13:00	1	0.95	2.01	12609	150	0.99
	3/26/25	8:14:00	1	1.00	2.03	12678	150	0.99
	3/26/25	8:15:02	1	1.03	2.04	12656	150	0.99
	3/26/25	8:16:00	1	0.97	2.00	12807	151	0.99
	3/26/25	8:17:00	1	1.00	2.02	12767	150	0.99
	3/26/25	8:18:00	1	1.00	1.96	12880	150	0.99
	3/26/25	8:19:00	1	1.00	1.94	12728	151	0.99
	3/26/25	8:20:00	1	1.00	1.96	12656	150	0.99
	3/26/25	8:21:00	1	1.00	1.99	12782	150	0.99
	3/26/25	8:22:01	1	1.02	2.06	12939	150	0.99
	3/26/25	8:23:00	1	0.98	2.02	12715	150	0.99
	3/26/25	8:24:00	1	1.00	2.02	12630	150	0.99
	3/26/25	8:25:00	1	1.00	2.06	12698	150	0.99
	3/26/25	8:26:00	1	1.00	2.08	12635	150	0.99
	3/26/25	8:27:01	1	1.02	2.04	12820	150	0.99
	3/26/25	8:28:00	1	0.98	2.10	12842	150	0.99
	3/26/25	8:29:00	1	1.00	2.09	12892	150	0.99
	3/26/25	8:30:00	1	1.00	2.06	12776	150	0.99
	3/26/25	8:31:01	1	1.02	2.02	12854	150	0.99
	3/26/25	8:32:00	1	0.98	2.06	12758	150	0.99
	3/26/25	8:33:02	1	1.03	2.11	12685	150	0.99
	3/26/25	8:34:00	1	0.97	2.13	12815	150	0.99
	3/26/25	8:35:01	1	1.02	2.15	12772	150	0.99
	3/26/25	8:36:02	1	1.02	2.12	12785	151	0.99
	3/26/25	8:37:00	1	0.97	2.10	12802	150	0.99
	3/26/25	8:38:02	1	1.03	2.10	12819	150	0.99
	3/26/25	8:39:00	1	0.97	2.12	12734	150	0.99
	3/26/25	8:40:00	1	1.00	2.13	12821	150	0.99
	3/26/25	8:41:00	1	1.00	2.10	12810	150	0.99
	3/26/25	8:42:01	1	1.02	2.12	12851	150	0.99
	3/26/25	8:43:03	1	1.03	2.06	12915	150	0.99
	3/26/25	8:44:00	1	0.95	2.09	12771	150	0.99
	3/26/25	8:45:01	1	1.02	2.10	12716	150	0.99
	3/26/25	8:46:00	1	0.98	2.11	12819	150	0.99
	3/26/25	8:47:00	1	1.00	2.05	12855	150	0.99
	3/26/25	8:48:00	1	1.00	2.01	12832	150	0.99
	3/26/25	8:49:00	1	1.00	2.02	12861	150	0.99
	3/26/25	8:50:00	1	1.00	1.98	12910	150	0.99
	3/26/25	8:51:02	1	1.03	1.99	12927	150	0.99
	3/26/25	8:52:02	1	1.00	1.98	12792	150	0.99
	3/26/25	8:53:03	1	1.02	1.98	12829	150	0.99
	3/26/25	8:54:00	1	0.95	1.90	12839	150	0.99
	3/26/25	8:55:00	1	1.00	1.86	12952	150	0.99
	3/26/25	8:56:03	1	1.05	1.89	12841	150	0.99
	3/26/25	8:57:00	1	0.95	1.88	12922	150	0.99
	3/26/25	8:58:03	1	1.05	1.90	12903	150	0.99
	3/26/25	8:59:00	1	0.95	1.91	12926	150	0.99
	3/26/25	9:00:00	1	1.00	1.88	12895	150	0.99
	3/26/25	9:01:01	1	1.02	1.93	12869	150	0.99
	3/26/25	9:02:00	1	0.98	1.92	12915	150	0.99
	3/26/25	9:03:00	1	1.00	1.91	12889	150	0.99
	3/26/25	9:04:00	1	1.00	1.95	12808	150	0.99
	3/26/25	9:05:02	1	1.03	1.97	12881	150	0.99
	3/26/25	9:06:00	1	0.97	1.94	12906	150	0.99
	3/26/25	9:07:01	1	1.02	1.98	12877	150	0.99
	3/26/25	9:08:00	1	0.98	1.96	12771	150	0.99
	3/26/25	9:09:00	1	1.00	1.99	13022	150	0.99
	3/26/25	9:10:03	1	1.05	1.91	12799	150	0.99
	3/26/25	9:11:00		0.95	1.97	12778	150	0.99
	3/26/25	9:12:01		1.02	0.16	836	150	0.99
	3/26/25	9:13:00		0.98	0.16	157	150	0.99
	3/26/25	9:14:00		1.00	0.46	1777	150	0.99
	3/26/25	9:15:02		1.03	1.64	12708	150	0.99
	3/26/25	9:16:02		1.00	1.90	12903	150	0.99
	3/26/25	9:17:00		0.97	1.64	10506	150	0.99
	3/26/25	9:18:00		1.00	0.16	315	150	0.99
	3/26/25	9:19:01		1.02	0.16	145	150	0.99
	3/26/25	9:20:02		1.02	0.71	4037	150	0.99
	3/26/25	9:21:03	2	1.02	1.66	12936	150	0.99
	3/26/25	9:22:03	2	1.00	1.83	12855	150	0.99
	3/26/25	9:23:00	2	0.95	1.86	12882	150	0.99
	3/26/25	9:24:00	2	1.00	1.88	12891	150	0.99
	3/26/25	9:25:00	2	1.00	1.89	12978	150	0.99
	3/26/25	9:26:00	2	1.00	1.90	12939	150	0.99
	3/26/25	9:27:00	2	1.00	1.93	12965	150	0.99
	3/26/25	9:28:02	2	1.03	1.93	13027	150	0.99
	3/26/25	9:29:00	2	0.97	1.93	12845	150	0.99

RCTO 4 Inlet FTIR Data

		Unitname	Location	Condition	CH4 Summary	H2O Summary	Temp(C) Summary	Press(atm) Summary
		RCTO4	Inlet	Compliance				
	3/26/25	9:30:03	2	1.05	1.92	12969	150	0.99
	3/26/25	9:31:00	2	0.95	1.89	12792	150	0.99
	3/26/25	9:32:00	2	1.00	1.95	12951	150	0.99
	3/26/25	9:33:00	2	1.00	1.96	12797	150	0.99
	3/26/25	9:34:02	2	1.03	1.93	12891	150	0.99
	3/26/25	9:35:01	2	0.98	1.96	12908	150	0.99
	3/26/25	9:36:00	2	0.98	1.97	12944	150	0.99
	3/26/25	9:37:00	2	1.00	2.01	12940	150	0.99
	3/26/25	9:38:02	2	1.03	1.95	12769	150	0.99
	3/26/25	9:39:00	2	0.97	1.95	12852	150	0.99
	3/26/25	9:40:01	2	1.02	1.98	12853	150	0.99
	3/26/25	9:41:01	2	1.00	2.02	13010	150	0.99
	3/26/25	9:42:00	2	0.98	2.04	12889	150	0.99
	3/26/25	9:43:03	2	1.05	2.04	12922	150	0.99
	3/26/25	9:44:00	2	0.95	1.99	13019	150	0.99
	3/26/25	9:45:00	2	1.00	2.01	12888	150	0.99
	3/26/25	9:46:00	2	1.00	2.01	12975	150	0.99
	3/26/25	9:47:03	2	1.05	1.97	12958	150	0.99
	3/26/25	9:48:00	2	0.95	1.97	12953	150	0.99
	3/26/25	9:49:03	2	1.05	1.96	12954	150	0.99
	3/26/25	9:50:00	2	0.95	1.92	12965	150	0.99
	3/26/25	9:51:00	2	1.00	1.95	12962	150	0.99
	3/26/25	9:52:02	2	1.03	1.94	13003	150	0.99
	3/26/25	9:53:00	2	0.97	1.93	13019	150	0.99
	3/26/25	9:54:01	2	1.02	1.91	12983	150	0.99
	3/26/25	9:55:02	2	1.02	1.90	12992	150	0.99
	3/26/25	9:56:03	2	1.02	1.91	13002	150	0.99
	3/26/25	9:57:02	2	0.98	1.93	12895	150	0.99
	3/26/25	9:58:00	2	0.97	1.91	12934	150	0.99
	3/26/25	9:59:01	2	1.02	1.86	12903	150	0.99
	3/26/25	10:00:00	2	0.98	1.87	12949	150	0.99
	3/26/25	10:01:00	2	1.00	1.90	12962	150	0.99
	3/26/25	10:02:00	2	1.00	1.91	12886	150	0.99
	3/26/25	10:03:03	2	1.05	1.87	12883	150	0.99
	3/26/25	10:04:03	2	1.00	1.94	13000	150	0.99
	3/26/25	10:05:00	2	0.95	1.96	12920	150	0.99
	3/26/25	10:06:01	2	1.02	1.97	12930	150	0.99
	3/26/25	10:07:00	2	0.98	1.97	12900	150	0.99
	3/26/25	10:08:00	2	1.00	1.96	12931	150	0.99
	3/26/25	10:09:00	2	1.00	1.97	12901	150	0.99
	3/26/25	10:10:00	2	1.00	1.95	12977	150	0.99
	3/26/25	10:11:03	2	1.05	1.98	12854	150	0.99
	3/26/25	10:12:00	2	0.95	1.93	12924	150	0.99
	3/26/25	10:13:03	2	1.05	1.91	12867	150	0.99
	3/26/25	10:14:05	2	1.03	1.93	12943	150	0.99
	3/26/25	10:15:00	2	0.92	1.95	12886	150	0.99
	3/26/25	10:16:00	2	1.00	1.91	13021	150	0.99
	3/26/25	10:17:01	2	1.02	1.93	13051	150	0.99
	3/26/25	10:18:00	2	0.98	1.91	13029	150	0.99
	3/26/25	10:19:00	2	1.00	1.94	13153	150	0.99
	3/26/25	10:20:00	2	1.00	1.91	13006	151	0.99
	3/26/25	10:21:00		1.00	1.82	12234	150	0.99
	3/26/25	10:22:01		1.02	0.16	512	150	0.99
	3/26/25	10:23:01		1.00	0.16	188	150	0.99
	3/26/25	10:24:00		0.98	0.58	2582	150	0.99
	3/26/25	10:25:00		1.00	1.65	12841	150	0.99
	3/26/25	10:26:02		1.03	1.89	12957	150	0.99
	3/26/25	10:27:00		0.97	1.31	8210	150	0.99
	3/26/25	10:28:00		1.00	0.16	260	150	0.99
	3/26/25	10:29:00		1.00	0.38	2074	150	0.99
	3/26/25	10:30:02		1.03	1.64	12902	150	0.99
	3/26/25	10:31:00	3	0.97	1.91	12962	150	0.99
	3/26/25	10:32:00	3	1.00	1.91	12986	150	0.99
	3/26/25	10:33:00	3	1.00	1.94	12997	150	0.99
	3/26/25	10:34:00	3	1.00	1.96	12934	150	0.99
	3/26/25	10:35:00	3	1.00	1.94	12926	150	0.99
	3/26/25	10:36:01	3	1.02	1.96	13075	150	0.99
	3/26/25	10:37:03	3	1.03	1.95	13125	150	0.99
	3/26/25	10:38:00	3	0.95	1.94	13082	150	0.99
	3/26/25	10:39:02	3	1.03	1.91	13135	150	0.99
	3/26/25	10:40:00	3	0.97	1.90	13138	150	0.99
	3/26/25	10:41:00	3	1.00	1.96	13043	150	0.99
	3/26/25	10:42:03	3	1.05	1.92	13018	150	0.99
	3/26/25	10:43:00	3	0.95	1.90	13000	150	0.99
	3/26/25	10:44:00	3	1.00	1.90	13075	150	0.99
	3/26/25	10:45:03	3	1.05	1.93	12943	150	0.99
	3/26/25	10:46:03	3	1.00	1.91	13018	150	0.99
	3/26/25	10:47:01	3	0.97	1.94	13090	150	0.99
	3/26/25	10:48:01	3	1.00	1.95	13025	150	0.99
	3/26/25	10:49:00	3	0.98	1.94	12972	150	0.99
	3/26/25	10:50:00	3	1.00	1.98	13116	150	0.99
	3/26/25	10:51:03	3	1.05	1.95	13073	150	0.99
	3/26/25	10:52:00	3	0.95	1.95	12999	150	0.99
	3/26/25	10:53:01	3	1.02	1.94	13175	150	0.99
	3/26/25	10:54:00	3	0.98	1.97	13091	150	0.99
	3/26/25	10:55:00	3	1.00	1.97	13115	150	0.99
	3/26/25	10:56:00	3	1.00	1.96	13048	150	0.99
	3/26/25	10:57:00	3	1.00	1.95	13032	150	0.99
	3/26/25	10:58:00	3	1.00	1.98	13026	150	0.99
	3/26/25	10:59:00	3	1.00	2.00	13039	150	0.99
	3/26/25	11:00:00	3	1.00	2.01	13080	150	0.99
	3/26/25	11:01:03	3	1.05	2.00	13150	150	0.99
	3/26/25	11:02:01	3	0.97	2.00	13006	150	0.99
	3/26/25	11:03:00	3	0.98	2.00	13082	150	0.99
	3/26/25	11:04:03	3	1.05	2.01	13049	151	0.99
	3/26/25	11:05:00	3	0.95	2.02	13035	150	0.99
	3/26/25	11:06:00	3	1.00	2.01	13066	150	0.99
	3/26/25	11:07:03	3	1.05	2.04	13069	150	0.99
	3/26/25	11:08:01	3	0.97	2.01	13047	150	0.99
	3/26/25	11:09:00	3	0.98	1.96	13094	150	0.99
	3/26/25	11:10:01	3	1.02	1.98	13195	150	0.99
	3/26/25	11:11:00	3	0.98	1.98	13111	150	0.99
	3/26/25	11:12:00	3	1.00	1.96	13181	150	0.99
	3/26/25	11:13:00	3	1.00	1.95	13046	150	0.99
	3/26/25	11:14:01	3	1.02	1.96	13050	150	0.99
	3/26/25	11:15:00	3	0.98	1.97	13133	150	0.99
	3/26/25	11:16:02	3	1.03	1.98	13100	150	0.99
	3/26/25	11:17:00	3	0.97	1.98	13108	150	0.99
	3/26/25	11:18:02	3	1.03	1.99	13069	150	0.99
	3/26/25	11:19:00	3	0.97	2.01	13176	150	0.99
	3/26/25	11:20:00	3	1.00	2.00	13108	150	0.99
	3/26/25	11:21:00	3	1.00	2.02	13065	150	0.99
	3/26/25	11:22:00	3	1.00	2.00	13048	150	0.99
	3/26/25	11:23:00	3	1.00	1.97	13135	150	0.99
	3/26/25	11:24:02	3	1.03	1.97	12976	150	0.99
	3/26/25	11:25:00	3	0.97	1.99	13166	150	0.99
	3/26/25	11:26:02	3	1.03	2.01	13159	150	0.99
	3/26/25	11:27:04	3	1.03	2.03	13150	150	0.99

RCTO 4 Inlet FTIR Data

		Unitname RCTO4	Location Inlet	Condition Compliance	CH4 Summary	H2O Summary	Temp(C) Summary	Press(atm) Summary
	3/26/25	11:28:00	3	0.93	2.04	13070	150	0.99
	3/26/25	11:29:00	3	1.00	2.01	13079	150	0.99
	3/26/25	11:30:00	3	1.00	2.04	13114	150	0.99
	3/26/25	11:31:03		1.05	1.40	8763	150	0.99
	3/26/25	11:32:00		0.95	0.16	333	150	0.99
	3/26/25	11:33:00		1.00	0.16	235	150	1.01
	3/26/25	11:34:02		1.03	0.16	114	150	0.99
	3/26/25	11:35:01		0.98	0.72	2818	150	0.99
	3/26/25	11:36:03		1.03	0.16	179	150	0.99
	3/26/25	11:37:00		0.95	0.54	3473	150	0.99
	3/26/25	11:38:00		1.00	1.68	14460	150	0.99
	3/26/25	11:39:00		1.00	2.07	15025	150	0.99
	3/26/25	11:40:00		1.00	2.14	15476	150	0.99
	3/26/25	11:41:00		1.00	2.65	15674	150	0.99
	3/26/25	11:42:01		1.02	19.9	808	150	0.99
	3/26/25	11:43:00		0.98	20.5	26.6	150	0.99
	3/26/25	11:44:00		1.00	20.6	26.6	150	0.99
	3/26/25	11:45:02		1.03	10.9	6648	150	0.99
	3/26/25	11:46:00		0.97	1.81	14217	150	0.99
	3/26/25	11:47:00		1.00	2.06	14270	150	0.99
	3/26/25	11:48:02		1.03	2.02	14310	150	0.99
	3/26/25	11:49:00		0.97	2.07	14295	150	0.99
	3/26/25	11:50:00		1.00	2.11	14234	150	0.99

RCTO 4 RCO FTIR Data

	Unitname	Location	Condition	CH4 Summary	H2O Summary	Temp(C) Summary	Press(atm) Summary
	RCTO4	RCO	Compliance				
Run Length 60.0 (min)	Run 1	Conc. (ppmv)	Minimum	1.74	12646	150	1.01
			Maximum	2.09	13062	150	1.01
			(BDL = 1/2MDL) Average	1.94	12839	150	1.01
			MDL	NA	NA	NA	NA
Test Length 60.0 (min)	Run 2	Conc. (ppmv)	Minimum	1.63	12189	150	1.01
			Maximum	1.99	13114	150	1.01
			(BDL = 1/2MDL) Average	1.81	12766	150	1.01
			MDL	NA	NA	NA	NA
Test Length 60.0 (min)	Run 3	Conc. (ppmv)	Minimum	1.57	12592	150	1.01
			Maximum	1.98	13288	150	1.02
			(BDL = 1/2MDL) Average	1.79	12995	150	1.01
			MDL	NA	NA	NA	NA

	Date	Time	Run	Scan Length	Conc. (ppm) BDL=1/2MDL	Conc. (ppm) BDL=1/2MDL	Conc. (ppm) BDL=1/2MDL	Conc. (ppm) BDL=1/2MDL
	3/26/25	7:51:00		1.00	0.28	1906	150	1.01
	3/26/25	7:52:03		1.05	1.77	12674	150	1.01
	3/26/25	7:53:00		0.95	1.73	11874	150	1.01
	3/26/25	7:54:00		1.00	0.076	130	150	1.01
	3/26/25	7:55:00		1.00	0.57	2998	150	1.01
	3/26/25	7:56:00		1.00	1.66	12706	150	1.01
	3/26/25	7:57:02		1.03	1.80	12680	150	1.01
	3/26/25	7:58:00		0.97	1.72	11033	150	1.01
	3/26/25	7:59:00		1.00	0.076	130	150	1.01
	3/26/25	8:00:00		1.00	0.076	130	150	1.01
	3/26/25	8:01:02		1.03	1.25	9730	150	1.01
	3/26/25	8:02:00		0.97	1.92	12609	150	1.01
	3/26/25	8:03:01		1.02	18.5	1246	150	1.01
	3/26/25	8:04:01		1.00	20.5	130	150	1.01
	3/26/25	8:05:03		1.03	20.7	130	150	1.01
	3/26/25	8:06:00		0.95	9.30	6966	150	1.01
	3/26/25	8:07:00		1.00	1.65	12835	150	1.01
	3/26/25	8:08:00		1.00	1.85	12734	150	1.01
	3/26/25	8:09:00		1.00	1.87	12923	150	1.01
	3/26/25	8:10:01		1.02	1.86	12855	150	1.01
	3/26/25	8:11:01	1	1.00	1.93	12763	150	1.01
	3/26/25	8:12:00	1	0.98	1.77	12716	150	1.01
	3/26/25	8:13:00	1	1.00	1.83	12719	150	1.01
	3/26/25	8:14:00	1	1.00	1.87	12721	150	1.01
	3/26/25	8:15:00	1	1.00	1.87	12716	150	1.01
	3/26/25	8:16:00	1	1.00	1.94	12696	150	1.01
	3/26/25	8:17:00	1	1.00	1.94	12661	150	1.01
	3/26/25	8:18:00	1	1.00	1.94	12711	150	1.01
	3/26/25	8:19:00	1	1.00	1.89	12646	150	1.01
	3/26/25	8:20:00	1	1.00	1.87	12730	150	1.01
	3/26/25	8:21:00	1	1.00	1.85	12831	150	1.01
	3/26/25	8:22:00	1	1.00	1.91	12946	150	1.01
	3/26/25	8:23:00	1	1.00	1.84	12904	150	1.01
	3/26/25	8:24:00	1	1.00	2.05	12992	150	1.01
	3/26/25	8:25:00	1	1.00	2.09	12899	150	1.01
	3/26/25	8:26:00	1	1.00	2.02	12890	150	1.01
	3/26/25	8:27:00	1	1.00	1.91	12758	150	1.01
	3/26/25	8:28:00	1	1.00	1.93	12811	150	1.01
	3/26/25	8:29:02	1	1.03	1.93	12698	150	1.01
	3/26/25	8:30:02	1	1.00	1.87	12775	150	1.01
	3/26/25	8:31:00	1	0.97	1.95	12726	150	1.01
	3/26/25	8:32:00	1	1.00	2.01	12772	150	1.01
	3/26/25	8:33:03	1	1.05	2.00	12794	150	1.01
	3/26/25	8:34:03	1	1.00	2.02	12795	150	1.01
	3/26/25	8:35:00	1	0.95	1.96	12819	150	1.01
	3/26/25	8:36:00	1	1.00	2.01	12889	150	1.01
	3/26/25	8:37:00	1	1.00	1.95	12916	150	1.01
	3/26/25	8:38:00	1	1.00	2.01	12922	150	1.01
	3/26/25	8:39:00	1	1.00	1.92	13062	150	1.01
	3/26/25	8:40:00	1	1.00	2.03	13019	150	1.01
	3/26/25	8:41:01	1	1.02	1.99	12935	150	1.01
	3/26/25	8:42:00	1	0.98	2.09	12896	150	1.01
	3/26/25	8:43:00	1	1.00	2.01	12876	150	1.01
	3/26/25	8:44:02	1	1.03	1.95	12782	150	1.01
	3/26/25	8:45:00	1	0.97	1.95	12849	150	1.01
	3/26/25	8:46:00	1	1.00	2.07	12785	150	1.01
	3/26/25	8:47:01	1	1.02	2.06	12799	150	1.01
	3/26/25	8:48:00	1	0.98	1.91	12784	150	1.01
	3/26/25	8:49:01	1	1.02	2.04	12774	150	1.01
	3/26/25	8:50:00	1	0.98	1.96	12736	150	1.01
	3/26/25	8:51:00	1	1.00	1.95	12843	150	1.01
	3/26/25	8:52:02	1	1.03	1.99	12955	150	1.01
	3/26/25	8:53:02	1	1.00	1.85	12970	150	1.01
	3/26/25	8:54:00	1	0.97	2.05	13058	150	1.01
	3/26/25	8:55:02	1	1.03	1.93	13008	150	1.01
	3/26/25	8:56:00	1	0.97	1.89	12991	150	1.01
	3/26/25	8:57:00	1	1.00	1.93	12884	150	1.01
	3/26/25	8:58:00	1	1.00	1.93	12894	150	1.01
	3/26/25	8:59:00	1	1.00	1.95	12784	150	1.01
	3/26/25	9:00:02	1	1.03	1.84	12864	150	1.01
	3/26/25	9:01:00	1	0.97	1.98	12817	150	1.01
	3/26/25	9:02:00	1	1.00	1.90	12776	150	1.01
	3/26/25	9:03:03	1	1.05	1.74	12793	150	1.01
	3/26/25	9:04:00	1	0.95	1.88	12847	150	1.01
	3/26/25	9:05:00	1	1.00	1.95	12747	150	1.01
	3/26/25	9:06:00	1	1.00	2.06	12805	150	1.01
	3/26/25	9:07:01	1	1.02	1.88	12854	150	1.01
	3/26/25	9:08:00	1	0.98	1.78	12925	150	1.01
	3/26/25	9:09:03	1	1.05	1.89	13027	150	1.01
	3/26/25	9:10:00	1	0.95	1.82	12962	150	1.01
	3/26/25	9:11:01		1.02	2.13	11367	150	1.01
	3/26/25	9:12:00		0.98	0.076	130	150	1.01
	3/26/25	9:13:00		1.00	0.076	130	150	1.01
	3/26/25	9:14:00		1.00	0.076	130	150	1.01
	3/26/25	9:15:01		1.02	0.076	130	150	1.01
	3/26/25	9:16:00		0.98	0.076	130	150	1.01
	3/26/25	9:17:00		1.00	0.32	2321	150	1.01
	3/26/25	9:18:00		1.00	1.66	12634	150	1.01
	3/26/25	9:19:02		1.03	1.83	12785	150	1.01
	3/26/25	9:20:02		1.00	1.82	12689	150	1.01
	3/26/25	9:21:00	2	0.97	1.86	12822	150	1.01
	3/26/25	9:22:06	2	1.10	1.89	12850	150	1.01
	3/26/25	9:23:02	2	0.93	1.87	12929	150	1.01
	3/26/25	9:24:02	2	1.00	1.74	13020	150	1.01
	3/26/25	9:25:01	2	0.98	1.86	13058	150	1.01
	3/26/25	9:26:00	2	0.98	1.82	12960	150	1.01
	3/26/25	9:27:00	2	1.00	1.79	12846	150	1.01
	3/26/25	9:28:00	2	1.00	1.73	12759	150	1.01
	3/26/25	9:29:00	2	1.00	1.90	12688	150	1.01

RCTO 4 RCO FTIR Data

	Unitname RCTO4	Location RCO	Condition Compliance	CH4 Summary	H2O Summary	Temp(C) Summary	Press(atm) Summary
3/26/25	9:30:00	2	1.00	1.83	12474	150	1.01
3/26/25	9:31:01	2	1.02	1.75	12355	150	1.01
3/26/25	9:32:00	2	0.98	1.71	12486	150	1.01
3/26/25	9:33:00	2	1.00	1.81	12357	150	1.01
3/26/25	9:34:02	2	1.03	1.74	12349	150	1.01
3/26/25	9:35:03	2	1.02	1.82	12212	150	1.01
3/26/25	9:36:02	2	0.98	1.82	12232	150	1.01
3/26/25	9:37:00	2	0.97	1.87	12189	150	1.01
3/26/25	9:38:00	2	1.00	1.89	12599	150	1.01
3/26/25	9:39:00	2	1.00	1.80	13114	150	1.01
3/26/25	9:40:02	2	1.03	1.86	13086	150	1.01
3/26/25	9:41:00	2	0.97	1.72	12998	150	1.01
3/26/25	9:42:00	2	1.00	1.77	12977	150	1.01
3/26/25	9:43:00	2	1.00	1.76	12944	150	1.01
3/26/25	9:44:00	2	1.00	1.89	12849	150	1.01
3/26/25	9:45:00	2	1.00	1.80	12816	150	1.01
3/26/25	9:46:00	2	1.00	1.69	12836	150	1.01
3/26/25	9:47:00	2	1.00	1.72	12834	150	1.01
3/26/25	9:48:00	2	1.00	1.83	12746	150	1.01
3/26/25	9:49:00	2	1.00	1.70	12761	150	1.01
3/26/25	9:50:00	2	1.00	1.76	12698	150	1.01
3/26/25	9:51:00	2	1.00	1.80	12837	150	1.01
3/26/25	9:52:00	2	1.00	1.84	12814	150	1.01
3/26/25	9:53:02	2	1.03	1.76	12909	150	1.01
3/26/25	9:54:03	2	1.02	1.82	12944	150	1.01
3/26/25	9:55:00	2	0.95	1.78	12919	150	1.01
3/26/25	9:56:00	2	1.00	1.78	12951	150	1.01
3/26/25	9:57:00	2	1.00	1.72	12856	150	1.01
3/26/25	9:58:00	2	1.00	1.85	12778	150	1.01
3/26/25	9:59:00	2	1.00	1.95	12815	150	1.01
3/26/25	10:00:02	2	1.03	1.83	12751	150	1.01
3/26/25	10:01:00	2	0.97	1.88	12791	150	1.01
3/26/25	10:02:00	2	1.00	1.99	12732	150	1.01
3/26/25	10:03:02	2	1.03	1.68	12727	150	1.01
3/26/25	10:04:03	2	1.02	1.63	12705	150	1.01
3/26/25	10:05:00	2	0.95	1.75	12676	150	1.01
3/26/25	10:06:00	2	1.00	1.99	12701	150	1.01
3/26/25	10:07:03	2	1.05	1.95	12734	150	1.01
3/26/25	10:08:01	2	0.97	1.82	12828	150	1.01
3/26/25	10:09:01	2	1.00	1.75	12872	150	1.01
3/26/25	10:10:00	2	0.98	1.80	12934	150	1.01
3/26/25	10:11:00	2	1.00	1.86	12955	150	1.01
3/26/25	10:12:00	2	1.00	1.82	12932	150	1.01
3/26/25	10:13:00	2	1.00	1.81	12793	150	1.01
3/26/25	10:14:03	2	1.05	1.74	12774	150	1.01
3/26/25	10:15:01	2	0.97	1.83	12681	150	1.01
3/26/25	10:16:00	2	0.98	1.78	12725	150	1.01
3/26/25	10:17:00	2	1.00	1.84	12748	150	1.01
3/26/25	10:18:00	2	1.00	1.85	12710	150	1.01
3/26/25	10:19:00	2	1.00	1.84	12710	150	1.01
3/26/25	10:20:02	2	1.03	1.79	12812	150	1.01
3/26/25	10:21:00		0.97	1.70	11985	150	1.01
3/26/25	10:22:00		1.00	0.076	270	150	1.01
3/26/25	10:23:00		1.00	0.076	130	150	1.01
3/26/25	10:24:00		1.00	0.076	130	150	1.01
3/26/25	10:25:03		1.05	0.076	130	150	1.01
3/26/25	10:26:00		0.95	0.076	130	150	1.01
3/26/25	10:27:00		1.00	0.55	4177	150	1.01
3/26/25	10:28:01		1.02	1.58	12745	150	1.01
3/26/25	10:29:00		0.98	1.74	12743	150	1.01
3/26/25	10:30:00		1.00	1.79	12694	150	1.01
3/26/25	10:31:00	3	1.00	1.80	12723	150	1.01
3/26/25	10:32:00	3	1.00	1.84	12664	150	1.01
3/26/25	10:33:01	3	1.02	1.80	12689	150	1.01
3/26/25	10:34:00	3	0.98	1.88	12592	150	1.01
3/26/25	10:35:00	3	1.00	1.80	12676	150	1.01
3/26/25	10:36:03	3	1.05	1.89	12657	150	1.01
3/26/25	10:37:01	3	0.97	1.74	12859	150	1.01
3/26/25	10:38:00	3	0.98	1.72	12850	150	1.01
3/26/25	10:39:02	3	1.03	1.75	12916	150	1.01
3/26/25	10:40:00	3	0.97	1.80	13006	150	1.01
3/26/25	10:41:00	3	1.00	1.57	13065	150	1.01
3/26/25	10:42:05	3	1.08	1.78	12984	150	1.01
3/26/25	10:43:01	3	0.93	1.88	12921	150	1.01
3/26/25	10:44:00	3	0.98	1.73	12821	150	1.01
3/26/25	10:45:01	3	1.02	1.66	12752	150	1.01
3/26/25	10:46:03	3	1.03	1.91	12706	150	1.01
3/26/25	10:47:04	3	1.02	1.76	12619	150	1.01
3/26/25	10:48:03	3	0.98	1.88	12837	150	1.01
3/26/25	10:49:00	3	0.95	1.82	12940	150	1.01
3/26/25	10:50:03	3	1.05	1.74	13039	150	1.01
3/26/25	10:51:00	3	0.95	1.98	13009	150	1.01
3/26/25	10:52:00	3	1.00	1.81	13066	150	1.01
3/26/25	10:53:03	3	1.05	1.72	13087	150	1.01
3/26/25	10:54:00	3	0.95	1.79	13181	150	1.01
3/26/25	10:55:01	3	1.02	1.75	13161	150	1.01
3/26/25	10:56:00	3	0.98	1.76	13201	150	1.01
3/26/25	10:57:00	3	1.00	1.72	13049	150	1.01
3/26/25	10:58:00	3	1.00	1.87	13077	150	1.01
3/26/25	10:59:02	3	1.03	1.67	12981	150	1.01
3/26/25	11:00:00	3	0.97	1.66	12885	150	1.01
3/26/25	11:01:00	3	1.00	1.82	12878	150	1.01
3/26/25	11:02:01	3	1.02	1.81	12841	150	1.01
3/26/25	11:03:01	3	1.00	1.91	12790	150	1.01
3/26/25	11:04:00	3	0.98	1.74	12726	150	1.01
3/26/25	11:05:00	3	1.00	1.78	12733	150	1.01
3/26/25	11:06:00	3	1.00	1.91	12794	150	1.01
3/26/25	11:07:00	3	1.00	1.78	13072	150	1.01
3/26/25	11:08:00	3	1.00	1.70	13223	150	1.01
3/26/25	11:09:01	3	1.02	1.77	13283	150	1.01
3/26/25	11:10:00	3	0.98	1.78	13288	150	1.01
3/26/25	11:11:00	3	1.00	1.74	13260	150	1.01
3/26/25	11:12:02	3	1.03	1.77	13151	150	1.02
3/26/25	11:13:00	3	0.97	1.74	13213	150	1.02
3/26/25	11:14:00	3	1.00	1.72	13068	150	1.02
3/26/25	11:15:00	3	1.00	1.76	13131	150	1.02
3/26/25	11:16:00	3	1.00	1.72	13110	150	1.02
3/26/25	11:17:00	3	1.00	1.73	13186	150	1.02
3/26/25	11:18:00	3	1.00	1.89	13098	150	1.02
3/26/25	11:19:00	3	1.00	1.86	13162	150	1.02
3/26/25	11:20:00	3	1.00	1.81	13074	150	1.02
3/26/25	11:21:03	3	1.05	1.83	13078	150	1.02
3/26/25	11:22:00	3	0.95	1.96	13047	150	1.02
3/26/25	11:23:00	3	1.00	1.80	13125	150	1.02
3/26/25	11:24:00	3	1.00	1.74	13122	150	1.02
3/26/25	11:25:00	3	1.00	1.73	13249	150	1.02
3/26/25	11:26:00	3	1.00	1.94	13271	150	1.02
3/26/25	11:27:00	3	1.00	1.83	13175	150	1.02

RCTO 4 RCO FTIR Data

		Unitname RCTO4	Location RCO	Condition Compliance	CH4 Summary	H2O Summary	Temp(C) Summary	Press(atm) Summary
	3/26/25	11:28:00	3	1.00	1.85	13282	150	1.02
	3/26/25	11:29:00	3	1.00	1.63	13135	150	1.02
	3/26/25	11:30:00	3	1.00	1.76	13122	150	1.02
	3/26/25	11:31:00		1.00	1.12	7994	150	1.02
	3/26/25	11:32:01		1.02	0.076	130	150	1.02
	3/26/25	11:33:03		1.03	0.076	130	150	1.02
	3/26/25	11:34:00		0.95	0.076	130	150	1.02
	3/26/25	11:35:00		1.00	1.12	9020	150	1.02
	3/26/25	11:36:03		1.05	1.62	12946	150	1.02
	3/26/25	11:37:00		0.95	1.14	8278	150	1.02
	3/26/25	11:38:00		1.00	0.076	130	150	1.02
	3/26/25	11:39:01		1.02	0.076	130	150	1.02
	3/26/25	11:40:00		0.98	0.076	130	150	1.02
	3/26/25	11:41:03		1.05	2.28	13650	150	1.01
	3/26/25	11:42:01		0.97	20.7	130	150	1.02
	3/26/25	11:43:00		0.98	20.7	130	150	1.02
	3/26/25	11:44:01		1.02	20.5	130	150	1.02
	3/26/25	11:45:00		0.98	10.7	6878	150	1.02
	3/26/25	11:46:00		1.00	1.45	14900	150	1.03
	3/26/25	11:47:02		1.03	1.84	14844	150	1.03
	3/26/25	11:48:02		1.00	1.84	14803	150	1.03
	3/26/25	11:49:00		0.97	1.70	14720	150	1.03
	3/26/25	11:50:03		1.05	1.79	14600	150	1.01

RCTO 4 TO FTIR Data

	Unitname	Location	Condition	CH4 Summary	H2O Summary	Temp(C) Summary	Press(atm) Summary
	RCTO4	Outlet	Compliance				
Run Length 60.0 (min)	Run 1	Conc. (ppmv)	Minimum	0.94	51621	149	0.99
			Maximum	2.17	57420	150	0.99
			(BDL = 1/2MDL) Average	1.36	55025	150	0.99
			MDL	NA	NA	NA	NA
Test Length 60.0 (min)	Run 2	Conc. (ppmv)	Minimum	0.99	51602	149	0.99
			Maximum	2.10	56523	150	0.99
			(BDL = 1/2MDL) Average	1.55	54318	150	0.99
			MDL	NA	NA	NA	NA
Test Length 60.0 (min)	Run 3	Conc. (ppmv)	Minimum	0.087	38195	149	0.99
			Maximum	1.77	186108	150	0.99
			(BDL = 1/2MDL) Average	1.34	54272	150	0.99
			MDL	NA	NA	NA	NA

	Date	Time	Run	Scan Length	Conc. (ppm) BDL=1/2MDL	Conc. (ppm) BDL=1/2MDL	Conc. (ppm) BDL=1/2MDL	Conc. (ppm) BDL=1/2MDL
	3/26/25	7:51:00		1.00	0.087	12625	150	0.99
	3/26/25	7:52:00		1.00	0.087	54806	150	0.99
	3/26/25	7:53:01		1.02	0.51	37077	150	0.99
	3/26/25	7:54:00		0.98	0.087	1315	150	0.99
	3/26/25	7:55:02		1.03	0.087	16782	150	0.99
	3/26/25	7:56:01		0.98	0.48	55183	150	0.99
	3/26/25	7:57:03		1.03	1.10	57063	150	0.99
	3/26/25	7:58:00		0.95	0.51	30264	150	0.99
	3/26/25	7:59:00		1.00	0.087	1315	151	0.99
	3/26/25	8:00:01		1.02	0.087	1315	151	0.99
	3/26/25	8:01:00		0.98	0.087	55185	150	0.99
	3/26/25	8:02:00		1.00	1.73	50233	150	0.99
	3/26/25	8:03:01		1.02	19.8	1315	150	0.99
	3/26/25	8:04:00		0.98	20.0	1315	151	0.99
	3/26/25	8:05:03		1.05	20.1	1315	151	0.99
	3/26/25	8:06:00		0.95	4.61	37236	150	0.99
	3/26/25	8:07:03		1.05	0.92	54846	151	0.99
	3/26/25	8:08:00		0.95	1.06	57510	150	0.99
	3/26/25	8:09:06		1.10	1.19	56699	150	0.99
	3/26/25	8:10:00		0.90	1.04	55835	150	0.99
	3/26/25	8:11:00	1	1.00	0.94	55039	150	0.99
	3/26/25	8:12:00	1	1.00	1.18	56798	150	0.99
	3/26/25	8:13:00	1	1.00	1.03	56506	150	0.99
	3/26/25	8:14:05	1	1.08	1.11	55323	150	0.99
	3/26/25	8:15:00	1	0.92	1.11	55006	150	0.99
	3/26/25	8:16:00	1	1.00	1.18	56609	150	0.99
	3/26/25	8:17:00	1	1.00	0.98	55366	150	0.99
	3/26/25	8:18:01	1	1.02	1.05	54651	150	0.99
	3/26/25	8:19:02	1	1.02	0.96	53073	150	0.99
	3/26/25	8:20:03	1	1.02	1.09	52255	150	0.99
	3/26/25	8:21:00	1	0.95	1.16	53296	150	0.99
	3/26/25	8:22:00	1	1.00	1.24	55001	149	0.99
	3/26/25	8:23:00	1	1.00	1.07	56830	149	0.99
	3/26/25	8:24:00	1	1.00	1.40	57420	150	0.99
	3/26/25	8:25:01	1	1.02	1.09	56118	149	0.99
	3/26/25	8:26:02	1	1.02	1.11	54924	150	0.99
	3/26/25	8:27:00	1	0.97	1.19	56612	149	0.99
	3/26/25	8:28:00	1	1.00	1.23	56527	150	0.99
	3/26/25	8:29:01	1	1.02	1.10	55596	150	0.99
	3/26/25	8:30:00	1	0.98	1.17	55089	150	0.99
	3/26/25	8:31:00	1	1.00	1.50	56329	150	0.99
	3/26/25	8:32:02	1	1.03	1.30	55335	150	0.99
	3/26/25	8:33:00	1	0.97	1.18	54881	150	0.99
	3/26/25	8:34:02	1	1.03	1.12	53471	150	0.99
	3/26/25	8:35:02	1	1.00	1.31	52157	150	0.99
	3/26/25	8:36:00	1	0.97	1.26	52632	150	0.99
	3/26/25	8:37:00	1	1.00	1.43	55015	150	0.99
	3/26/25	8:38:00	1	1.00	1.24	56092	150	0.99
	3/26/25	8:39:00	1	1.00	1.56	57336	150	0.99
	3/26/25	8:40:03	1	1.05	1.30	55979	150	0.99
	3/26/25	8:41:00	1	0.95	1.23	55404	150	0.99
	3/26/25	8:42:00	1	1.00	1.28	55845	150	0.99
	3/26/25	8:43:00	1	1.00	1.54	56603	150	0.99
	3/26/25	8:44:06	1	1.10	1.23	55413	150	0.99
	3/26/25	8:45:00	1	0.90	1.41	54634	150	0.99
	3/26/25	8:46:00	1	1.00	1.34	56219	150	0.99
	3/26/25	8:47:00	1	1.00	1.44	55455	150	0.99
	3/26/25	8:48:00	1	1.00	1.16	54559	150	0.99
	3/26/25	8:49:02	1	1.03	1.24	53454	150	0.99
	3/26/25	8:50:00	1	0.97	1.27	52337	150	0.99
	3/26/25	8:51:03	1	1.05	1.22	52357	150	0.99
	3/26/25	8:52:00	1	0.95	1.76	54471	150	0.99
	3/26/25	8:53:00	1	1.00	1.35	55490	150	0.99
	3/26/25	8:54:00	1	1.00	1.74	57182	150	0.99
	3/26/25	8:55:01	1	1.02	1.50	56025	150	0.99
	3/26/25	8:56:00	1	0.98	1.49	55288	150	0.99
	3/26/25	8:57:03	1	1.05	1.46	55126	149	0.99
	3/26/25	8:58:00	1	0.95	1.91	56480	149	0.99
	3/26/25	8:59:02	1	1.03	1.50	55269	149	0.99
	3/26/25	9:00:03	1	1.02	1.77	54867	149	0.99
	3/26/25	9:01:01	1	0.97	1.65	55512	149	0.99
	3/26/25	9:02:00	1	0.98	1.80	55629	149	0.99
	3/26/25	9:03:00	1	1.00	1.70	53836	149	0.99
	3/26/25	9:04:00	1	1.00	1.67	53294	149	0.99
	3/26/25	9:05:03	1	1.05	1.52	52018	149	0.99
	3/26/25	9:06:00	1	0.95	1.51	51621	149	0.99
	3/26/25	9:07:03	1	1.05	2.17	53312	149	0.99
	3/26/25	9:08:01	1	0.97	1.48	54684	149	0.99
	3/26/25	9:09:00	1	0.98	1.96	56135	149	0.99
	3/26/25	9:10:00	1	1.00	1.62	55732	150	0.99
	3/26/25	9:11:00		1.00	1.70	34795	149	0.99
	3/26/25	9:12:03		1.05	0.087	1315	149	0.99
	3/26/25	9:13:00		0.95	0.087	1315	149	0.99
	3/26/25	9:14:00		1.00	0.087	1315	149	0.99
	3/26/25	9:15:00		1.00	0.087	1315	149	0.99
	3/26/25	9:16:00		1.00	0.087	1315	149	0.99
	3/26/25	9:17:03		1.05	0.087	14356	149	0.99
	3/26/25	9:18:01		0.97	0.46	53655	149	0.99
	3/26/25	9:19:01		1.00	1.30	53586	149	0.99
	3/26/25	9:20:02		1.02	1.36	51584	149	0.99
	3/26/25	9:21:00	2	0.97	1.34	51602	149	0.99
	3/26/25	9:22:00	2	1.00	1.36	53563	149	0.99
	3/26/25	9:23:00	2	1.00	1.50	54139	149	0.99
	3/26/25	9:24:00	2	1.00	1.50	56316	149	0.99
	3/26/25	9:25:03	2	1.05	1.51	56226	149	0.99
	3/26/25	9:26:00	2	0.95	1.55	54544	149	0.99
	3/26/25	9:27:01	2	1.02	1.38	54173	149	0.99
	3/26/25	9:28:02	2	1.02	1.59	55762	150	0.99
	3/26/25	9:29:02	2	1.00	1.41	55194	150	0.99

RCTO 4 TO FTIR Data

		Unitname RCTO4	Location Outlet	Condition Compliance	CH4 Summary	H2O Summary	Temp(C) Summary	Press(atm) Summary
	3/26/25	9:30:00	2	0.97	1.73	54253	150	0.99
	3/26/25	9:31:00	2	1.00	1.44	54810	150	0.99
	3/26/25	9:32:03	2	1.05	1.91	55279	150	0.99
	3/26/25	9:33:00	2	0.95	1.64	53980	150	0.99
	3/26/25	9:34:00	2	1.00	1.60	53687	150	0.99
	3/26/25	9:35:00	2	1.00	1.52	52163	150	0.99
	3/26/25	9:36:00	2	1.00	1.63	51780	150	0.99
	3/26/25	9:37:03	2	1.05	1.75	52536	150	0.99
	3/26/25	9:38:00	2	0.95	1.57	54590	150	0.99
	3/26/25	9:39:00	2	1.00	1.66	55689	150	0.99
	3/26/25	9:40:01	2	1.02	1.93	56100	150	0.99
	3/26/25	9:41:00	2	0.98	1.60	54682	150	0.99
	3/26/25	9:42:01	2	1.02	1.67	53814	150	0.99
	3/26/25	9:43:00	2	0.98	1.55	55573	150	0.99
	3/26/25	9:44:00	2	1.00	1.54	55584	150	0.99
	3/26/25	9:45:02	2	1.03	1.65	54292	150	0.99
	3/26/25	9:46:00	2	0.97	1.35	54321	150	0.99
	3/26/25	9:47:00	2	1.00	1.69	55448	150	0.99
	3/26/25	9:48:02	2	1.03	1.52	54281	150	0.99
	3/26/25	9:49:02	2	1.00	1.36	53856	150	0.99
	3/26/25	9:50:01	2	0.98	1.36	52418	150	0.99
	3/26/25	9:51:01	2	1.00	1.37	51654	150	0.99
	3/26/25	9:52:00	2	0.98	1.45	52046	150	0.99
	3/26/25	9:53:03	2	1.05	1.93	53885	149	0.99
	3/26/25	9:54:00	2	0.95	1.57	55170	150	0.99
	3/26/25	9:55:00	2	1.00	2.09	55952	150	0.99
	3/26/25	9:56:00	2	1.00	1.80	54792	150	0.99
	3/26/25	9:57:00	2	1.00	1.84	54040	150	0.99
	3/26/25	9:58:00	2	1.00	1.74	54811	150	0.99
	3/26/25	9:59:00	2	1.00	2.10	55425	150	0.99
	3/26/25	10:00:00	2	1.00	1.82	54340	150	0.99
	3/26/25	10:01:00	2	1.00	1.96	53953	150	0.99
	3/26/25	10:02:03	2	1.05	2.09	55194	150	0.99
	3/26/25	10:03:00	2	0.95	1.84	54825	150	0.99
	3/26/25	10:04:00	2	1.00	1.52	53779	150	0.99
	3/26/25	10:05:00	2	1.00	1.57	52715	150	0.99
	3/26/25	10:06:00	2	1.00	1.59	51609	150	0.99
	3/26/25	10:07:03	2	1.05	1.34	52135	150	0.99
	3/26/25	10:08:02	2	0.98	1.76	53959	150	0.99
	3/26/25	10:09:00	2	0.97	1.29	54751	150	0.99
	3/26/25	10:10:03	2	1.05	1.58	56523	150	0.99
	3/26/25	10:11:03	2	1.00	1.38	55171	150	0.99
	3/26/25	10:12:03	2	1.00	1.39	54481	150	0.99
	3/26/25	10:13:02	2	0.98	1.13	54827	150	0.99
	3/26/25	10:14:03	2	1.02	1.36	55993	150	0.99
	3/26/25	10:15:00	2	0.95	0.99	54616	150	0.99
	3/26/25	10:16:00	2	1.00	1.29	54144	150	0.99
	3/26/25	10:17:03	2	1.05	1.07	55177	150	0.99
	3/26/25	10:18:00	2	0.95	1.32	55240	150	0.99
	3/26/25	10:19:02	2	1.03	1.04	53991	150	0.99
	3/26/25	10:20:01	2	0.98	1.19	53217	150	0.99
	3/26/25	10:21:00		0.98	0.76	32819	150	0.99
	3/26/25	10:22:02		1.03	0.087	1315	150	0.99
	3/26/25	10:23:00		0.97	0.087	1315	150	0.99
	3/26/25	10:24:01		1.02	0.087	1315	150	0.99
	3/26/25	10:25:01		1.00	0.087	1315	150	0.99
	3/26/25	10:26:02		1.02	0.087	1315	150	0.99
	3/26/25	10:27:00		0.97	0.087	20483	150	0.99
	3/26/25	10:28:03		1.05	0.91	53795	150	0.99
	3/26/25	10:29:00		0.95	1.55	55855	150	0.99
	3/26/25	10:30:01		1.02	1.27	54808	150	0.99
	3/26/25	10:31:00	3	0.98	1.57	53753	150	0.99
	3/26/25	10:32:01	3	1.02	1.30	54497	150	0.99
	3/26/25	10:33:00	3	0.98	1.57	54996	150	0.99
	3/26/25	10:34:00	3	1.00	1.37	53402	150	0.99
	3/26/25	10:35:00	3	1.00	1.31	53275	150	0.99
	3/26/25	10:36:00	3	1.00	1.13	51965	150	0.99
	3/26/25	10:37:03	3	1.05	1.30	51453	150	0.99
	3/26/25	10:38:01	3	0.97	1.69	52824	150	0.99
	3/26/25	10:39:03	3	1.03	1.39	54168	150	0.99
	3/26/25	10:40:02	3	0.98	1.66	55812	150	0.99
	3/26/25	10:41:00	3	0.97	1.59	55468	150	0.99
	3/26/25	10:42:00	3	1.00	1.42	54170	150	0.99
	3/26/25	10:43:03	3	1.05	1.23	53569	150	0.99
	3/26/25	10:44:03	3	1.00	1.60	54126	150	0.99
	3/26/25	10:45:00	3	0.95	1.23	53082	150	0.99
	3/26/25	10:46:00	3	1.00	1.45	51626	150	0.99
	3/26/25	10:47:02	3	1.03	1.14	50055	150	0.99
	3/26/25	10:48:01	3	0.98	1.40	48648	150	0.99
	3/26/25	10:49:00	3	0.98	1.21	47491	150	0.99
	3/26/25	10:50:00	3	1.00	1.12	46421	150	0.99
	3/26/25	10:51:00	3	1.00	1.06	45570	150	0.99
	3/26/25	10:52:03	3	1.05	1.15	44682	150	0.99
	3/26/25	10:53:00	3	0.95	1.19	43630	150	0.99
	3/26/25	10:54:00	3	1.00	1.40	43014	150	0.99
	3/26/25	10:55:00	3	1.00	1.50	42372	150	0.99
	3/26/25	10:56:00	3	1.00	1.69	41718	150	0.99
	3/26/25	10:57:00	3	1.00	1.59	41033	150	0.99
	3/26/25	10:58:01	3	1.02	1.46	40397	150	0.99
	3/26/25	10:59:02	3	1.02	1.74	39862	150	0.99
	3/26/25	11:00:03	3	1.02	1.51	39402	150	0.99
	3/26/25	11:01:00	3	0.95	1.65	38931	150	0.99
	3/26/25	11:02:00	3	1.00	1.52	38577	150	0.99
	3/26/25	11:03:00	3	1.00	1.77	38195	150	0.99
	3/26/25	11:04:00	3	1.00	1.36	50095	150	0.99
	3/26/25	11:05:00	3	1.00	0.27	102008	150	0.99
	3/26/25	11:06:00	3	1.00	0.087	186108	150	0.99
	3/26/25	11:07:02	3	1.03	0.90	79122	150	0.99
	3/26/25	11:08:01	3	0.98	1.39	57299	150	0.99
	3/26/25	11:09:00	3	0.98	1.50	55871	149	0.99
	3/26/25	11:10:00	3	1.00	1.43	55230	149	0.99
	3/26/25	11:11:03	3	1.05	1.72	55993	149	0.99
	3/26/25	11:12:04	3	1.02	1.34	54669	149	0.99
	3/26/25	11:13:02	3	0.97	1.36	53999	149	0.99
	3/26/25	11:14:01	3	0.98	1.39	55038	150	0.99
	3/26/25	11:15:02	3	1.02	1.45	55288	149	0.99
	3/26/25	11:16:00	3	0.97	1.18	54454	149	0.99
	3/26/25	11:17:00	3	1.00	1.32	53570	149	0.99
	3/26/25	11:18:00	3	1.00	1.18	55277	150	0.99
	3/26/25	11:19:00	3	1.00	1.27	54207	150	0.99
	3/26/25	11:20:01	3	1.02	1.14	53299	149	0.99
	3/26/25	11:21:00	3	0.98	0.98	52786	149	0.99
	3/26/25	11:22:02	3	1.03	1.02	51433	149	0.99
	3/26/25	11:23:00	3	0.97	1.15	51304	149	0.99
	3/26/25	11:24:00	3	1.00	1.54	53501	149	0.99
	3/26/25	11:25:03	3	1.05	1.16	54541	150	0.99
	3/26/25	11:26:03	3	1.00	1.55	55720	150	0.99
	3/26/25	11:27:00	3	0.95	1.43	54286	150	0.99

RCTO 4 TO FTIR Data

		Unitname RCTO4	Location Outlet	Condition Compliance	CH4 Summary	H2O Summary	Temp(C) Summary	Press(atm) Summary
	3/26/25	11:28:00	3	1.00	1.39	54008	150	0.99
	3/26/25	11:29:00	3	1.00	1.38	53966	149	0.99
	3/26/25	11:30:01	3	1.02	1.76	55040	149	0.99
	3/26/25	11:31:02		1.02	0.55	21307	149	0.99
	3/26/25	11:32:00		0.97	0.087	1315	150	0.99
	3/26/25	11:33:00		1.00	0.087	1315	150	0.99
	3/26/25	11:34:00		1.00	0.087	1315	149	0.99
	3/26/25	11:35:00		1.00	1.37	14488	150	0.99
	3/26/25	11:36:04		1.07	1.96	13899	150	0.99
	3/26/25	11:37:00		0.93	0.97	6865	150	0.99
	3/26/25	11:38:01		1.02	0.087	1315	150	0.99
	3/26/25	11:39:00		0.98	0.087	1315	150	0.99
	3/26/25	11:40:00		1.00	0.28	1315	150	0.99
	3/26/25	11:41:00		1.00	4.33	11980	150	0.99
	3/26/25	11:42:01		1.02	20.0	1315	150	0.99
	3/26/25	11:43:00		0.98	20.0	1315	150	0.99
	3/26/25	11:44:02		1.03	20.0	1315	150	0.99
	3/26/25	11:45:00		0.97	7.75	8605	150	0.99
	3/26/25	11:46:00		1.00	1.97	13897	150	0.98
	3/26/25	11:47:01		1.02	1.78	21247	150	0.99
	3/26/25	11:48:01		1.00	2.11	13824	150	0.99
	3/26/25	11:49:00		0.98	1.94	14137	149	0.99
	3/26/25	11:50:00		1.00	1.73	21693	149	0.98

RCTO 4 THC Raw Data

# NuWave - analyzer file				
# LabJack Voltage Ranges:	10	10	10	
# Channels:	AIN0	AIN1	AIN2	
# Client / Site / Source:	Microchip	Gresham	RCTO4	
Timestamp	Inlet_CONC	RCO_CONC	TO_CONC	
3/26/25 7:34:12	0.89	0.10	0.05	
3/26/25 7:35:12	0.90	0.08	0.05	
3/26/25 7:36:12	0.84	0.07	0.05	
3/26/25 7:37:12	0.87	0.06	0.04	
3/26/25 7:38:12	0.83	0.06	0.04	
3/26/25 7:39:12	0.94	0.05	0.04	
3/26/25 7:40:12	0.97	0.03	0.03	
Calibration				
3/26/25 7:41:12	9.47	1.82	4.45	
3/26/25 7:42:12	11.92	9.98	10.21	
3/26/25 7:43:12	11.63	10.30	10.22	
3/26/25 7:44:12	22.92	6.50	6.82	
3/26/25 7:45:12	175.20	1.11	3.75	
Cal Error				
3/26/25 7:46:12	27.25	0.32	0.44	
3/26/25 7:47:12	0.76	0.07	0.03	
3/26/25 7:48:12	6.44	3.71	4.40	
3/26/25 7:49:12	16.32	10.11	10.22	
3/26/25 7:50:12	18.36	10.37	10.23	
3/26/25 7:51:12	120.33	4.28	5.79	
3/26/25 7:52:12	191.69	1.07	3.25	
3/26/25 7:53:12	91.80	5.58	5.95	
3/26/25 7:54:12	24.78	6.15	6.19	
3/26/25 7:55:12	94.55	2.34	3.92	
3/26/25 7:56:12	116.91	1.04	3.50	
3/26/25 7:57:12	117.02	0.98	4.16	
3/26/25 7:58:12	49.87	3.31	4.42	
3/26/25 7:59:12	18.10	3.46	3.61	
3/26/25 8:00:12	33.85	2.82	3.83	
3/26/25 8:01:12	70.93	1.03	3.80	
FTIR QAQC				
3/26/25 8:02:12	45.20	7.41	9.73	
3/26/25 8:03:12	19.83	20.09	19.97	
3/26/25 8:04:12	20.02	20.22	19.98	
3/26/25 8:05:12	19.38	19.31	18.79	
Sampling Stack Gas				
3/26/25 8:06:12	19.99	1.32	4.34	
3/26/25 8:07:12	20.07	1.05	3.59	
3/26/25 8:08:12	21.23	0.97	4.15	
3/26/25 8:09:12	22.72	0.96	3.84	
3/26/25 8:10:12	23.12	0.94	3.65	
Start Run 1				
3/26/25 8:11:12	26.43	0.94	3.41	1
3/26/25 8:12:12	22.49	0.94	4.14	1
3/26/25 8:13:12	23.26	0.94	3.48	1
3/26/25 8:14:12	24.38	0.94	3.98	1
3/26/25 8:15:12	23.76	0.94	3.83	1
3/26/25 8:16:12	20.00	0.96	4.05	1
3/26/25 8:17:12	19.76	0.92	3.36	1
3/26/25 8:18:12	21.27	0.92	3.57	1
3/26/25 8:19:12	21.90	0.92	3.42	1
3/26/25 8:20:12	22.44	0.92	3.61	1
3/26/25 8:21:12	21.28	0.92	4.08	1
3/26/25 8:22:12	21.49	0.93	3.67	1
3/26/25 8:23:12	23.20	0.94	3.90	1
3/26/25 8:24:12	29.47	0.96	4.00	1
3/26/25 8:25:12	32.71	0.97	3.57	1
3/26/25 8:26:12	34.65	0.98	3.43	1
3/26/25 8:27:12	34.74	1.00	4.10	1
3/26/25 8:28:12	35.07	1.01	3.65	1
3/26/25 8:29:12	32.31	1.01	3.64	1
3/26/25 8:30:12	31.72	1.00	3.56	1
3/26/25 8:31:12	29.76	0.99	4.21	1
3/26/25 8:32:12	27.65	0.98	3.63	1
3/26/25 8:33:12	25.69	0.98	3.39	1
3/26/25 8:34:12	23.66	0.96	3.46	1
3/26/25 8:35:12	23.59	0.96	3.68	1
3/26/25 8:36:12	22.66	0.94	3.86	1
3/26/25 8:37:12	22.74	0.95	3.65	1
3/26/25 8:38:12	22.63	0.95	3.81	1
3/26/25 8:39:12	23.54	0.94	4.12	1
3/26/25 8:40:12	31.18	0.95	3.86	1
3/26/25 8:41:12	32.72	0.96	3.48	1
3/26/25 8:42:12	34.26	0.98	4.31	1
3/26/25 8:43:12	32.17	0.98	4.01	1
3/26/25 8:44:12	30.22	1.01	3.96	1
3/26/25 8:45:12	31.36	0.99	4.18	1
3/26/25 8:46:12	31.10	0.99	4.43	1
3/26/25 8:47:12	35.42	0.99	4.16	1
3/26/25 8:48:12	35.50	0.98	3.99	1
3/26/25 8:49:12	34.55	0.98	3.81	1
3/26/25 8:50:12	34.64	0.98	3.96	1
3/26/25 8:51:12	36.37	0.98	3.98	1
3/26/25 8:52:12	38.66	0.98	4.66	1
3/26/25 8:53:12	52.76	1.00	4.00	1
3/26/25 8:54:12	56.13	1.02	4.97	1
3/26/25 8:55:12	53.56	1.03	4.11	1
3/26/25 8:56:12	51.27	1.04	3.94	1
3/26/25 8:57:12	46.01	1.02	4.55	1
3/26/25 8:58:12	40.90	1.01	4.29	1
3/26/25 8:59:12	38.84	1.00	3.91	1
3/26/25 9:00:12	37.73	0.99	3.75	1
3/26/25 9:01:12	34.85	0.96	4.11	1

RCTO 4 THC Raw Data

# NuWave - analyzer file				
# LabJack Voltage Ranges:	10	10	10	
# Channels:	AIN0	AIN1	AIN2	
# Client / Site / Source:	Microchip	Gresham	RCTO4	
Timestamp	Inlet_CONC	RCO_CONC	TO_CONC	
3/26/25 9:02:12	34.71	0.94	3.97	1
3/26/25 9:03:12	38.67	0.92	3.89	1
3/26/25 9:04:12	36.22	0.93	3.51	1
3/26/25 9:05:12	31.90	0.90	3.60	1
3/26/25 9:06:12	31.97	0.90	3.52	1
3/26/25 9:07:12	31.78	0.92	4.79	1
3/26/25 9:08:12	34.10	0.93	3.61	1
3/26/25 9:09:12	29.48	0.90	4.75	1
3/26/25 9:10:12	30.79	0.88	3.94	1
End Run 1	**31.57**	**0.96**	**3.90**	
3/26/25 9:11:12	19.99	0.78	2.28	
3/26/25 9:12:12	0.78	0.01	0.03	
3/26/25 9:13:12	0.80	-0.06	0.01	
3/26/25 9:14:12	18.09	2.10	2.65	
3/26/25 9:15:12	25.70	3.34	3.55	
3/26/25 9:16:12	25.22	3.51	3.55	
3/26/25 9:17:12	58.43	1.88	4.19	
3/26/25 9:18:12	75.88	1.07	3.92	
3/26/25 9:19:12	75.51	1.04	3.77	
3/26/25 9:20:12	39.63	1.01	4.00	
Start Run 2				
3/26/25 9:21:12	44.31	1.04	3.52	2
3/26/25 9:22:12	45.17	1.05	4.33	2
3/26/25 9:23:12	42.72	1.06	3.74	2
3/26/25 9:24:12	38.84	1.05	4.45	2
3/26/25 9:25:12	40.15	1.05	3.75	2
3/26/25 9:26:12	38.05	1.04	4.25	2
3/26/25 9:27:12	38.90	1.05	3.63	2
3/26/25 9:28:12	39.87	1.05	4.37	2
3/26/25 9:29:12	37.65	1.04	3.87	2
3/26/25 9:30:12	33.64	1.05	4.36	2
3/26/25 9:31:12	30.94	1.03	3.87	2
3/26/25 9:32:12	30.84	1.02	4.48	2
3/26/25 9:33:12	33.72	1.02	3.80	2
3/26/25 9:34:12	35.20	1.04	3.81	2
3/26/25 9:35:12	32.88	1.04	3.80	2
3/26/25 9:36:12	30.17	1.03	3.81	2
3/26/25 9:37:12	29.37	1.04	4.49	2
3/26/25 9:38:12	29.18	1.04	3.68	2
3/26/25 9:39:12	28.56	1.01	4.81	2
3/26/25 9:40:12	26.76	1.00	4.33	2
3/26/25 9:41:12	30.44	1.00	4.30	2
3/26/25 9:42:12	29.33	1.00	3.77	2
3/26/25 9:43:12	33.39	1.00	4.53	2
3/26/25 9:44:12	32.84	1.00	3.75	2
3/26/25 9:45:12	35.93	1.02	4.54	2
3/26/25 9:46:12	35.02	1.01	3.65	2
3/26/25 9:47:12	35.04	1.01	4.51	2
3/26/25 9:48:12	35.59	1.00	3.75	2
3/26/25 9:49:12	39.46	1.00	3.69	2
3/26/25 9:50:12	50.96	1.02	3.58	2
3/26/25 9:51:12	47.24	1.03	3.64	2
3/26/25 9:52:12	44.50	1.02	4.23	2
3/26/25 9:53:12	44.41	1.05	4.17	2
3/26/25 9:54:12	44.55	1.04	4.44	2
3/26/25 9:55:12	42.13	1.04	4.74	2
3/26/25 9:56:12	39.72	1.03	4.32	2
3/26/25 9:57:12	43.38	1.02	3.97	2
3/26/25 9:58:12	42.66	1.03	4.62	2
3/26/25 9:59:12	44.08	1.04	4.39	2
3/26/25 10:00:12	40.31	1.04	4.41	2
3/26/25 10:01:12	40.92	1.03	4.25	2
3/26/25 10:02:12	38.84	1.02	4.75	2
3/26/25 10:03:12	34.38	1.01	3.99	2
3/26/25 10:04:12	32.65	1.00	3.80	2
3/26/25 10:05:12	30.40	0.99	3.71	2
3/26/25 10:06:12	28.81	0.98	3.86	2
3/26/25 10:07:12	28.79	1.00	3.46	2
3/26/25 10:08:12	28.85	0.99	4.15	2
3/26/25 10:09:12	28.07	0.98	3.60	2
3/26/25 10:10:12	23.26	0.98	4.09	2
3/26/25 10:11:12	20.82	0.97	3.76	2
3/26/25 10:12:12	24.90	0.96	3.33	2
3/26/25 10:13:12	33.40	0.99	3.83	2
3/26/25 10:14:12	35.78	1.00	3.62	2
3/26/25 10:15:12	41.45	1.01	3.45	2
3/26/25 10:16:12	45.78	1.04	3.45	2
3/26/25 10:17:12	38.71	1.01	3.71	2
3/26/25 10:18:12	35.23	1.01	3.71	2
3/26/25 10:19:12	33.97	1.03	3.49	2
3/26/25 10:20:12	31.38	1.03	3.47	2
End Run 2	**35.91**	**1.02**	**3.99**	
3/26/25 10:21:12	16.51	0.72	1.57	
3/26/25 10:22:12	0.70	0.17	0.03	
3/26/25 10:23:12	0.69	0.12	0.01	
3/26/25 10:24:12	25.32	2.58	2.97	
3/26/25 10:25:12	34.68	3.43	3.54	
3/26/25 10:26:12	35.03	3.54	3.54	
3/26/25 10:27:12	67.72	1.57	3.75	
3/26/25 10:28:12	76.89	1.08	3.80	
3/26/25 10:29:12	49.46	1.07	4.03	

RCTO 4 THC Raw Data

# NuWave - analyzer file				
# LabJack Voltage Ranges:	10	10	10	
# Channels:	AIN0	AIN1	AIN2	
# Client / Site / Source:	Microchip	Gresham	RCTO4	
Timestamp	Inlet_CONC	RCO_CONC	TO_CONC	
3/26/25 10:30:12	36.88	1.06	3.58	
Start Run 3				
3/26/25 10:31:12	35.42	1.08	3.89	3
3/26/25 10:32:12	37.07	1.07	3.55	3
3/26/25 10:33:12	32.38	1.07	4.06	3
3/26/25 10:34:12	28.61	1.05	3.62	3
3/26/25 10:35:12	30.09	1.06	3.42	3
3/26/25 10:36:12	33.37	1.06	3.25	3
3/26/25 10:37:12	33.42	1.07	3.50	3
3/26/25 10:38:12	28.43	1.07	4.69	3
3/26/25 10:39:12	27.38	1.06	3.54	3
3/26/25 10:40:12	26.60	1.07	4.61	3
3/26/25 10:41:12	26.77	1.06	3.91	3
3/26/25 10:42:12	26.75	1.07	3.82	3
3/26/25 10:43:12	28.62	1.06	3.57	3
3/26/25 10:44:12	32.35	1.07	4.12	3
3/26/25 10:45:12	32.66	1.09	3.31	3
3/26/25 10:46:12	31.67	1.09	3.76	3
3/26/25 10:47:12	30.44	1.09	3.23	3
3/26/25 10:48:12	30.33	1.09	3.74	3
3/26/25 10:49:12	32.43	1.08	3.06	3
3/26/25 10:50:12	34.30	1.11	2.91	3
3/26/25 10:51:12	32.67	1.11	2.97	3
3/26/25 10:52:12	32.08	1.11	2.85	3
3/26/25 10:53:12	31.97	1.10	3.10	3
3/26/25 10:54:12	31.15	1.11	3.06	3
3/26/25 10:55:12	32.75	1.10	3.47	3
3/26/25 10:56:12	30.89	1.10	3.31	3
3/26/25 10:57:12	30.81	1.10	3.24	3
3/26/25 10:58:12	29.27	1.09	2.90	3
3/26/25 10:59:12	26.18	1.09	3.74	3
3/26/25 11:00:12	29.90	1.08	2.92	3
3/26/25 11:01:12	31.69	1.09	3.58	3
3/26/25 11:02:12	28.35	1.05	2.95	3
3/26/25 11:03:12	29.00	1.08	3.72	3
3/26/25 11:04:12	27.14	1.08	3.51	3
3/26/25 11:05:12	24.57	1.06	3.19	3
3/26/25 11:06:12	21.87	1.06	4.15	3
3/26/25 11:07:12	18.14	1.05	4.89	3
3/26/25 11:08:12	17.42	1.04	4.97	3
3/26/25 11:09:12	17.29	1.06	4.58	3
3/26/25 11:10:12	20.99	1.04	5.16	3
3/26/25 11:11:12	21.32	1.02	5.00	3
3/26/25 11:12:12	25.40	1.05	4.52	3
3/26/25 11:13:12	23.94	1.06	4.25	3
3/26/25 11:14:12	24.81	1.07	4.75	3
3/26/25 11:15:12	23.31	1.07	4.34	3
3/26/25 11:16:12	22.69	1.07	4.12	3
3/26/25 11:17:12	24.50	1.07	4.08	3
3/26/25 11:18:12	29.46	1.07	3.87	3
3/26/25 11:19:12	30.91	1.09	3.93	3
3/26/25 11:20:12	32.06	1.09	3.51	3
3/26/25 11:21:12	31.94	1.09	3.09	3
3/26/25 11:22:12	33.16	1.09	3.29	3
3/26/25 11:23:12	37.93	1.10	3.66	3
3/26/25 11:24:12	40.41	1.13	3.93	3
3/26/25 11:25:12	39.72	1.12	3.41	3
3/26/25 11:26:12	37.73	1.13	4.17	3
3/26/25 11:27:12	32.84	1.10	3.70	3
3/26/25 11:28:12	32.87	1.10	3.47	3
3/26/25 11:29:12	34.29	1.10	4.04	3
3/26/25 11:30:12	34.02	1.11	4.02	3
End Run 3	**29.61**	**1.08**	**3.75**	
3/26/25 11:31:12	11.21	0.55	0.77	
3/26/25 11:32:12	1.06	0.20	0.04	
3/26/25 11:33:12	0.80	0.17	0.03	
3/26/25 11:34:12	0.96	0.25	0.37	
3/26/25 11:35:12	69.89	0.89	0.92	
3/26/25 11:36:12	74.19	1.01	0.87	
3/26/25 11:37:12	19.14	2.93	2.99	
3/26/25 11:38:12	3.40	3.54	3.55	
3/26/25 11:39:12	1.85	3.60	3.56	
3/26/25 11:40:12	1.82	2.34	2.24	
FTIR QAQC				
3/26/25 11:41:12	10.69	10.64	10.31	
3/26/25 11:42:12	20.99	20.23	19.73	
3/26/25 11:43:12	20.97	20.34	19.74	
3/26/25 11:44:12	20.87	20.22	19.64	
3/26/25 11:45:12	2.62	1.55	1.24	
3/26/25 11:46:12	1.74	0.93	0.88	
3/26/25 11:47:12	1.74	0.85	1.46	
3/26/25 11:48:12	1.90	0.80	0.86	
3/26/25 11:49:12	1.87	0.79	0.84	
3/26/25 11:50:12	1.66	0.77	1.09	
3/26/25 11:51:12	1.86	0.76	1.30	
3/26/25 11:52:12	1.79	0.76	1.26	

Appendix D

Permit to Operate

State of Oregon
Department of
Environmental
Quality

STANDARD
AIR CONTAMINANT DISCHARGE PERMIT

Department of Environmental Quality
Northwest Region
700 NE Multnomah St., Suite 600
Portland, OR 97232

This permit is being issued in accordance with the provisions of ORS 468A.040 and based on the land use compatibility findings included in the permit record.

ISSUED TO:

Microchip Technology Incorporated
Gresham Fab 4
21015 SE Stark Street
Gresham, OR 97030

PLANT SITE LOCATION:

21015 SE Stark Street
Gresham, OR 97030

INFORMATION RELIED UPON:

Application No.: 029474
Date Received: 12/22/2017

LAND USE COMPATIBILITY FINDING:

Approving Authority: City of Gresham
Approval Date: 06/29/1995

ISSUED BY THE DEPARTMENT OF ENVIRONMENTAL QUALITY

Matt Hoffman, Northwest Region Air Quality Manager

6/21/2019
Dated

Sources Permitted to Discharge Air Contaminants (OAR 340-216-8010):

Table 1 Code	Source Description	SIC (NAICS)
Part B, 85	Sources which would have actual emissions, if they source were to operate uncontrolled, of 10 or more tons of any single criteria pollutant. Semiconductor manufacturing.	3674 (334413)
Part B, 13	Boilers over 10 mmBtu/hr heat input with oil back-up, or NG fired over 30 mmBtu/hr heat input with or without oil back-up (for database tracking purposes only, not a separate emission unit)	4961 (221330)

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1.0 GENERAL EMISSION STANDARDS AND LIMITS

1.1. Visible Emissions

The permittee must comply with the following visible emission limits from air contaminant sources other than fugitive emission sources, as applicable.

a. Emissions from any air contaminant source must not equal or exceed 20% opacity.

b. Opacity must be measured as a six-minute block average using EPA Method 9, a continuous opacity monitoring system (COMS) installed and operated in accordance with the DEQ Continuous Monitoring Manual or 40 CFR part 60, or an alternative monitoring method approved by DEQ that is equivalent to EPA Method 9.

1.2. Particulate Matter Emissions

The permittee must comply with the following particulate matter emission limits, as applicable:

a. Particulate matter emissions from any fuel burning equipment installed on or after April 16, 2015 must not exceed 0.10 grains per dry standard cubic foot, corrected to 12% CO_2 or 50% excess air.

b. Particulate matter emissions from any fuel burning equipment installed, constructed, or modified before April 16, 2015 must not exceed 0.14 grains per dry standard cubic foot, corrected to 12% CO_2 or 50% excess air.

c. Particulate matter emissions from any air contaminant source installed, constructed, or modified before April 16, 2015 other than fuel burning equipment and fugitive emission sources must not exceed 0.14 grains per dry standard cubic foot.

d. Particulate matter emissions from any air contaminant source installed, constructed, or modified on or after April 16, 2015 other than fuel burning equipment and fugitive emission sources must not exceed 0.10 grains per dry standard cubic foot.

1.3. Fugitive Emissions

The permittee must take reasonable precautions to prevent fugitive dust emissions, as measured by EPA method 22, by:

a. Using, where possible, water or chemicals for control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads or the clearing of land;

b. Applying water or other suitable chemicals on unpaved roads, materials stockpiles, and other surfaces which can create airborne dusts;

c. Enclosing (full or partial) materials stockpiles in cases where application of water or other suitable chemicals are not sufficient to prevent particulate matter from becoming airborne;

d. Installing and using hoods, fans, and fabric filters to enclose and vent the handling of dusty materials;
e. Installing adequate containment during sandblasting or other similar operations;
f. Covering, at all times when in motion, open bodied trucks transporting materials likely to become airborne;
g. Promptly removing earth or other material that does or may become airborne from paved streets; and
h. Developing a DEQ approved fugitive emission control plan upon request by DEQ if the above precautions are not adequate and implementing the plan whenever fugitive emissions leave the property for more than 18 seconds in a six-minute period.

1.4. Particulate Matter Fallout

The permittee must not cause or permit the deposition of any particulate matter larger than 250 microns in size at sufficient duration or quantity, as to create an observable deposition upon the real property of another person.

1.5. Nuisance and Odors

The permittee must not cause or allow air contaminants from any source to cause a nuisance. Nuisance conditions will be verified by DEQ personnel.

1.6. Fuels and Fuel Sulfur Content

The permittee must not use any fuel other than natural gas, propane, butane, ASTM grade 1 or 2 fuel oils, or a DEQ approved equivalent (e.g. biodiesel). Fuel oils must not contain more than:

a. 0.3% sulfur by weight for ASTM Grade 1 distillate oil; or
b. 0.5% sulfur by weight for ASTM Grade 2 distillate oil.

1.7. Emergency Stationary RICE

The permittee must comply with the following requirements for emergency stationary reciprocating internal combustion engines (RICE): [40 CFR 63.6640(f)]

For each emergency stationary RICE, the permittee must:

a. Change oil and filter every 500 hours of operation or annually, whichever comes first; [40 CFR 63. 6603(a), table 2d(4)(a)]
b. Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first; [40 CFR 63. 6603(a), table 2d(4)(b)]
c. Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary; [40 CFR 63. 6603(a), table 2d(4)(c)]
d. During periods of startup, minimize the engine's time spent at idle and minimize the engine's startup time at startup to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes, after which time the non-startup emission limitations apply; and [40 CFR 63. 6603(a), table 2d]
e. The permittee must install a non-resettable hour meter on each emergency stationary RICE, if one is not already installed. [40 CFR 63.6625(f)]

1.8. Operating Conditions for Emergency Stationary RICE

The permittee must operate any emergency stationary RICE in compliance with the following conditions: [40 CFR 63.6640(f)]

a. There is no time limit on the use of emergency stationary RICE in emergency situations.

b. Emergency stationary RICE may be operated for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by the manufacturer, the vendor, or the insurance company associated with the engine. Required maintenance and testing of such units is limited to 50 hours per year.

c. The permittee is prohibited from using its emergency stationary RICE for any non-emergency use including but not limited to peak shaving, demand response operation, and/or generation of income from the sale of power. To perform such activity the permittee must first obtain a modified permit in accordance with Condition 13.2 or a separate permit for power generation that appropriately addresses and allows this activity.

1.9. Operating Conditions for Emergency Stationary RICE

The permittee must keep records of the hours of operation of each emergency stationary RICE that is recorded through the non-resettable hour meter. The permittee must document how many hours are spent for emergency operation, including what classified the operation as emergency and how many hours are spent for non-emergency operation used for maintenance checks and readiness testing. [40 CFR 63.6655(f)]

2.0 NEW SOURCE PERFORMANCE STANDARDS (NSPS)

2.1. Boilers

The permittee must comply with 40 CFR 60 Subpart Dc, Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units, 10 – 100 million Btu per hour heat input, including:

a. Notifications - Date of construction, anticipated startup, and actual startup of each new boiler, subsequent to the effective date of this permit.

b. Recordkeeping - Monthly natural gas combusted per boiler, unless an alternative boiler monitoring schedule is approved by the EPA Administrator.

3.0 TYPICALLY ACHIEVABLE CONTROL TECHNOLOGY (TACT)

3.1. VOC Emissions

The permittee must control Volatile Organic Compound (VOC) emissions from Building 1 and Building 2 manufacturing operations with a concentrator thermal oxidizer that must achieve a minimum 90% destruction removal efficiency (DRE) of VOCs entering the concentrator thermal oxidizer (CTO).

3.2. Acid Gas Emissions

The permittee must control acid gases from Building 1 and Building 2 manufacturing operations with wet scrubber systems that achieves a minimum 90% DRE. As an alternative, the permittee may meet a facility-wide volumetric flow-weighted average emission concentration of 1 part per million by volume (ppmv) of HF and 1 ppmv of HCl, using results of a performance source test.

4.0 OPERATION AND MAINTENANCE REQUIREMENTS

4.1. O&M plan

The permittee must establish and maintain an O & M plan that addresses both short and long-term activities to ensure that all air pollution control devices are operating as efficient as possible at all times.

5.0 PLANT SITE EMISSION LIMITS

5.1. Plant Site Emission Limits (PSEL)

The permittee must not cause or allow plant site emissions to exceed the following:

Pollutant	Limit	Units
PM	24	tons per year
PM_{10}	14	tons per year
$PM_{2.5}$	9	tons per year
SO_2	39	tons per year
NO_X	39	tons per year
CO	99	tons per year
VOC	39	tons per year
GHGs (CO2e)	181,000	tons per year
Single HAP	9	tons per year
Combined HAPs	24	tons per year
Fluorides	2.9	tons per year

All PM is assumed to be PM10 and all PM10 is assumed to be PM2.5. Fluorides are calculated using the site specific fluorides emission factor based on 2015 emission testing results (see review report). HAP PSELs are included because uncontrolled PTE is greater than the major source threshold.

5.2. Annual Period

The annual plant site emissions limits apply to any 12-consecutive calendar month period.

6.0 COMPLIANCE DEMONSTRATION AND SOURCE TESTING

6.1. Testing Requirements

The permittee must conduct a source test of the control devices as specified below:

a. Once during this permit cycle the permittee must perform a performance test of each wet scrubber system to determine the HF and HCl destruction removal efficiency (DRE).

b. Once during this permit cycle the permittee must perform a performance test of the CTO to determine the VOC DRE.

c. Stack exhaust gas during each source test must be sampled while the facility is operating within 90% its normal operating capacity at the time of the test.

d. Exhaust gas concentrations must be sampled before and after each wet scrubber system and the CTO to demonstrate the system's DRE. The source test report must include the DRE demonstrated during each test run as well as the average DRE for the three test runs.

e. During each source test the following parameters must be monitored and recorded:

   i. Combustion temperature of the CTO; and

   ii. Recirculation flow rate and pH of the wet scrubbers.

   iii. Other facility/process operating parameters identified prior to the test.

f. Only regular operating staff may adjust the combustion system or production processes and emission control parameters during the source test and within two hours prior to the tests. Any operating adjustments made during the source test, which are a result of consultation during the tests with source testing personnel, equipment vendors or consultants, may render the source test invalid.

g. A pretest plan for each source test required above must be submitted for approval to DEQ's Source Test Coordinator at the ODEQ Northwest Regional Office, at least 15 days prior to testing.

h. The reference test methods identified in the table below must be utilized in the source tests identified above. A test method modification/variance or substitution of an alternative test method must be pre-approved by the DEQ's Source Test Coordinator.

i. All tests must be conducted in accordance with the DEQ's Source Sampling Manual and with the pretest plan. All test data and results must be submitted to the Source Test Coordinator for review within 45 days after completion of the testing cycle unless an alternate submission date or extension is approved by DEQ.

Reference Test Method	Tested pollutant/parameter	
EPA 1&2	Flow Rate	
EPA 3	Dry Molecular Weight	
EPA 4 or ODEQ Method	Moisture	
EPA 25A	Total VOC	
EPA 26, 26A or 320	Acid Gases	

7.0 PSEL COMPLIANCE DEMONSTRATION

7.1. Boiler Emissions

On a monthly basis, the permittee must calculate $PM_{2.5}$, SO_2, CO, NO_x, and VOC using the formula below:

$$\mathbf{E = EF_{NG\text{-}1} \times NG\text{-}1 + EF_{OIL\text{-}1} \times OIL\text{-}1 + EF_{NG\text{-}2} \times NG\text{-}2 + EF_{OIL\text{-}2} \times OIL\text{-}2}$$

Where:

E = Emissions, pounds per month

$EF_{NG\text{-}1}$ and $EF_{OIL\text{-}1}$ and $EF_{NG\text{-}2}$ and $EF_{OIL\text{-}2}$ = see Condition 0

NG-1 and NG-2 = Amount of natural gas combusted in Bldg 1 and Bldg 2

OIL-1 and OIL-2 = Amount of fuel oil combusted in Bldg 1 and Bldg 2

7.2. Generator Emissions

On a monthly basis, the permittee must calculate $PM_{2.5}$, SO_2, CO, NOx, and VOC using the formula below:

$$\mathbf{E = EF_G \times G}$$

Where:

E = Emissions, pounds per month

EF_G = see Condition 0

G = Number of hours of operation per month

7.3. CTO Emissions

On a monthly basis, the permittee must calculate $PM_{2.5}$, SO_2, CO, NO_x and VOC resulting from natural gas combustion in the CTO using the formula below:

$$\mathbf{E = EF_{NG} \times NG}$$

Where:

E = Emissions, pounds per month

EF_{NG} = see Condition 0

NG = Amount of natural gas combusted in the CTO

7.4. VOC Fab Emissions

On a monthly basis, the permittee must calculate VOC emissions from the Building 1 and Building 2 manufacturing processes as described below.

a. VOC emissions are determined as follows:

$$\mathbf{E = \sum [Q \times EF \times (1\text{-}DRE)]}$$

Where:

E = Emissions, pounds per month

$\sum$ = Summation of VOC contributions (pounds of emissions) of each VOC-containing material

Q = Amount of VOC-containing material used, pounds per month

Material used = Amount of material issued minus the amount transferred off-site or disposed of as waste

EF = Emission factor for VOCs, pounds VOC emitted per pound of material used

DRE = (see 7.7.b.)

b. VOC emissions will be calculated by assuming that the CTO DRE is 90%, unless demonstrated otherwise through DEQ-approved stack testing results.

c. Fugitive emissions that do not pass through the CTO have a DRE equal to zero.

d. The representative VOC content of waste must be measured by EPA Method 8015M GC/FID or other method approved by DEQ.

7.5. VOC Emission Factors

The permittee must use the VOC EFs in the permit application for calculating emissions. If the permittee uses a different VOC-containing material, which current equipment is capable of accommodating, the emission factor must be adjusted in direct proportion to the ratio of VOC content. Any changes in emissions factors must follow Condition 8.3.

7.6. Acid Gas Fab Emissions

On a monthly basis, the permittee must calculate HCl and HF emissions from the Building 1 and Building 2 manufacturing processes as described below.

a. HCl emissions are determined as follows:

$$\mathbf{E_{HCl} = \sum [Q_{HCl} \times EF_{HCl}]}$$

Where:

E_{HCl} = Emissions, pounds per month

$\sum$ = Summation of HCl contributions (pounds of emissions) of each HCl-containing material and each HCl-precursor material

Q_{HCl} = Amount of HCl-containing and HCl-precursor material used, pound per month

Material used = Amount of material issued minus the amount transferred off-site or disposed of as waste

EF_{HCl} = Emission factor, pounds HCl emitted per pound of HCl-containing and HCl-precursor material used per month

b. HF emissions are determined as follows:

$$E_{HF} = \sum [Q_{HF} \times EF_{HF}]$$

Where:

E_{HF} = Emissions, pounds per month

$\sum$ = Summation of HF contributions (pounds of emissions) of each HF-containing material and each HF-precursor material

Q_{HF} = Amount of HF-containing and HF-precursor material used, pounds per month

Material used = Amount of material issued minus the amount transferred off-site or disposed of as waste

EF_{HF} = Emission factor, pounds HF emitted per pound of HF-containing and HF-precursor material used per month

7.7. Acid Gas Emission Factors The permittee must use the HCl and HF EFs in the permit application for calculating emissions. If the permittee uses a different HCL or HF- containing material, which current equipment is capable of accommodating, the emission factor must be adjusted in direct proportion to the ratio of HCl or HF content. Any changes in emission factors must follow Condition 8.3.

7.8. Alternate Methods Alternate methods may be used for emissions calculations if demonstrated by the permittee to be equivalent to or more accurate than the above methods. An alternate method must be reviewed and approved by DEQ prior to use.

7.9. GHG emissions On a monthly basis the permittee must determine compliance with the GHG PSEL in accordance with OAR 340 division 215 and the calculation protocols in 40 CFR Part 98 Subparts A, C and I. Point of use (POU) abatement devices are used primarily for safety and facilities protection purposes; a portion of the facility's POU abatement devices may be used for GHG abatement provided they meet the conditions below. POU abatement device GHG destruction or removal efficiency (DRE) may be used to calculate actual greenhouse gas emissions once a site maintenance plan is submitted to Oregon DEQ. Installation, maintenance and operation of POU abatement devices claiming a GHG DRE must follow a site maintenance plan that meets the requirements of 40 CFR Part 98 Subpart I made effective January 1, 2014. If the site maintenance plan is modified, the permittee must submit a copy to Oregon DEQ. (Note: the GHG PSEL is in tons/year and not metric-tons/year). GHGs are defined in OAR 340-200-0020 for PSEL compliance, and in OAR 340-215-0020 for GHG reporting purposes.

7.10. Fluorides emissions

On a monthly basis the permittee must determine compliance with the fluorides PSEL by calculating fluorides emissions using fluorides specific emission factors from source testing conducted in June 2015 as detailed in the review report of this permit renewal. Condition 0 includes a ratio to HF emissions that may be used for this calculation.

8.0 SPECIAL CONDITIONS

8.1. Installation of Additional Control Devices

The permittee must notify DEQ in writing of the date any additional VOC or acid gas control device begins treating process exhaust, within seven (7) days.

8.2. Emission factor adjustments

In the event the permittee exchanges the use of a material for a similar material, which the existing equipment is capable of accommodating and which has higher or lower emission potential (VOC, HCl, HF, GHG), the permittee must adjust the associated emission factor using the ratio of the content of the new material to the content of the material used to establish the original emission factor. The permittee must include a summary of these changes in the annual report.

8.3. Change of Emission Factors

Except as allowed in Condition 8.2, the permittee must notify DEQ in writing of a change in the recipe of chemicals that changes the emission factors. This notification must include an analysis of how the changes in the emission factors affect plant site emissions relative to the PSEL.

9.0 MONITORING CONDITIONS

9.1. Continuous Monitoring

The permittee must monitor and maintain the following records related to the operation of control devices continuously during all hours of operation:

a. CTO combustion chamber temperature; and

b. Wet scrubber recirculation flow rate and pH.

c. The permittee is presumed to be in compliance with the 20% visible emissions standard and the 0.10 gr/dscf particulate emissions standard as long as the boilers burn natural gas.

9.2. Fuel Monitoring

The permittee must record and maintain records of the amounts of each fuel combusted monthly for each boiler that is an affected facility under 40 CFR 60 Subpart Dc, unless an alternate monitoring schedule is approved by the EPA Administrator.

9.3. Monthly Monitoring

The permittee must monitor and maintain the following records related to the operation and maintenance of the facility and associated air contaminant control devices monthly:

a. The amount and type of fuel combusted in the Building 1 boilers (combined) and the Building 2 boilers (individual, unless combining is approved by EPA).

b. The hours of non-emergency generator operation (combined).

c. The amount of natural gas combusted in the CTO.

d. The quantity of VOC, HCl- and HF-containing, and HCl- or HF-precursor, fluoride-containing, GHG-containing, or GHG-precursor material issued.

e. The quantity of VOC, HCl- and HF-containing, and HCl- or HF-precursor, fluoride-containing, GHG-containing, or GHG-precursor raw material shipped off-site or disposed of as waste.

f. Any change in emission factors of VOC, HCl, HF, fluorides, or GHG.

10.0 RECORDKEEPING REQUIREMENTS

10.1. Excess Emissions

The permittee must maintain records of excess emissions as defined in OAR 340-214-0300 through 340-214-0340 (recorded on occurrence). Typically, excess emissions are caused by process upsets, startups, shutdowns, or scheduled maintenance. In many cases, excess emissions are evident when visible emissions are greater than 20% opacity as a six-minute block average. If there is an ongoing excess emission caused by an upset or breakdown, the permittee must cease operation of the equipment or facility no later than 48 hours after the beginning of the excess emissions, unless continued operation is approved by DEQ in accordance with OAR 340-214-0330(4).

10.2. Complaint Log

The permittee must maintain a log of all written complaints and complaints received via telephone that specifically refer to air pollution concerns associated to the permitted facility. The log must include a record of the permittee's actions to investigate the validity of each complaint and a record of actions taken for complaint resolution.

10.3. Maintenance Log

The permittee must maintain records of major maintenance performed on air pollution control equipment as described in Section 4. See also O & M Plan on file for logs of routine maintenance.

10.4. Retention of Records Unless otherwise specified, the permittee must retain all records for a period of at least five (5) years from the date of the monitoring sample, measurement, report, or application and make them available to DEQ upon request. The permittee must maintain the two (2) most recent years of records onsite.

11.0 REPORTING REQUIREMENTS

11.1. Excess Emissions The permittee must notify DEQ of excess emissions events if the excess emission is of a nature that could endanger public health.

a. Such notice must be provided as soon as possible, but never more than one hour after becoming aware of the problem. Notice must be made to the regional office identified in Condition 15.0 by email, telephone, facsimile, or in person.

b. If the excess emissions occur during non-business hours, the permittee must notify DEQ by calling the Oregon Emergency Response System (OERS). The current number is 1-800-452-0311.

c. The permittee must also submit follow-up reports when required by DEQ.

11.2. Semi-annual The permittee must submit a report to the Administrator, United States Environmental Protection Agency, Region X a report of the fuel sulfur content of fuel oil received at the facility during the previous six months for use in any NSPS-affected boiler. The report must be submitted no later than the 30th day after the end of the reporting period. The reporting period begins on January 1 and July 1 of each year.

11.3. Annual Report For each year this permit is in effect, the permittee must submit to DEQ by **March 15** two (2) copies of the following information for the previous calendar year:

a. A letter stating the facility's compliance status with permit conditions for the calendar year. Any violations or exceedances must be explained in detail including corrective actions taken.

b. Operating parameters:

i. A summary of the monthly amount (therms, gallons, or cubic feet) of fuel (natural gas, propane, oil, or other) combusted in the boilers.

ii. A summary of the rolling 12-month amount (therms, gallons or cubic feet) of fuel (natural gas, propane, oil, or other) combusted in the boilers.

iii. A summary of the monthly hours of non-emergency generator operation.

iv. A summary of the rolling 12-month hours of non-emergency generator operation.

v. A summary of the monthly amount (pounds) of VOC, HCl- and HF-containing, and HCl- and HF-precursor, fluorides-containing, GHG-containing, or GHG precursor materials received on site for use in the fab.

vi. A summary of the monthly amount (pounds) of VOC, HCl- and HF-containing, and HCl- and HF-precursor, fluorides-containing, GHG-containing, or GHG precursor materials shipped off-site or disposed of as waste.

vii. A summary of any changes in material content that affect emission factor values.

viii. A summary of the rolling 12-month amount (pounds) of VOC, HCl- and HF-containing, and HCl- and HF-precursor fluorides-containing, GHG-containing, or GHG precursor materials used.

Material used = Amount of material issued minus the amount transferred off-site or disposed of as waste

ix. Revisions of the DRE of the CTO used for compliance emission calculations in Condition 7.4.b.

x. A summary of the rolling 12-month emissions of $PM_{2.5}$, SO_2, CO, NO_x, VOC, HCl, HF and PSEL fluorides.

c. Greenhouse gas emissions in accordance with OAR 340 division 215

d. A summary of all planned and unplanned excess emissions events as recorded in the Excess Emissions Log.

e. A summary of any emission factors which were changed.

f. A summary of complaints relating to air quality received by the permittee during the previous calendar year, as recorded in the Complaint Log.

12.0 NOTIFICATIONS

12.1. Notice of Change of Ownership or Company Name

The permittee must notify DEQ in writing using a DEQ "Permit Application Form" within 60 days after the following:

a. Legal change of the name of the company as registered with the Corporations Division of the State of Oregon; or

b. Sale or exchange of the activity or facility.

12.2. Construction or Modification Notices

The permittee must notify DEQ in writing using a DEQ "Notice of Construction Form," or "Permit Application Form," and obtain approval in accordance with OAR 340-210-0205 through 340-210-0250 before:

a. Constructing, installing, or establishing a new stationary source that will cause an increase in any regulated pollutant emissions;

b. Making any physical change or change in operation of an existing stationary source that will cause an increase, on an hourly basis at full production, in any regulated pollutant emissions; or

c. Constructing or modifying any air pollution control equipment.

12.3. Where to Send Reports and Notices The reports, with the permit number prominently displayed, must be sent to the Permit Coordinator for the region where the source is located as identified in Condition 15.3

13.0 ADMINISTRATIVE REQUIREMENTS

13.1. Permit Renewal Application The permittee must submit the completed application package for renewal of this permit **180 days prior to the expiration date**. Two (2) copies of the application must be submitted to the DEQ Permit Coordinator listed in Condition 15.0.

13.2. Permit Modifications Application for a modification of this permit must be submitted within **60 days** prior to the source modification. When preparing an application, the applicant should also consider submitting the application 180 days prior to allow DEQ adequate time to process the application and issue a permit before it is needed. A special activity fee must be submitted with an application for the permit modification. The fees and two (2) copies of the application must be submitted to the DEQ Business Office.

14.0 FEES

14.1. Annual Compliance Fee The permittee must pay the annual fee specified in OAR 340-216-8020, Table 2, Part 2 for a Standard ACDP on **December 1** of each year this permit is in effect. An invoice indicating the amount, as determined by DEQ regulations will be mailed prior to the above date. **Late fees in accordance with Part 4 of the table will be assessed as appropriate.**

14.2. Change of Ownership or Company Name Fee The permittee must pay the non-technical permit modification fee specified in OAR 340-216-8020, Table 2, Part 3(a) with an application for changing the ownership or the name of the company.

14.3. Special Activity Fees The permittee must pay the special activity fees specified in OAR 340-216-8020, Table 2, Part 3 (b through k) with an application to modify the permit.

15.0 DEQ CONTACTS / ADDRESSES

15.1. Business Office

The permittee must submit payments for invoices, applications to modify the permit, and any other payments to DEQ's Business Office:

Department of Environmental Quality
Accounting / Revenue
700 NE Multnomah St., Suite 600
Portland, Oregon 97232

15.2. Permit Coordinator

The permittee must submit all notices and applications that do not include payment to the Northwest Region Air Quality Permit Coordinator:

Department of Environmental Quality
Northwest Region Air Quality PC
700 NE Multnomah St., Suite 600
Portland OR 97232

15.3. Report Submittals

Unless otherwise notified, the permittee must submit all reports (annual reports, source test plans and reports, etc.) to DEQ's Region. If you know the name of the Air Quality staff member responsible for your permit, please include it.

15.4. Web Site

Information about air quality permits and DEQ's regulations may be obtained from the DEQ web page at www.oregon.gov/deq

16.0 GENERAL CONDITIONS AND DISCLAIMERS

16.1. Permitted Activities

This permit allows the permittee to discharge air contaminants from processes and activities related to the air contaminant source(s) listed on the first page of this permit until this permit expires, is modified, or is revoked.

16.2. Other Regulations

In addition to the specific requirements listed in this permit, the permittee must comply with all other legal requirements enforceable by DEQ.

16.3. Conflicting Conditions

In any instance in which there is an apparent conflict relative to conditions in this permit, the most stringent conditions apply.

16.4. Masking of Emissions

The permittee must not cause or permit the installation of any device or use any means designed to mask the emissions of an air contaminant that causes or is likely to cause detriment to health, safety, or welfare of any person or otherwise violate any other regulation or requirement.

16.5. DEQ Access

The permittee must allow DEQ's representatives access to the plant site and pertinent records at all reasonable times for the purposes of performing inspections, surveys, collecting samples, obtaining data, reviewing and copying air contaminant emissions discharge records and conducting all necessary functions related to this permit in accordance with ORS 468-095.

16.6. Permit Availability

The permittee must have a copy of the permit available at the facility at all times.

16.7. Open Burning

The permittee may not conduct any open burning except as allowed by OAR 340, division 264.

16.8. Asbestos

The permittee must comply with the asbestos abatement requirements in OAR 340, division 248 for all activities involving asbestos-containing materials, including, but not limited to, demolition, renovation, repair, construction, and maintenance.

16.9. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations.

16.10. Permit Expiration

a. A source may not be operated after the expiration date of the permit, unless any of the following occur prior to the expiration date of the permit:

   i. A timely and complete application for renewal or for an Oregon Title V Operating Permit has been submitted, or

   ii. Another type of permit (ACDP or Oregon Title V Operating Permit) has been issued authorizing operation of the source.

b. For a source operating under an ACDP or Oregon Title V Operating Permit, a requirement established in an earlier ACDP remains in effect notwithstanding expiration of the ACDP, unless the provision expires by its terms or unless the provision is modified or terminated according to the procedures used to establish the requirement initially.

16.11. Permit Termination, Revocation, or Modification

DEQ may modify or revoke this permit pursuant to OAR 340-216-0082 and 340-216-0084.

17.0 EMISSION FACTORS

Combustion emission factor table

Emissions device or activity	Pollutant	Emission Factor (EF)	EF units	EF Reference
Boilers B1, B2, B3 Natural gas (Building 1)	$PM/PM_{10}/PM_{2.5}$	0.0075	Lbs/mmBtu	AP-42 Tbl 1.4-2
	CO	0.040	Lbs/mmBtu	Manufacturer
	NO_x	0.04	Lbs/mmBtu	Manufacturer
	SO_2	0.0017	Lbs/mmBtu	ODEQ AQ-EF05
	VOC	0.016	Lbs/mmBtu	Manufacturer
Boilers B4, B5, B6 Natural gas (Building 2)	$PM/PM_{10}/PM_{2.5}$	0.0075	Lbs/mmBtu	AP-42 Tbl 1.4-2
	CO	0.037	Lbs/mmBtu	Manufacturer
	NO_x	0.035	Lbs/mmBtu	Manufacturer
	SO_2	0.0017	Lbs/mmBtu	ODEQ AQ-EF05
	VOC	0.016	Lbs/mmBtu	Manufacturer
Boilers B1, B2, B3 Fuel oil (Building 1)	$PM/PM_{10}/PM_{2.5}$	4.2	Lbs/mgal	Manufacturer
	CO	9.8	Lbs/mgal	Manufacturer
	NO_x	16.8	Lbs/mgal	Manufacturer
	SO_2	50.26	Lbs/mgal	Manufacturer
	VOC	4.06	Lbs/mgal	Manufacturer
Boilers B4, B5, B6 Fuel oil (Building 2)	$PM/PM_{10}/PM_{2.5}$	3.36	Lbs/mgal	Manufacturer
	CO	9.8	Lbs/mgal	Manufacturer
	NO_x	26.6	Lbs/mgal	Manufacturer
	SO_2	57.68	Lbs/mgal	Manufacturer
	VOC	4.2	Lbs/mgal	Manufacturer
Fire pump	$PM/PM_{10}/PM_{2.5}$	0.0022	Lbs/hp-hr	AP-42 Table 3.3-1
	CO	0.00668	Lbs/hp-hr	AP-42 Table 3.3-1
	NO_x	0.031	Lbs/hp-hr	AP-42 Table 3.3-1
	SO_2	0.00205	Lbs/hp-hr	AP-42 Table 3.3-1
	VOC	0.00247	Lbs/hp-hr	AP-42 Table 3.3-1
Building 1 diesel generators (2 each) [Full load/weekly testing]	$PM/PM_{10}/PM_{2.5}$	0.8/0.1	Lbs/hr	Manufacturer
	CO	3.5/0.4	Lbs/hr	Manufacturer
	NO_x	26.5/3.2	Lbs/hr	Manufacturer
	SO_2	1.7/0.2	Lbs/hr	Manufacturer
	VOC	0.6/0.1	Lbs/hr	Manufacturer

Emissions device or activity	**Pollutant**	**Emission Factor (EF)**	**EF units**	**EF Reference**
Building 2 diesel generators (3 each) [Full load/weekly testing]	$PM/PM_{10}/PM_{2.5}$	0.6/0.1	Lbs/hr	Manufacturer
	CO	5.2/0.6	Lbs/hr	Manufacturer
	NO_x	32.0/3.8	Lbs/hr	Manufacturer
	SO_2	1.9/0.2	Lbs/hr	Manufacturer
	VOC	0.8/0.1	Lbs/hr	Manufacturer
CTO on NG	$PM/PM_{10}/PM_{2.5}$	0.0073	Lbs/mmBtu	Manufacturer
	CO	0.0808	Lbs/mmBtu	Manufacturer
	NO_x	0.06	Lbs/mmBtu	Manufacturer
	SO_2	0.00058	Lbs/mmBtu	Manufacturer
	VOC	0.0053	Lbs/mmBtu	Manufacturer
Facility wide	Fluorides	0.583	Lbs F/lbs HF	Source test and empirical calcs.

Gas and Liquid Precursors – Emission factor Table

Chemical/Precursor	Pollutant	Emissions factor	Units
01000-060643, 01000-003985	NOx	0.270	Lb/lb
01000-065355	CO	1	Lb/lb
01000-060020	CO	0.269	Lb/lb
01000-060005	CO	0.203	Lb/lb
01000-060644 Process 1	CO NO_x	0.008 0.648	Lb/lb
01000-060644 Process 2	CO NO_x	0.00239 0.011	Lb/lb
01000-064403	NO_x	0.209	Lb/lb
01000-060014	CO	0.280	Lb/lb
01000-062718	CO	0.330	Lb/lb
01000-062689	CO	0.223	Lb/lb
01000-060018 Process 1	SO_2	0.439	Lb/lb
01000-060045	CO	0.269	Lb/lb
01000-064404	CO	0.159	Lb/lb
01000-064404, 01000-060007	CO	0.159	Lb/lb
01000-060006	CO	0.200	Lb/lb

Emission factors are based on an evaluation of the site specific emissions from the various chemicals and precursor

18.0 ABBREVIATIONS, ACRONYMS, AND DEFINITIONS

ACDP	Air Contaminant Discharge Permit
ASTM	American Society for Testing and Materials
AQMA	Air Quality Maintenance Area
calendar year	The 12-month period beginning January 1st and ending December 31st
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2e	carbon dioxide equivalent
DEQ	Oregon Department of Environmental Quality
dscf	dry standard cubic foot
EPA	US Environmental Protection Agency
FCAA	Federal Clean Air Act
Gal	gallon(s)
GHG	greenhouse gas
gr/dscf	grains per dry standard cubic foot
HAP	Hazardous Air Pollutant as defined by OAR 340-244-0040
I&M	inspection and maintenance
lb	pound(s)
MMBtu	million British thermal units
NA	not applicable
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NO_X	nitrogen oxides
NSPS	New Source Performance Standard
NSR	New Source Review
O_2	oxygen
OAR	Oregon Administrative Rules
ORS	Oregon Revised Statutes
O&M	operation and maintenance
Pb	lead
PCD	pollution control device
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in size
$PM_{2.5}$	particulate matter less than 2.5 microns in size
ppm	part per million
PSD	Prevention of Significant Deterioration
PSEL	Plant Site Emission Limit
PTE	Potential to Emit
RACT	Reasonably Available Control Technology
scf	standard cubic foot
SER	Significant Emission Rate
SIC	Standard Industrial Code
SIP	State Implementation Plan
SO_2	sulfur dioxide
Special Control Area	as defined in OAR 340-204-0070
VE	visible emissions
VOC	volatile organic compound
year	A period consisting of any 12-consecutive calendar months

State of Oregon
Department of
Environmental
Quality

Department of Environmental Quality
Northwest Region
Air Quality Program

Standard AIR CONTAMINANT DISCHARGE PERMIT REVIEW REPORT

Source Information:

SIC	3674, 4961
NAICS	221330, 334413

Source Categories (Table 1 Part, code)	B13, B85
Public Notice Category	III

Compliance and Emissions Monitoring Requirements:

FCE	
Compliance schedule	
Unassigned emissions	
Emission credits	
Special Conditions	

Source test	once
COMS	
CEMS	
PEMS	
Ambient monitoring	

Reporting Requirements

Annual report	March 15
Quarterly report	

Monthly report	
Excess emissions report	
Other (Semi-annual)	July 30

Air Programs

Synthetic Minor (SM)	
SM -80	
NSPS (list subparts)	Dc
NESHAP (list subparts)	ZZZZ
Part 68 Risk Management	
CFC	

NSR	
PSD	
RACT	
TACT	
Other (specify)	

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PERMITTING

GENERAL BACKGROUND INFORMATION

1. Microchip Technology Incorporated ("Microchip") owns and operates an existing semiconductor manufacturing facility located at 21015 SE Stark Street, Gresham, Oregon, referred to as the Microchip Gresham Fab 4. There are two main buildings at the facility, Building 1 and Building 2, within which semiconductor manufacturing occurs. The manufacturing-related emissions from both buildings are controlled by numerous wet scrubber systems and a concentrator thermal oxidizer (CTO). The wet scrubber systems and the CTO remove approximately 90% of the potential emissions. There are several support buildings (e.g., water and wastewater treatment, emergency generators, boilers) also located at the facility.

   Microchip Gresham Fab 4 ("facility") was previously owned and operated by Fujitsu Microelectronics, Incorporated ("Fujitsu"), and the existing permit for the facility was transferred to Microchip upon closing of the sale to Microchip (approximately August 23, 2002). Prior to the sale to Microchip, Fujitsu discontinued semiconductor manufacturing and removed many of the individual process tools that are used in the semiconductor manufacturing process. However, Fujitsu did not remove the various control devices. Microchip subsequently brought the manufacturing process back on-line by installing the process tools necessary to produce Microchip's products.

PERMIT HISTORY

2. DEQ issued Air Contaminant Discharge Permit Number 26-3240 ("permit") to Fujitsu on June 11, 1997 and was originally scheduled to expire on September 1, 2000. Fujitsu made timely application for permit renewal on June 2, 2000; however, Fujitsu subsequently discontinued semiconductor manufacturing operations and DEQ halted its review of the renewal application prior to issuing a renewal permit.

3. Microchip purchased the Fujitsu facility on August 23, 2002, and, at Microchip's request, DEQ transferred Fujitsu's permit to Microchip. DEQ also authorized Microchip to replace Fujitsu's permit renewal application with one more closely reflecting Microchip's semiconductor manufacturing process emissions. Microchip submitted a modified permit application on November 26, 2002.

4. The old ACDP was converted to a Standard ACDP in accordance with the rules adopted in May 2001.

5. This permit renewal updates the existing permit to include current applicable conditions, increases the GHG PSEL that was previously set to keep the facility out of Title V permitting and modifies emission factors to be based on chemical usage instead of production parameters. A moderate technical modification is included in this permit renewal, under the same application number, to increase the GHG PSEL.

OTHER PERMITS AND REGISTRATION

6. Other permits issued or required by DEQ for this source include a No Exposure Certification for Stormwater. Microchip is also registered as a Large Quantity Generator (LQG) of hazardous waste with DEQ.

ATTAINMENT STATUS

7. The source is located in maintenance areas for carbon monoxide (CO) and ozone (O_3). The permittee is a small source of volatile organic compounds (VOCs) and nitrogen oxides (NOx), both ozone precursors, and of CO. The area is in attainment for all other pollutants.

COMPLIANCE

8. The facility was inspected on March 17, 2016, and found to be in compliance with permit conditions. No enforcement actions have been taken during this last permit cycle.

9. During the prior permit period there were no complaints recorded for this facility.

SOURCE DESCRIPTION

10. The general layout of the air contaminant sources at the facility consist of the following:

Amount	Equipment/Process	Capacity	Control Equipment	Installed
Building 1				
1	Semiconductor Fab	N/A	Wet scrubber systems	1988
3	Boilers 1, 2, 3	12.565 mmBtu/hr each	low-NOx burners	1988
2	Emergency Generators	1,456 hp each	N/A	1988
Building 2				
1	Semiconductor Fab	N/A	Wet scrubber systems	1996
1	Semiconductor Fab	N/A	CTO*	1996
3	Boilers 4, 5, 6	29.291 mmBtu/hr each	Low-NOx burners	1996
3	Emergency Generators	1,582 hp each	N/A	1996

* The CTO is physically located at Building 2, but serves both Building 1 and Building 2.

11. The facility emissions are controlled by several wet scrubber systems (for ammonia and acid gas emission control) and a CTO for VOC emission control. A single CTO treats VOC emissions from both Building 1 and Building 2.

The wet scrubber systems are variously manifolded into common exhaust manifolds and individual as well as combined emission stacks. A given combination of wet scrubbers, their associated exhaust fans, and stacks results in a "discharge point" or "wet scrubber system." A wet scrubber system can have several or single "stacks" and several or single wet scrubbers/manifolded exhaust fans serving it. The following table shows that there are six wet scrubber discharge points (1-3 through 2-3) and one CTO discharge point (2-4). Therefore, for purposes of the ACDP, there are six "wet scrubber systems."

Air Emission Discharge Points

Common Name	Microchip ID	DEQ ID	Exhaust Discharge Point ID	# of Fans*	Design Flow Rate (cfm)
Ammonia Scrubber	S-4	DEQ-4	1-3	2	13,500
Acid Scrubber	S-2	DEQ-2	1-4	2	28,000
Acid Scrubber	S-5	DEQ-5	1-4	2	36,000
Acid Scrubber	S-6	DEQ-6	1-5	2	16,000
Ion Implant Scrubber	S-9	DEQ-16	2-1	7	14,500
CVD Scrubber	S-11	DEQ-16	2-1	7	30,000
Acid Scrubber	S-13	DEQ-16	2-1	7	42,300
CVD Scrubber	S-14	DEQ-16	2-1	7	30,000
Acid Scrubber	S-15	DEQ-16	2-1	7	42,300
Acid Scrubber	S-16	DEQ-16	2-1	7	42,300
Nitric Scrubber	S-10	NA	2-2	2	7,400
Ammonia Scrubber	S-12	NA	2-3	2	26,900
CTO	C-1	NA	2-4	2	29,000

* Note: Number of exhaust fans pulling air through discharge point.

CONTINUOUS MONITORING DEVICES

12. The facility has the following continuous monitoring devices:
    a. The CTO is continuously monitored for the temperature in its combustion chamber.
    b. The wet scrubber systems are continuously monitored for the flow rate of recirculation water and pH.

SPECIAL CONDITIONS

13. The permittee must notify DEQ in writing of the date any additional VOC or acid gas control device begins treating process exhaust, within seven (7) days.

14. Except for change of materials that existing equipment is capable accommodating, the permittee must notify DEQ in writing of a change in the recipe of chemicals that changes the emission factors and the revised emission factors used in the Fab processes. This notification must include an analysis of how the changes in the emission factors affect plant site emissions relative to the PSEL.

EMISSIONS

15. The Baseline Emission Rate for the facility is zero since it was constructed after 1978.

16. The Microchip permit renewal application projects maximum potential emissions at full operation of the facility using Microchip's proprietary processes.

17. The following table shows the current (2013) PSEL and the proposed (2019) PSEL:

Pollutant	Current (2013) PSEL (tpy)	Proposed (2019) PSEL (tpy)
PM	24	24
PM_{10}	14	14
$PM_{2.5}$	9	9
SO_2	39	39
NOx	39	39
CO	99	99
VOC	39	39
Single HAP	9	9
Combined HAPs	24	24
Fluorides	2.9	2.9
GHG	74,000	181,000

SIGNIFICANT EMISSION RATE ANALYSIS

18. For each pollutant, the proposed Plant Site Emission Limit is less than the Netting Basis plus the significant emission rate, thus no further air quality analysis is required.

CALCULATION METHODOLOGY

19. The PSELs for the Microchip permit were calculated by using a set of emission factors (EFs) provided by manufacturers and the permittee and using the following methodology:

a. Boilers Combustion Emissions –Boilers 1 through 3 serve Building 1 and Boilers 4 through 6 serve Building 2. All of the boilers are capable of combusting both natural gas and #2 oil. The boilers are considered "gas-fired boilers" that burn gaseous fuels not combined with any solid fuels and burn liquid fuel only during periods of gas curtailment, gas supply interruption, startups, or for periodic testing, maintenance or operator training on liquid fuel. Periodic testing, maintenance, or operator training on liquid fuel does not exceed a combined total of 48 hours per boiler during any calendar year.

In addition, although there are six boilers on site, typically at least one of the boilers in each building is in hot standby and is not used. Therefore, in order to calculate potential emissions from the boilers, assumptions regarding annual load factor and the amount of oil versus natural gas burned were made.

The maximum annual emissions from boiler natural gas combustion is calculated based on a load factor of 35% across all boilers operating simultaneously. (This is roughly equivalent to one of three boilers serving each building at full load and the other two boilers serving each building in standby).

The EFs were provided by the manufacturers of the boilers and are contained in the permit and the application.

b. Generator Combustion Emissions – All of the generators combust ultra low sulfur distillate oil. These units are used for emergency power only when electricity is curtailed from the manufacturing facility.

c. CTO Combustion Emissions - Criteria pollutant emissions from natural gas combustion in the CTO are calculated in the same manner as the boilers. The emission factors were provided by the manufacturer and are shown in the permit and the application.

d. Building 1 and Building 2 Fab Emissions – Emissions from semiconductor manufacturing processes are calculated based on the use of materials containing air pollutants or precursors for air pollutants. The quantities of materials are determined by reviewing Microchip's parts inventory, locating the materials of interest by part number, and computing the quantity of air pollutant or precursor used based on the material's composition determined by analytical testing, vendor statement, SDS, or other appropriate method.

Emission factors (EF) for the Fab processes are in units of lb / lb chemical or precursor. The factors are calculated based on the following information: Amount of chemical consumed in the process tool and any built-in point-of-use abatement (POU); Percent weight of each chemical and/or precursor in the material; Chemistry of conversion of the chemical into air pollutants. Emissions are determined by multiplying the total pounds of chemical or precursor used by the associated EF. Control efficiencies for the centralized scrubber system or RCTO are applied if the pollutant is removed in either system.

The emission factors used for calculating Fab emissions are provided in detail in the air contaminant discharge permit renewal application. These emissions may include pollutant classes such as: hazardous air pollutants (HAPs), particulate matter (PM) emissions from non-combustion sources, volatile organic compounds (VOCs), carbon dioxide (CO2), greenhouse gases and other miscellaneous criterial pollutants. The emission factors are derived from a number of sources including: Microchip's knowledge and experience with these or similar tools and processes; specific chemistries or recipes of chemicals from multiple processes; professional engineering consultation and industry specific knowledge. If there is a change in the formulation of chemicals in the manufacturing process, the facility will recalculate the emission factors and analyze whether they will cause an increase in emissions that may exceed the PSEL. The facility must notify DEQ of any change in emission factors.

Total fluorides are calculated by multiplying total calculated HF emissions by the empirically determined ratio of fluorides to HF. This EF is based on previous fluorides source testing results and is specified in Section 17 Emission Factors.

The EFs are for emissions that pass through an emission point. Fugitive VOC emissions are also emitted from Fab processes, and are calculated based on a mass balance methodology.

SOURCE TESTING

20. Microchip is required to conduct a source test of the wet scrubber systems, in accordance with a DEQ-approved pretest plan, to confirm that the HF and HCl destruction removal efficiency is at least 90% or that the facility-wide volumetric flow-weighted average outlet concentration of HF and HCl in the wet scrubber systems is less than 1 part per million by volume (ppmv) each.

The source test will be conducted for each of the wet scrubber systems in accordance with the DEQ-approved pretest plan. The removal efficiency will be determined by measuring the inlet HF and HCl mass and the outlet HF and HCl mass at the same time.

Source testing must be completed once during this permit cycle at least 180 days prior to the scheduled expiration date.

At semiconductor facilities, it is common for the inlet concentration of acid gases and other pollutants of interest to have very low (less than 1 ppmv) inlet concentrations. At low concentrations, measuring removal efficiency is problematic and the scrubbers themselves may not be as efficient. Therefore, if the facility-wide volumetric flow-weighted average outlet concentration of HF and HCl is found to be less than 1 ppmv each during the source test, but the HF or HCl removal efficiency for one or more wet scrubber systems is less than 90%, the facility is deemed compliant.

To determine the facility-wide volumetric flow-weighted average HF and HCl concentrations, the following equation is used.

$$C_x = \sum VF_n \times C_{xn} / \sum VF_n$$

Where:

C = Volumetric flow-weighted average concentration of pollutant x (HF or HCl)
VF_n = volumetric flow rate of wet scrubber system n
C_{xn} = Concentration of pollutant x in each of the n wet scrubber systems
n = facility wet scrubber systems 1 through 6
x = pollutant HF or HCl

PRIOR TESTING RESULTS

21. The results of the most recent source tests are listed below:

Emission Device	Test Date	Production Rate	Pollutant	Measured Value
PEI-001	6/3/2015	6433 WIP 9864 WM	HF	$<2.8\times10^{-7}$lbs/WIP $<1.9\times10^{-7}$lbs/WM <0.0017 lbs/hr
			HCl	$<1.5\times10^{-6}$lbs/WIP $<9.7\times10^{-7}$lbs/WM <0.0091 lbs/hr
			Fluorides	$<2.6\times10^{-7}$lbs/WIP $<1.7\times10^{-7}$lbs/WM <0.0016 lbs/hr
PES-003	6/4/2015	7285 WIP 10,404 WM	HF	$<4.8\times10^{-7}$lbs/WIP $<3.4\times10^{-7}$lbs/WM <0.0032 lbs/hr
			HCl	$<1.8\times10^{-6}$lbs/WIP $<1.3\times10^{-6}$lbs/WM

Emission Device	Test Date	Production Rate	Pollutant	Measured Value
				<0.012 lbs/hr
			Fluorides	$3.3x10^{-7}$lbs/WIP $2.3x10^{-7}$lbs/WM 0.0055 lbs/hr
PES-002	6/4/2015	6914 WIP 9800 WM	HF	$<5.5x10^{-7}$lbs/WIP $<3.9x10^{-7}$lbs/WM 0.0036 lbs/hr
			HCl	$<1.9x10^{-6}$lbs/WIP $<1.4x10^{-6}$lbs/WM <0.012 lbs/hr
			Fluorides	$<3.6x10^{-7}$lbs/WIP $<2.8x10^{-7}$lbs/WM <0.0059 lbs/hr
PES-001	6/5/2015	6441 WIP 9356 WM	HF	$<5.4x10^{-7}$lbs/WIP $<3.7x10^{-7}$lbs/WM <0.0033 lbs/hr
			HCl	$<2.1x10^{-6}$lbs/WIP $<1.4x10^{-6}$lbs/WM <0.013 lbs/hr
			Fluorides	$<5.8x10^{-8}$lbs/WIP $<3.5x10^{-8}$lbs/WM <0.0036 lbs/hr
PEC-002	6/6/2015	6376 WIP 9586 WM	HF	$<4.5x10^{-7}$lbs/WIP $<3.0x10^{-7}$lbs/WM <0.0027 lbs/hr
			HCl	$<1.6x10^{-6}$lbs/WIP $<1.1x10^{-6}$lbs/WM <0.0097 lbs/hr
			Fluorides	$<1.2x10^{-7}$lbs/WIP $<8.1x10^{-8}$lbs/WM <0.0034 lbs/hr
PEC-001	6/7/2015	6439 WIP 9072 WM	HF	$<4.1x10^{-7}$lbs/WIP $<2.9x10^{-7}$lbs/WM <0.0025 lbs/hr
			HCl	$<1.5x10^{-6}$lbs/WIP $<1.1x10^{-6}$lbs/WM <0.0093 lbs/hr

Emission Device	Test Date	Production Rate	Pollutant	Measured Value
			Fluorides	<1.7x10^{-7}lbs/WIP <1.2x10^{-7}lbs/WM <0.0035 lbs/hr
PEA-001	6/8/2015	7015 WIP 10,242 WM	HF	<7.9x10^{-7}lbs/WIP <5.4x10^{-7}lbs/WM <0.0051 lbs/hr
			HCl	<2.0x10^{-6}lbs/WIP <1.4x10^{-6}lbs/WM <0.013 lbs/hr
			Fluorides	<6.1x10^{-7}lbs/WIP <4.2x10^{-7}lbs/WM <0.0039 lbs/hr
PEN-001	6/9/2015	6813 WIP 9721 WM	HF	1.0x10^{-7}lbs/WIP 7.0x10^{-8}lbs/WM 0.0006 lbs/hr
			HCl	<7.8x10^{-7}lbs/WIP <5.5x10^{-7}lbs/WM <0.0048 lbs/hr
			Fluorides	<1.6x10^{-8}lbs/WIP <1.2x10^{-8}lbs/WM <0.0007 lbs/hr
PEA-004	6/10/2015	7077 WIP 10,324 WM	HF	<1.1x10^{-7}lbs/WIP <7.8x10^{-8}lbs/WM <0.0008 lbs/hr
			HCl	<4.3x10^{-7}lbs/WIP <2.9x10^{-7}lbs/WM <0.0029 lbs/hr
			Fluorides	<4.3x10^{-8}lbs/WIP <2.9x10^{-8}lbs/WM <0.0008 lbs/hr
PES-005	6/10/2015	7084 WIP 8990 WM	HF	<2.2x10^{-6}lbs/WIP <1.7x10^{-6}lbs/WM 0.014 lbs/hr
			HCl	<2.6x10^{-6}lbs/WIP <2.1x10^{-6}lbs/WM <0.018 lbs/hr
			Fluorides	<1.6x10^{-6}lbs/WIP

Emission Device	Test Date	Production Rate	Pollutant	Measured Value
				<1.3x10^{-6}lbs/WM 0.025 lbs/hr
PES-006	6/11/2015	6694 WIP 9038 WM	HF	3.0x10^{-7}lbs/WIP 2.2x10^{-7}lbs/WM 0.0019 lbs/hr
			HCl	<7.4x10^{-7}lbs/WIP <5.4x10^{-7}lbs/WM <0.0048 lbs/hr
			Fluorides	5.9x10^{-8}lbs/WIP 4.4x10^{-8}lbs/WM 0.0023 lbs/hr
Concentrator Inlet	6/4/2015	6847 WIP 8803 WM	VOC as propane	6.4 lbs/hr 47.5 ppmvd
Concentrator outlet	6/4/2015	6847 WIP 8803 WM	VOC as propane	0.18 lbs/hr 1.6 ppmvd
CTO Exhaust	6/4/2015	6847 WIP 8803 WM	VOC as propane	0.033 lbs/hr 2.1 ppmvd

WIP = Wafers in process
WM = Wafer moves
ppmvd = parts per million volume dry

MAJOR SOURCE APPLICABILITY

POLLUTANTS

Pollutant	Proposed PSEL (tons per year)	Major Source Threshold (tons per year)
PM	24	25
PM_{10}	14	15
$PM_{2.5}$	9	10
SO_2	39	40
NOx	39	40
CO	99	100
VOC	39	40
Single HAP	9	10
Combined HAPs	24	25
Fluorides	2.9	3.0
GHG	181,000	75,000

* Note: All PM emissions are assumed to be PM_{10} and $PM_{2.5}$.

22. A major source is a facility that has the potential to emit more than 100 tons per year of any criteria pollutant. Although the Fab emissions of this facility have the potential to produce in excess of 100 tons of VOCs uncontrolled, the presence of control devices which are intrinsic to the manufacturing process limits its potential-to-emit.

23. In addition, the permittee has elected to request federally enforceable PSELs below the major source threshold levels. Therefore, this facility is not a major source of criteria pollutants.

24. GHG emissions in excess of the significant emission rate do not trigger any additional program requirements (NSR or Title V) on their own, only if another pollutant triggers one of these programs. In other words, GHG does not make the facility a major source.

HAZARDOUS AIR POLLUTANTS

Pollutant	Annual Emissions (tons per year)	Major Source Threshold (tons per year)
Hydrogen Chloride	0.3	10
Hydrogen Fluoride	2.1	10
Other minor HAPs	0.3	10
Total HAPs	2.7	25

25. A major source is a facility that has the potential to emit 10 or more tons/year of any single HAP or 25 or more tons/year of combined HAPs. Although the Fab emissions of this facility has the potential to produce in excess 10 tons of individual HAPs or 25 tons of combined HAPs uncontrolled, the presence of control devices which are intrinsic to the manufacturing process limits its potential-to-emit.

26. In addition, the permittee has elected to request federally enforceable PSELs below the major source threshold levels. Therefore, this facility is not a major source of individual or combined HAPs.

ADDITIONAL REQUIREMENTS

NSPS APPLICABILITY

27. 40 CFR Part 60, Subpart Dc is applicable to all three boilers in Building 2 since they were constructed after June 9, 1989 and are greater than 10 mmBtu/hr in capacity.

28. 40 CFR 60, Subpart IIII does not apply to the Compression ignition engines at the facility because they all predate the subpart applicability date.

NESHAPS/MACT APPLICABILITY

29. A National Emission Standard for Hazardous Air Pollutants (NESHAP Subpart BBBBB) for semiconductor manufacturing facilities was proposed by EPA on February 2, 2003. This facility is not subject to this NESHAP since it is not a major source of HAPs.

30. NESHAP Subpart ZZZZ is applicable to the reciprocating internal combustion engines at the facility and the subpart requirements have been included in the permit.

RACT APPLICABILITY

31. The facility is located in the Portland AQMA, but it is not one of the listed source categories in OAR 340-232-0010, thus the categorical RACT rules do not apply.

32. The pre-control emissions of VOC are greater than 100 tons per year, and, per OAR 340-232-0020(4) and 340-232-0040(1), the facility is subject to case by case Reasonably Available Control Technology (RACT) requirements. However, the CTO controls VOC emissions by a minimum of 90%. In addition, the permittee has requested a federally enforceable PSEL below the RACT threshold level.

TACT APPLICABILITY

33. A formal TACT analysis has not be conducted, but the source is likely meeting the state's TACT by conducting the following activities:
    a. VOC emissions are controlled by the CTO to a minimum DRE of 90%;
    b. Acid gas emissions are controlled by the wet scrubber systems to a DRE of 90% or a facility-wide volumetric flow-weighted outlet concentration of HF and HCl of less than 1 ppmv each; and
    c. All boilers are equipped with low-NO_x burners and are primarily fueled with natural gas.

GREENHOUSE GASES

34. This permit renewal increases the PSEL for Greenhouse Gases (GHG). The PSEL was previously set at 98,000 tons/year to keep the facility below the Title V threshold, because actual emissions are greater than the reporting threshold (deminimis level) of 2,756 tons/year (2,500 metric tons/year) of carbon dioxide equivalent (CO_2e). The GHG PSEL is being increased in this permit renewal to allow the facility to utilize existing capacity. GHG emissions do not trigger either New Source Review or Title V permitting on their own, only if another pollutant triggers one of those programs. A Baseline for GHG emissions has not been established, but could be reviewed in the future.

PUBLIC NOTICE

35. Pursuant to OAR 340-216-0066(4)(a)(A), issuance of Standard Air Contaminant Discharge Permits require public notice in accordance with OAR 340-209-0030(3)(c), which requires DEQ to provide notice of the proposed permit action and a minimum of 35 days for interested persons to submit written comments. In addition, a hearing will be scheduled to allow interested persons to submit oral or written comments. If DEQ receives written request for a hearing from ten persons, or from an organization representing at least ten persons, within 35 days of the mailing of the public notice. If a hearing is scheduled, DEQ will provide a minimum of 30 days notice for the hearing. **The public notice was emailed/mailed on Friday May 17, 2019 and the comment period ended on Friday June 21, 2019 at 5 p.m.**

- One comment was received during the public notice. That comment and DEQs response is attached below.

Microchip Technology Standard ACDP 26-3240-ST-01

Response to Comments

Public Comment from Gregg Lande of Northwest Portland lande.gregg@gmail.com

Comment
It appears the Public Notice is missing the usual Table 2 of Emissions for HAP. This is a significant oversight.
In addition, the information about specific HAP covered in the permit is extremely limited. Aside from HF, what are other fluorides being released; as particles or gases? Are there no metal HAP emissions? Since HAP emissions are associated more with local impacts than area-wide impacts as are the criteria pollutants, it would be preferable to have a site map which shows where these emissions are located.
The public deserves to be given this information, and I believe the Department may even be required to provide it.

DEQ response
Table 2 for HAPs was not included in the public notice cover page because of the level of emissions expected from the facility. However, the HAP information is included in the review report, that was attached as part of the public notice package, along with source test data to support the emission estimates.

Under the current DEQ air quality program additional requirements are only triggered if a HAP is emitted at major source threshold levels (10 tons/year of individual HAP or 25 tons/year of combined HAPs). Since the total estimated HAP emissions are 2.7 tons/year, and there are no

area source NESHAPs that apply to the manufacturing process at Microchip, DEQ did not repeat the information from the review report into the public notice cover page.

Current DEQ regulations are for airshed management and do not address localized impacts or the form fluorides and HAPs are emitted. Localized impacts of toxic air pollutants will be addressed when Microchip is called into the Cleaner Air Oregon program or they make a major modification that triggers CAO requirements. Note: Fluorides are included in the list of toxic air pollutants.

The public notice cover page along with the permit and review report provide the information that is required by the DEQ regulations. If additional information is desired all of DEQs records are open for public inspection. If an individual wants to refer to a site map or other detailed information they could review the files for such an item.

Oregon
Kate Brown, Governor

Department of Environmental Quality
Northwest Region
700 NE Multnomah St Ste 600
Portland, OR 97232-4100
(503) 229-5263
FAX (503) 229-6945
TTY 711

June 21, 2019

Bret Herbert
Microchip Technology Inc
21015 SE Stark Street
Gresham OR 9730 2015

Re: Renewal of a Standard Air Contaminant Discharge Permit
Permit Number **26-3240-ST-01** Application Number **029474**

The Department of Environmental Quality has completed its review and public notice for Microchip Technology's Standard permit renewal. The facility is located at 21015 SE Stark Street in Portland. Based on the information in the renewal application and public notice, DEQ has issued the enclosed permit.

The effective date of the permit modification is the date it was signed by the regional Air Quality Manager. The signature and date appear on the first page of the document. The permit modification is issued pursuant to Oregon Revised Statutes 468A and Oregon Administrative Rules (OAR) 340-14-005 through 340-14-050, and 216-0010 through 216-0100.

You may appeal conditions or limitations contained in the attached permit modification by applying to the Environmental Quality Commission, or its authorized representative, within twenty days from the date of this letter. Appeals are pursuant to ORS Chapter 183 and OAR Chapter 340, Division 14-025 (6). Appeal procedures are contained in OAR Division 11-005 through 11-140.

A copy of the current permit along with the modification must be available at the facility at all times. Failure to comply with permit conditions may result in civil penalties. **You are expected to read the permit carefully and comply with all conditions** to protect the environment of Oregon.

If you have any questions, please contact Dave Kauth at 503-229-5053.

Sincerely,

Matt Hoffman, Air Quality Manager
DEQ Northwest Region

Enclosure
Cc: HQ/AQ

STANDARD
AIR CONTAMINANT DISCHARGE PERMIT

Department of Environmental Quality
Northwest Region
700 NE Multnomah St., Suite 600
Portland, OR 97232

This permit is being issued in accordance with the provisions of ORS 468A.040 and based on the land use compatibility findings included in the permit record.

ISSUED TO:

Microchip Technology Incorporated
21015 SE Stark Street
Gresham, OR 97030

INFORMATION RELIED UPON:

Application No.: 034318
Date Received: 09/21/2022

PLANT SITE LOCATION:

Gresham Fab 4
21015 SE Stark Street
Gresham, OR 97030

LAND USE COMPATIBILITY FINDING:

Approving Authority: City of Gresham
Approval Date: 06/29/1995

ISSUED BY THE DEPARTMENT OF ENVIRONMENTAL QUALITY

Joshua Alexander — 06/06/2023

Joshua Alexander, Northwest Region Air Quality Permit Manager — Dated

Sources Permitted to Discharge Air Contaminants (OAR 340-216-8010):

Table 1 Code	Source Description	SIC (NAICS)
Part B, 85	Sources which would have the emission capacity of 10 or more tons of any single criteria pollutant. Semiconductor manufacturing.	3674 (334413)
Part B, 13	Oil-fired boilers whose total heat input rating at the source is over 10 MMBtu/hr; or individual natural gas boilers over 30 MMBtu/hr or greater heat input rating.	4961 (221330)

Addendum Number R-01

In accordance with OAR 340-216-0020, Conditions 1.7, 3.1, 4.2, 5.1, 6.1 and 9.1 are the only changes and now read as follows:

wl/DEQ:HQ:file

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1.0 GENERAL EMISSION STANDARDS AND LIMITS

1.7. Emergency Stationary RICE

The permittee must comply with the following requirements for each emergency stationary reciprocating internal combustion engine (RICE): [40 CFR 63.6640(f)]

a. Change oil and filter every 500 hours of operation or annually, whichever comes first. [40 CFR 63. 6603(a), table 2d(4)(a)] The permittee may elect to comply with the oil analysis requirements of 40 CFR 63.6625(i) in lieu of the oil change requirement. Oil analyses must be conducted at the same frequency as the oil change requirement;

b. Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first; [40 CFR 63.6603(a), table 2d(4)(b)]

c. Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary; [40 CFR 63.6603(a), table 2d(4)(c)]

d. During periods of startup, minimize the engine's time spent at idle and minimize the engine's startup time at startup to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes, after which time the non-startup emission limitations apply; and [40 CFR 63.6603(a), table 2d]

e. The permittee must install a non-resettable hour meter on each emergency stationary RICE, if one is not already installed. [40 CFR 63.6625(f)]

3.0 TYPICALLY ACHIEVABLE CONTROL TECHNOLOGY (TACT)

3.1. VOC Emissions

The permittee must control Volatile Organic Compound (VOC) emissions from Building 1 and Building 2 manufacturing operations with rotor concentrator thermal oxidizers (RCTOs) that must each achieve a minimum 90% destruction removal efficiency (DRE) of VOCs entering the RCTOs when the inlet VOC concentration (measured as propane) is 90 ppmv or greater. If/when the inlet VOC concentration falls below 90 ppmv, the outlet VOC concentration (measured as propane) must not exceed 10 ppmv.

4.0 OPERATION AND MAINTENANCE REQUIREMENTS

4.2. Highest and Best Practicable Treatment and Control

The permittee must comply with the following conditions pertaining to the operation of its thermal oxidizer(s): [OAR 340-226-0120]

a. The oxidizer temperature and desorption chamber temperature of each RCTO unit must be maintained such that the temperatures of the unit are sustained and do not drift more than 25 °F below the required minimum temperatures or the temperatures recorded during the most recent DEQ approved source test demonstrating compliance with

applicable emissions limits in Condition 3.1 based on a three-hour average:

i. The required minimum oxidizer temperature is 1,375 °F;

ii. The required minimum desorption chamber temperature is 360 °F;

iii. If the oxidizer or desorption chamber temperatures drop to more than 25 °F below the required temperatures or the temperatures recorded during the most recent DEQ approved source test demonstrating compliance with applicable emissions limits in Condition 3.1 based on a three-hour average, the permittee must immediately investigate and commence corrective action to return the temperatures to the established operating range; and

iv. The temperature falling below this emission action level is not a violation of this permit condition; however, it is a violation of this permit condition if the permittee fails to immediately investigate and commence corrective actions to correct the operating temperature after it has fallen below the range.

b. A continuous temperature monitoring system must be used to monitor and record the oxidizer temperature and desorption chamber temperature of each RCTO unit at all times the unit is operating.

5.0 PLANT SITE EMISSION LIMITS

5.1. Plant Site Emission Limits (PSEL)

The permittee must not cause or allow plant site emissions to exceed the following: [OAR 340-222-0041 and OAR 340-222-0060]

Pollutant	Limit	Units
PM	9	tons per year
PM_{10}	9	tons per year
$PM_{2.5}$	9	tons per year
SO_2	3	tons per year
NO_X	39	tons per year
CO	84	tons per year
VOC	34	tons per year
GHGs (CO2e)	279,300	tons per year
Single HAP	5	tons per year
Combined HAPs	9	tons per year
Fluorides	2.9	tons per year

All PM is assumed to be PM_{10} and all PM_{10} is assumed to be $PM_{2.5}$. Fluorides are calculated using the site specific fluorides emission factor based on 2015 emission testing results. HAP PSELs are included because uncontrolled PTE is greater than the major source threshold.

6.0 COMPLIANCE DEMONSTRATION AND SOURCE TESTING

6.1. Testing Requirements

The permittee must conduct a source test of the control devices as specified below: [OAR 340-212-0120]

a. Once during this permit cycle the permittee must perform a performance test of each wet scrubber system to determine the HF and HCl destruction removal efficiency (DRE);

b. Within 180 days after two of the new RCTO units are brought into normal operation the permittee must perform a performance test of each RCTO to determine the VOC DRE, unless an alternative date is approved by Oregon DEQ. Normal operation is defined when the RCTOs are fully operational and when VOC process exhaust is routed to two of the new RCTOs;

c. Source testing must be conducted while the facility is operating within 90% its normal operating capacity at the time of the test. Sampling must take place under worst case operating conditions observed during normal operations (i.e., redundant control devices should not be operating during testing);

d. Gas concentrations must be sampled at the inlet and outlet of each wet scrubber system and each RCTO to demonstrate the system's DRE. The source test report must include the DRE demonstrated during each test run as well as the average DRE for the three test runs. As an alternative, the permittee can sample only the outlet of the wet scrubber systems to demonstrate compliance with the 1 ppmv HF and HCl limitations as listed in Condition 3.2;

e. During each source test the following parameters must be monitored and recorded:
   i. RCTO oxidizer and desorption chamber temperatures;
   ii. Pressure drop across concentrator wheel of the RCTO;
   iii. RCTO natural gas usage;
   iv. Recirculation flow rate and pH of the wet scrubbers; and
   v. Other facility/process operating parameters identified prior to the test.

f. Only regular operating staff may adjust the combustion system or production processes and emission control parameters during the source test and within two hours prior to the tests. Any operating adjustments made during the source test, which are a result of consultation during the tests with source testing personnel, equipment vendors or consultants, may render the source test invalid;

g. A pretest plan for each source test required above must be submitted for approval to DEQ's Source Test Coordinator at the ODEQ Northwest Regional Office, at least 30 days prior to testing;

h. The reference test methods identified in the table below must be utilized in the source tests identified above. A test method modification/variance or substitution of an alternative test method must be pre-approved by the DEQ's Source Test Coordinator and

i. All tests must be conducted in accordance with the DEQ's Source Sampling Manual and with the pretest plan. All test data and results must be submitted to the Source Test

Coordinator for review within 60 days after completion of the testing cycle unless an

j. alternate submission date or extension is approved by DEQ.

Reference Test Method	Tested pollutant/parameter
EPA 1&2	Flow Rate
EPA 3	Dry Molecular Weight
EPA 4 or ODEQ Method	Moisture
EPA 25A	Total VOC
EPA 26, 26A, 320 or ASTM D6348-12	HF & HCl

9.0 MONITORING CONDITIONS

9.1. Continuous Monitoring

The permittee must monitor and maintain the following records related to the operation of control devices continuously during all hours of operation: [OAR 340-226-0120]

a. The oxidizer and desorption chamber temperature of each RCTO must be continuously monitored and reduced to an hourly average (one hour block average). For the purpose of this condition, "continuously monitored" means that measurements are taken at a frequency of not less than once every 15 minutes;

b. Wet scrubber recirculation flow rate and pH; and

c. The permittee is presumed to be in compliance with the 20% visible emissions standard and the 0.10 gr/dscf particulate emissions standard as long as the boilers burn natural gas.

Appendix E

Source Test Protocol and Acceptance

2024 COMPLIANCE TEST PROTOCOL FOR PERFORMANCE TESTING OF THE LAST NEWLY INSTALLED ROTOR CONCENTRATOR THERMAL OXIDIZERS AT MICROCHIP'S GRESHAM, OR FACILITY

PERMIT 26-3240-ST-01

Prepared for:
Microchip Technology, Inc.
21015 Stark Street
Gresham, OR 97030

Date Prepared:
January 31, 2025
Prepared by:

2340 W Braker Lane, Suite A
Austin, TX 78727

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APPENDICES

A Field Data Sheets and Example Calculations
B Standard Air Contaminant Discharge Permit

LIST OF ACRONYMS AND ABBREVIATIONS

acfm	actual cubic feet per minute
ASTM	American Society for Testing and Materials
cal	calibration (gases)
CO	carbon monoxide
CO_2	carbon dioxide
CH_4	Methane
dscfm	dry standard cubic feet per minute
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
FTIR	Fourier Transform Infrared
lb/hr	pounds per hour
lb/day	pounds per day
MDL	Minimum detection limit
MDC	Minimum detectable concentration
Microchip	Microchip Incorporated Technology
ml	milliliter
NIST	National Institute of Standards and Technology
NMNEVOC	Non-methane, non-ethane volatile organic compounds
O_2	oxygen
ppmv	parts per million by volume
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
RCO	Rotor Concentrator Outlet
RCTO	Rotor concentrator thermal oxidizer
Spectrum	Spectrum Environmental Solutions
THC	Total Hydrocarbon
TO	Thermal Oxidizer or Thermal Oxidizer Outlet
VOC	volatile organic compounds

1.0 INTRODUCTION

Microchip Technology Incorporated (Microchip) has contracted Spectrum to perform compliance testing on the last of the three newly installed Rotor Concentrator Thermal Oxidizer (RCTO) units located at their facility in Gresham, Oregon. These units were manufactured by Munters Corporation. This compliance testing will be completed in accordance with Permit 26-3240-ST-01.

The RCTO compliance testing requires measuring total volatile organic compound (VOC) emissions at each RCTO inlet and RCTO outlet (thermal oxidizer outlet (TO) and rotor concentrator outlet (RCO)). Since methane and ethane are not considered VOCs per EPA definition[1], the methane and ethane concentrations will be subtracted from the total hydrocarbon (THC) concentration as measured by EPA Method 25A (Flame ionization detector or FID). All THC concentrations will be measured as propane in accordance with EPA Reference Method 25A. Methane and ethane will be measured at each location using a Fourier Transform Infrared spectrometer in accordance with ASTM Method D6348-12. Additionally, volumetric flowrate will also be measured at each location in accordance with EPA Methods 1-2 and a modified EPA Method 3. The cumulation of data will be used to determine compliance with Microchip's air permit criteria as follows:

- 90% destruction removal efficiency (DRE) of VOCs when inlet loading to the RCTO is ≥ 90 ppmv (as propane) or
- A total outlet emission VOC concentration of ≤ 10 ppmv (as propane) when inlet loading to the RCTO is less than 90 ppmv (as propane).

It should be noted that the ≤10 ppmv (as propane) criterion is based on a flow weighted average of the TO and RCO. For reference, Microchip's air permit as issued in 2019 and the permit modification issued in June 2023 (Permit Number 26-3240-ST-01) are both provided in Appendix B. This test protocol was developed to satisfy the requirements of the 2023 permit modification, where it supersedes the 2019 permit, and the 2019 permit where the modification it is not applicable.

To determine the VOC DRE, VOC mass emissions will be determined at the inlet, TO and RCO of the RCTO units. This data will be used for the limitations prescribed in the Microchip Technology Standard Air Contaminant Discharge Permit (ACDP), Permit 26-3240-ST-01 Section 3.1 of the 2023 permit modification, which states:

3.1. VOC Emissions

The permittee must control Volatile Organic Compound (VOC) emissions from Building 1 and Building 2 manufacturing operations with rotor concentrator thermal oxidizers (RCTOs) that must each achieve a minimum 90% destruction removal efficiency (DRE) of VOCs entering the RCTOs when the inlet VOC concentration (measured as propane) is 90 ppmv or greater. If/when the inlet VOC

[1] The EPA definition of VOC excludes methane and ethane per 40 CFR Part 51 Subpart F (s) (1). https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-51/subpart-F/section-51.100

concentration falls below 90 ppmv, the outlet VOC concentration (measured as propane) must not exceed 10 ppmv.

The operating conditions of the facility and the RCTO unit during the compliance testing, the RCTO unit's parameters to be collected during the compliance testing, and requirements for this test plant and a resultant test report are listed in Microchip's 2023 permit modification, Section 6.1 (b), (c), (e)(i)(ii)(iii)(v), (d), (f), (g), (h), (i), and (j) which state:

6.1. Testing Requirements

The permittee must conduct a source test of the control devices as specified below: [OAR 340-212-0120]

b. Within 180 days after two of the new RCTO units are brought into normal operation the permittee must perform a performance test of each RCTO to determine the VOC DRE, unless an alternative date is approved by Oregon DEQ. Normal operation is defined when the RCTOs are fully operational and when VOC process exhaust is routed to two of the new RCTOs;

c. Source testing must be conducted while the facility is operating within 90% its normal operating capacity at the time of the test. Sampling must take place under worst case operating conditions observed during normal operations (i.e., redundant control devices should not be operating during testing);

d. Gas concentrations must be sampled at the inlet and outlet of each wet scrubber system and each RCTO to demonstrate the system's DRE. The source test report must include the DRE demonstrated during each test run as well as the average DRE for the three test runs. As an alternative, the permittee can sample only the outlet of the wet scrubber systems to demonstrate compliance with the 1 ppmv HF and HCl limitations as listed in Condition 3.2;

e. During each source test the following parameters must be monitored and recorded:
- *i. RCTO oxidizer and desorption chamber temperatures;*
- *ii. Pressure drop across concentrator wheel of the RCTO;*
- *iii. RCTO natural gas usage;*
- *v. Other facility/process operating parameters identified prior to the test.*

f. Only regular operating staff may adjust the combustion system or production processes and emission control parameters during the source test and within two hours prior to the tests. Any operating adjustments made during the source test, which are a result of consultation during the tests with source testing personnel, equipment vendors or consultants, may render the source test invalid;

g. A pretest plan for each source test required above must be submitted for approval to DEQ's Source Test Coordinator at the ODEQ Northwest Regional Office, at least 30 days prior to testing;

h. The reference test methods identified in the table below must be utilized in the source tests identified above. A test method modification/variance or substitution of an alternative test method must be pre-approved by the DEQ's Source Test Coordinator and

i. All tests must be conducted in accordance with the DEQ's Source Sampling Manual and with the pretest plan. All test data and results must be submitted to the Source Test Coordinator for review within 60 days after completion of the testing cycle unless an alternate submission date or extension is approved by DEQ.

j.

Reference Test Method	***Tested pollutant/parameter***
EPA 1&2	*Flow Rate*
EPA 3	*Dry Molecular Weight*
EPA 4 or ODEQ Method	*Moisture*
EPA 25A	*Total VOC*
EPA 26, 26A, 320 or ASTM D6348-12	*HF & HCl*

1.1 TEST PROGRAM OPERATIONS SUMMARY

A summary of the test program is provided in Table 1-1 below. A list of the parameters to be tested along with reporting unit is presented in Table 1-2. Testing will be performed in accordance with ODEQ and Environmental Protection Agency (EPA) test methodology with exception to the proposed deviations listed in section 3.2 of this Test Protocol.

Table 1-1. Test Program Operations Summary

Category	Description
Project Name	Compliance Testing of Microchip's New RCTO Units
Equipment Owner	Microchip Technology, Inc. 21015 Stark Street Gresham, OR 97030
Project Contact	Becky Kim Environmental Engineer Microchip Technology, Inc. 21015 Stark Street Gresham, OR 97030 (971)-266-7887
Equipment Tested	One Munters RCTO Unit
Equipment Location	Microchip Technology, Inc. 21015 Stark Street Gresham, OR 97030
Regulatory Agency	ODEQ
ODEQ Permit No.	26-3240-ST-01
Source Test Firm	Spectrum Environmental Solutions 2340 West Braker Lane, Suite A Austin, Tx 78758
Source Testing Project Manager	Steve Hall Phone (512) 587-1386 Steve@spectrumenvsoln.com

Table 1-2. Reporting Units of Parameters to be Tested

Parameter	Units	Location
Volumetric Flow Rate	dscfm, acfm	RCTO Inlet, Oxidizer Exhaust, Concentrator Exhaust
Moisture	Percent by Volume	RCTO Inlets, Oxidizer Exhaust, Concentrator Exhaust
O_2	Percent by Volume	RCTO Inlets, Oxidizer Exhaust, Concentrator Exhaust
CO_2	ppmv	RCTO Inlets, Oxidizer Exhaust, Concentrator Exhaust
Volatile Organic Compounds (VOC)	ppmv, lb/hr	RCTO Inlet, Oxidizer Exhaust, Concentrator Exhaust
Methane (CH_4)	ppmv	RCTO Inlet, Oxidizer Exhaust, Concentrator Exhaust
Ethane (C_2H_6)	ppmv	RCTO Inlet, Oxidizer Exhaust, Concentrator Exhaust

dscfm – dry standard cubic feet per minute
acfm – actual cubic feet per minute
lb/hr – pounds per hour
ppmv – parts per million by volume

2.0 FACILITY AND UNIT DESCRIPTIONS

2.1 FACILITY DESCRIPTION

Microchip's facility conducts semiconductor manufacturing operations and processes. Currently Microchip has two RCTO units that were brought online in the summer of 2024 and a third unit that was brought online in late 2024. The single old RCTO has been decommissioned. The final unit of the three newly installed Munters RCTO units will be monitored for compliance as a part of this testing campaign. Each RCTO is equipped with a single zeolite concentrator and thermal oxidizer operated concurrently. Microchip operates its facilities and RCTOs on a 365 x 24 schedule.

2.2 UNIT DESCRIPTION

Microchip owns and operates three newly installed RCTO units. The RCTOs are equipped with a single zeolite concentrator wheel followed by a thermal oxidizer. Figure 2-1 depicts normal operation of an RCTO unit.

The process operates as follows:

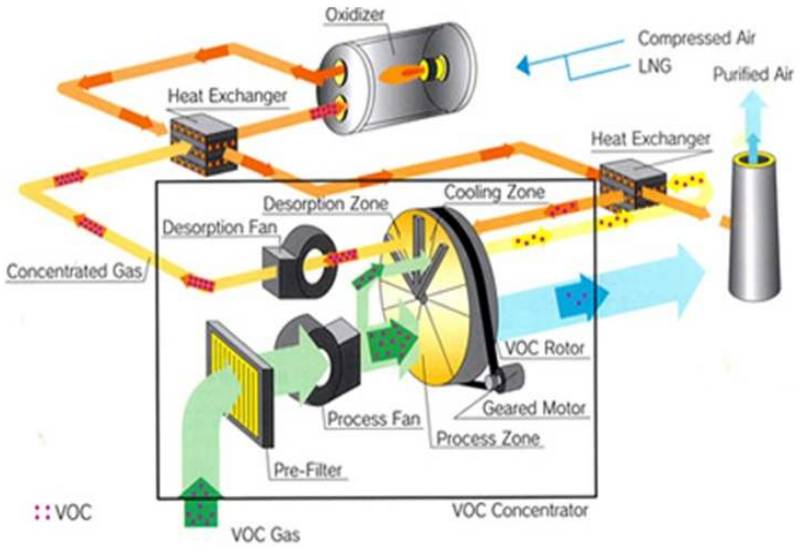
- Solvent-laden air is drawn through the rotor wheel where VOCs are removed from the air stream by adsorption onto the hydrophobic zeolite. After passing through the rotor, the cleaned air is discharged to a common exhaust line shared by the three RCTOs where it is then discharged to the atmosphere through one of five outlet stacks.

- The Zeolite rotor turns continuously and transports the adsorbed VOCs into a regeneration zone. In that zone, the VOCs are removed by a small heated air stream and the regenerated zeolite is then rotated back into the process air stream.

- The heated air is then passed into the thermal oxidizer combustion chamber, where it is further heated to approximately 1,400 °F (1,375 °F minimum), oxidizing the VOCs.

- The treated air is forwarded to the TO exhaust stack where it is discharged into the atmosphere.

Figure 2-1. Basic Design of Rotor Concentrator Thermal Oxidizer



2.3 UNIT OPERATION

The control systems will be operated under normal conditions during testing. Per Condition 6.1. of Microchip's Standard ACDP, compliance testing must be conducted while the facility is operating within 90% of its normal operating capacity at the time of testing. As part of a previous compliance testing campaign for Microchip for one RCTO unit, Microchip reported and verified that the facility was operating at approximately 90% capacity of the normal daily production for the previous 12-month period. Table 2-1 summarizes the average operating data recorded during that previous compliance testing campaign. The operating parameters to be recorded by Microchip during testing and submitted with the source test report are presented in Table 2-2.

Table 2-1. RCTO 1 Operating Parameters

RCTO ID	Date	Run	Pressure Differential ("H2O)	Natural Gas Usage (c ft^3)	Desorption Chamber Temperature (°F)	Oxidizer Temperature (°F)
RCTO 1	2/27/24	1	1.95	44	356	1423
		2	1.94	22	356	1423
		3	1.95	47	358	1424
Three-run average			**1.95**	**38**	**357**	**1423**

Table 2-2. Operating Parameters to be Recorded

Parameter	Units
RCTO Oxidizer Temperature	°F
Desorption Chamber Temperature	°F
Zeolite Differential Pressure	In. H_2O
Production Moves	Total Number
Natural Gas Usage	Cf

2.4 SAMPLING LOCATION

The exact sampling location and dimensions will be measured as part of the testing and provided in the final report. However, it is known that the RCO ports do not meet the EPA Method 1 criteria for upstream and downstream distances from flow disturbances. As such, the flow measurements will be performed in accordance with Section 11.5 of EPA Method 1 using a 3-dimensional probe. The number of traverse points will be determined onsite based on actual measurements in accordance with EPA Reference Method 1 and to be used solely for gas flow measurements. All inlet THC concentration measurements may be extracted using a small (3/8”) port at the inlet into the RCTO.

3.0 TECHNICAL APPROACH

The number of samples and sample duration are designed to meet applicable permit requirements. Testing will be performed during normal RCTO operations and is expected to be completed in three days. Three THC analyzers, three FTIRs, and three heated extractive systems will be utilized to perform the monitoring. The three RCTO sources (Inlet, RCO and TO) for each unit will be analyzed for total hydrocarbons (as propane) using three THC analyzers. The THC analyzers will provide a total hydrocarbon concentration and the FTIR will provide methane and ethane concentration at each location. Three FTIRs will be used to simultaneously monitor the three gas streams for methane, ethane, CO_2 and moisture. CO_2 and moisture concentrations as determined by FTIR will be used for calculation of molecular weight of the gas in lieu of EPA Methods 3 and 4, respectively. All gas samples will be delivered to the THC analyzers and the FTIR on a hot, wet basis using heated sample lines (250 F˚or higher) and the compliance test will consist of three, 1-hour runs. The methane and ethane concentrations from all sources will be subtracted from their respective THC concentrations to determine the total VOCs concentration (as propane) using Equation 1 below:

$$VOC\ (ppm\ as\ propane) = THC - \left(CH_4(ppm) * \frac{1}{3}\right) - \left(C_2H_6(ppm) * \frac{2}{3}\right) \qquad \textbf{Equation 1}$$

Should the concentrations of methane and/or ethane fall below the detection limit of the FTIR and any data point, 0 ppm will be used to calculate the average concentration during the run.

Following a modified EPA Method 3, the O_2 concentration will be analyzed at each location. A grab sample with be collected from the Inlet, TO and RCO ducts and delivered to a Testo combustion gas analyzer and quantified for O_2 concentration. This will be performed as part of the flow measurements at each RCTO location for each run and used in the molecular weight calculation for the gas flowrate. The Testo response will be verified pre-test using nitrogen (zero) and ambient air (20.9%) prior to use. Since the O_2 data is only to be used for molecular weight of the gas, this approach is method compliant.

In accordance with the ASTM D6348-12 method, Spectrum will perform an analyte spike of the target analyte to demonstrate the FTIR is accurately quantifying the analyte(s) and the extractive system is properly transporting the gas samples without loss. Spectrum will perform the analyte spike using methane (CH_4) at each sample location (Inlet, TO, and RCO). This QA spike is a matrix spike where a known volume of spike gas is injected into the extracted sample system, at no more than 10% of the sampling rate. The CH_4 spike will serve as a surrogate for ethane, CO_2 and moisture which are also quantified by each FTIR. A calibration transfer standard (CTS) gas will be injected to the FTIR before commencement of testing and at the end of the 3-run test. The CTS may be injected through the sample system to also demonstrate a leak check as a sample system, that is slightly under vacuum, would not recover the CTS accurately were there a significant leak.

Three THC analyzers will be employed using two distinct measurement ranges. Owing to the anticipated low concentrations of VOCs at the RCO and TO, a lower range of 0-12 ppm (as propane) will be utilized. Conversely, a higher range of 0-250 ppm (as propane) will be employed at the RCTO inlet to accommodate the expected elevated VOC concentrations. All calibration gases will adhere to the EPA 25A requirements

for their respective measurement ranges. A 3-point linearity check will be conducted at the beginning of the test for each THC analyzer using EPA Protocol 1 calibration gases. A drift check will also be conducted after each test run using a zero and a midpoint calibration gas.

A single volumetric flowrate measurement will be performed at each of the RCTO locations during the test run. Stack traverse points will be determined, and a gas velocity measured at each point, in accordance with EPA Methods 1 & 2. Moisture (per FTIR) will be measured at the TO and RCO exhaust and included in the volumetric flow determination.

3.1 SAMPLING MATRIX

The sampling matrix, including the methods used, number of runs, analytical device, etc., is presented in Table 3-1 for the compliance test. Using this aggregate of measurements, a VOC mass in and combined mass out of the RCTOs will be determined and subsequently used for calculation of VOC DRE.

Table 3-1. Performance Testing Sampling Matrix

Location	# of Runs	Sample/Type Pollutant	Sampling Method	Run Time (hr)	Analytical Method
Thermal Oxidizer Exhaust	3	Volumetric Flow Rate	EPA 1-2	NA[1]	Pitot/Temp
	3	Moisture[2]	ASTM D6348-12	1 hr	FTIR
	3	O_2	EPA 3	1 hr	Calculation
	3	THCs	EPA 25A	1 hr	Flame Ionization
	3	Methane, Ethane, CO_2	ASTM D6348-12	1 hr	FTIR
Concentrator Exhaust	3	Volumetric Flow Rate	EPA 1-2	NA[1]	Pitot/Temp
	3	Moisture	ASTM D6348-12	1 hr	FTIR
	3	O_2	EPA 2	1 hr	Assume 29g/mol[3]
	3	THCs	EPA 25A	1 hr	Flame Ionization
	3	Methane, Ethane, CO_2	ASTM D6348-12	NA[1]	FTIR
Inlet	3	Volumetric Flow Rate	EPA 1-2	NA[1]	Pitot/Temp
	3	Moisture	ODEQ Method 4	1 hr	FTIR
	3	O_2	EPA 2	1 hr	Assume 29g/mol[3]
	3	THCs	EPA 25A	1 hr	Flame Ionization
	3	Methane, Ethane	ASTM D6348-12	NA[1]	FTIR

[1]Not Applicable - Sample time is not fixed for flow measurements.
[2]Moisture samples will be collected by FTIR in 1-minute increments.
[3]Per EPA Method 2 "For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0".

3.2 METHOD MODIFICATIONS

A number of sampling and analytical method deviations are proposed for use during the Performance Test of Microchip's RCTO. The requested method modifications and the justification for each are as follows:

1. Spectrum is proposing using FTIR results in accordance with ASTM D6348-12 for moisture and CO_2 concentration in lieu of EPA Methods 3 and 4 at each sample location. Since the FTIR is already onsite and can measure moisture and CO_2 concentration every minute, it is logical to use this data in lieu of redundant measurements.

2. Spectrum will perform the ASTM required QA Spike using methane which will be used as a surrogate for ethane, moisture, and CO_2. Methane was chosen as it is likely to be present at the locations whereas ethane will likely be below the detection limit of the FTIR.

3. Although not necessarily a deviation, Spectrum is requesting to calculate the O2 concentration stoichiometrically using the quantified CO2 results as measured by the FTIR at each location.

4.0 SAMPLING AND ANALYTICAL METHODS

Source emission testing will be performed according to EPA, ODEQ or ASTM reference methods. The test methods are available online and discussed in the following subsections.

4.1 EPA METHOD 1: SAMPLING AND VELOCITY TRAVERSE POINT LOCATIONS

EPA Method 1, "Sampling and Velocity Traverse Point Locations," will be used to position the velocity traverse point locations at the sample locations. Additionally, EPA Method 1 will be used to determine the number of traverse points for flow at each location. Additionally, it is known that the RCO sample ports will not meet Method 1 minimum requirements. Microchip has notified ODEQ of this and has agreed to perform the flow measurements at this location in accordance with section 11.5 of Method 1 using a 3-dimensional probe and manometer setup. The Method 1 measurements will be documented on their respective data sheet of which an example is presented in Appendix A.

4.2 EPA METHOD 2: DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)," will be used to measure exhaust gas velocity. A Type S Pitot tube, constructed according to Method 2 criteria will be connected to either an inclined or electronic manometer (e.g. Grey Wolf or Shortridge manometer). The Pitot tube will be inserted into the gas stream at the pre-determined traverse points and the velocity, as a function of differential pressure (delta p), recorded. The effluent gas temperature will be recorded using a Type-K thermocouple. The Method 2 measurement will be documented on a data sheet of which an example is presented in Appendix A.

4.3 MOLECULAR WEIGHT DETERMINATION

For the TO exhaust test location, the FTIR-measured CO_2 concentration will be used to calculate the oxygen (O_2) level stoichiometrically using the equation provided by ODEQ:

$$O_2 \text{ Concentration (\%)} = 20.95 - (CO_2 \text{ Concentration} - \text{Bkg } CO_2) \,/\, (\text{Ratio (Max } CO_2/\text{Theo Bkg } O_2)$$

$$20.95 - (CO_2 \text{ Concentration} - 0.04)/0.56024292$$

Where;

Fuel Type is natural gas (CH_4)
The theoretical background of CO_2 = 0.04%
The theoretical background of O_2 = 20.95%
Max Theoretical CO_2% = 11.737%
Ratio Max Theo CO_2/Bkg Theo O_2 = 0.56024292

This approach has been accepted by ODEQ in previous test programs. For the inlet and concentrator exhausts, a dry molecular weight of 29.0 g/mol will be used as stated in EPA Method 2. This approach has been accepted by ODEQ in previous test programs and is supported by the fact that inlet and concentrator exhaust streams of the RCTOs are essentially ambient air drawn from the factory, the tools, and hoods that contribute to the organic exhaust.

4.4 ASTM D6348-12: Determination of Methane, Ethane, Moisture and CO_2 Emissions From Stationary Sources

Three FTIRs will be used during the RCTO performance test to determine the concentrations CH_4, C_2H_6, CO_2 and moisture of each gas stream. The analyte concentration used in all calculations will be the average from three, 1-hour runs. An analyte spike recovery test will be performed using methane at each sample location. This is further described in Section 3.0 of this document, Annex A5 of the ASTM method, and Table 5-1.

4.5 EPA Method 25A: Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

THC sampling will be conducted according to EPA Method 25A using a VIG Model 20/2 or equivalent THC analyzer. Discrete 1-minute THC concentrations (as propane) will be collected and reported. Field calibrations will be conducted using EPA Protocol 1 propane in air standards.

The samples will be extracted from the sources through heated sample lines approximately 100-200 feet long. The sample lines will be maintained at approximately 250°F during sampling. The average of each 1-hour run will be used in all calculations and reported as ppm (as propane) in the final report.

Calibrations of the instrumentation will be conducted by injecting calibration gas into the sampling system before and after each test run as stipulated in the method. A high, mid, low, and zero gas will be used for calibrations. Certified calibration gas values will be recorded on the field data sheets. EPA Protocol 1 calibration gases in current certification will be used for all calibration purposes. Copies of the certificates will be included in the final report. Should a drift fail, the data between the failed drift and the previous passing drift will be invalid and retested.

5.0 QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

The Spectrum QA/QC program for source test projects includes the following areas of focus: sampling, sample analysis, documentation, equipment maintenance, calibration, data reduction, and reporting. The program specifies procedures that ensure that work performed in each one of these areas is performed in a manner consistent with providing emission test data that are accurate and legally defensible. This section provides details on the procedures that are followed to accomplish this assurance of data quality. Spectrum QA objectives for precision and accuracy are based on the Reference Methods or published precision and accuracy data.

The usefulness and validity of all data are contingent upon 1) the results being representative of the source being tested, and 2) comparable with other results (either calculated or directly measured) generated by Spectrum, Microchip , or another source test organization. Spectrum has adopted the objective that all measurements will be representative and comparable. These objectives will be met by performing tests while the process is operating under known and documented conditions, following published reference methods, using standard data reduction techniques and reporting formats, and proper training of personnel.

5.1 DATA PRECISION, ACCURACY, AND COMPLETENESS

The QA/QC procedures described in this section are provided to ensure data precision, accuracy, and completeness. All data sheets and calculation spreadsheets used as part of this project will be controlled. Should any edits to controlled documents be required, they must be reviewed for accuracy and require signature approval by a Spectrum QA Officer. It is the responsibility of each project team member to: 1) complete all pertinent sections of the data sheets, 2) make comments, where appropriate, 3) notify Project Managers of sampling difficulties that may lead to invalid data, and 4) follow chain-of-custody procedures for all samples, data sheets, and documents. Additionally, it is the responsibility of the FTIR operator(s) to correctly perform all pertinent ASTM QA procedures, document (electronically or other) all issues and sampling narratives and perform validation of a select set of spectra from the testing.

Each test report is reviewed before release by a designated independent technical reviewer. Procedures, results, and data are reviewed to verify adherence to method requirements, that proper procedures were followed, and that calculations were performed properly. These reviews are conducted independently from any project-related data reduction and reporting activities.

5.2 TRAINING

Training is an ongoing process for all Spectrum personnel. Personnel completing any task will be properly trained in such task, or be under direct supervision of someone trained in the task. There are certain skills that all technical personnel are expected to acquire and perform professionally and safely. All source test personnel must review the applicable portions of the following technical documents before being involved in any capacity in any program:

- EPA 40 Code of Federal Regulations Part 60;
- Developed SOPs;
- EPA QA Handbook for Air Pollution Measurement Systems, Volume III; and
- Air Pollution Districts' Specific Source Test Methods.

In addition to the general awareness training discussed previously, each person responsible for the performance of a test procedure is required to demonstrate proficiency in the method involved. This demonstration will be accomplished through: 1) reading the source test method involved, 2) reading the manual of the equipment being used, 3) reading and understanding of the SOP associated with each method and 4) demonstrating aptitude and knowledge of the methodology via performance under a mentor or field lead(s). Qualified testing individuals are documented on a per method/SOP basis. Information related to training for specific methods is provided below.

- Monitoring of Emissions: EPA Methods
    1. Understanding of the sampling schematic drawing;
    2. Understanding of the sampling systems;
    3. Leak checks;
    4. Analyzer adjustments and calibrations;
    5. Sample system bias calibration checks;
    6. Strip chart recorder operation and documentation;
    7. Data Acquisition System operation and access;
    8. Gaseous stratification checks; and
    9. Correction for sample system bias and analyzer drift.
- Sampling Location Criteria: EPA Method 1
    1. Identify sampling locations;
    2. Inspect inside of duct to identify any obstructions;
    3. Determine upstream and downstream distances;
    4. Perform stack area calculations;
    5. Determine number and location of sample points; and
    6. Perform cyclonic flow checks and determine sample location acceptability.
- Stack Gas Velocity and Volumetric Flow Rate: EPA Method 2
    1. Assemble pitot tube/thermocouple;
    2. Perform leak checks;
    3. Record differential pressure and temperature;
    4. Record static pressure;
    5. Record barometric pressure; and
    6. Calculate stack gas velocity and volumetric flow rate.
- Total Organic Carbon Emissions Testing: EPA Method 25a
    1. Assemble sampling system;
    2. Light the FID;

3. Verify data recording times and data flow;
4. Calibration of analyzer;
5. Perform calibration error check;
6. Perform response time check (also constitutes a leak check);
7. Collect test data;
8. Perform post-run drift determination.

- FTIR Emissions Monitoring: ASTM D6348-12, Spectrum Developed SOP, and Protocol
  1. Perform complete FTIR operational checks in Spectrum laboratory;
  2. Assemble sample extractive system;
  3. Perform leak checks;
  4. Collect FTIR background;
  5. Collect "zero" FTIR spectrum;
  6. Perform ASTM required QA/QC; and
  7. Perform routine spectral analysis during and after collection.

5.3 SAMPLING PROCEDURES

Spectrum maintains complete copies of federal, state, and local regulatory agency source test methods that serve as the final authority on sampling procedures. Spectrum strives to follow the appropriate source test methods whenever possible. Source test methods are listed in all Source Test Protocols for review by both clients and regulatory agencies.

The steps listed below are taken to ensure that the source test method sampling procedures are followed:

1. Training of personnel;
2. Copies of reference methods are available to all personnel and are taken to every job site;
3. Appropriate selection of Project Managers; and
4. QA reviews of test programs.

Occasionally, due to the sample location limitations, or other factors, variations from the standard methods will sometimes be necessary. Any variations from the methods will be assessed to determine the effect that the variation will have on data quality. On all occasions, variations will be included in the Source Test Protocol and receive approval prior to implementation of the program. Any variations will be clearly documented in the source test report.

5.4 CHAIN-OF-CUSTODY PROCEDURES

The Project Manager collects and maintains possession of all data sheets or keeps them in secure storage. Upon return to the office, a copy of all field data sheets is made and placed in a locked file. The original field data sheets are used for report preparation and are kept with the final report. Data sheets, test plans, and reports are kept in files, organized by client and project.

5.5 CALIBRATION PROCEDURES AND FREQUENCY

All major equipment components are calibrated according to the procedures established by EPA which are presumed to meet any that may be specified by ODEQ or Microchip. When regulations differ, the stricter of the regulation will be followed. Table 5-1 summarizes the procedures and frequency of the calibration performed on the major equipment components.

5.6 EXTRACTIVE SAMPLING SYSTEM EQUIPMENT QUALITY CONTROL

The calibration gases are certified according to EPA Protocol 1, certified to an analytical accuracy of ±2 percent, certified to an accuracy of ±5 percent for particularly reactive or corrosive compounds, or certified to an accuracy of ±5 percent where custom blends cannot be manufactured with a higher accuracy.

On-site calibration checks include THC calibration error, THC analyzer drift checks, n, FTIR analysis accuracy and FTIR optical alignment checks.

5.7 PERFORMANCE AND SYSTEM AUDITS

The appropriate regulatory agency will be notified of all scheduled compliance test programs. The regulatory agency will be allowed the opportunity to perform side-by-side tests and/or observe the sampling test program. Spectrum will cooperate fully in any pre-arranged regulatory agency audit.

5.8 EQUIPMENT MAINTENANCE

Routine and preventative maintenance is performed on all major sampling equipment. These procedures are in addition to method-specific requirements. Table 5-2 summarizes the equipment maintenance schedule. This preventative maintenance schedule should minimize equipment failures and downtime in the field. On the occasion where equipment does break down in the field, a replacement is used or the equipment will be repaired in the field.

Table 5-1. Calibration Requirements for Source Test Sampling Equipment

Sampling Equipment	Calibration Frequency	Calibration Procedure	Acceptable Calibration Criteria
Analyzer Span	As needed	Before and after each test	Measured emissions between 20-100% of span
Extractive (THC)	Before each test series	4-point calibration error check	± 5% of certified calibration gas value
Extractive (THC)	Before and after each test run	Analyzer drift test	≤ 3% of Span
Extractive (THC)	Before each test series	Response Time Test	None Stated
Extractive FTIR	Minimum of daily during testing	Calibration Transfer Standard (CTS)	± 5% certified calibration gas value
FTIR Mechanical Response Time	Once per test campaign unless extractive system is altered	Flow CTS through entire sample system	None stated
FTIR Equilibration Response Time	Once per test campaign unless extractive system is altered	Flow analyte through entire sample system	None stated
FTIR System Recovery Check (analyte matrix spike)	Once prior to testing and at the conclusion of the test campaign.[2]	Annex A5 of the ASTM D6348 Methodology	± 30% recovery
FTIR System Zero	Once per test campaign unless extractive system is altered	Direct N_2 through the entire sample system	None stated
Extractive Sampling	During set-up at each RCTO	Leak Check	Successful recovery of calibration gas sent up and down the extraction line. or <0.25 lpm on FTIR sample system or <0.20 cfm or <4% of sample system volume
Temperature Sensors	Semi-annually	3-point calibration vs. NIST traceable standard	Agree within ±1.5% absolute
Pitot Tubes	Prior to first field use	Dimension calibration	Meets Method 2 dimensional criteria

[2] ASTM D6348-12 only requires an initial spike assuming all sample matrices are similar. However, ODEQ has historically required an analyte spike at the conclusion of testing.

Table 5-2. Test Equipment Maintenance Schedule

Equipment	Acceptance Limits	Frequency of Service	Methods of Service
Pump	1. Absence of leaks 2. Ability to draw within reported specifications	Every 500 hours of operation or 6 months, whichever is less	Visual inspection
Flow Meter	1. Free mechanical movement 2. Absence of malfunction	Every 500 hours of operation or 5 months, whichever is less	1. Visual inspection 2. Clean 3. Calibrate
Emission Analyzers	1. Absence of malfunction 2. Proper response to zero, span gas	As recommended by manufacturer	As recommended by manufacturer
Sampling System	Absence of leaks	Depends on nature of use	1. Change filters 2. Change gas dryer 3. Leak check 4. Check for system contamination
FTIR Pressure Sensor	± 2% f.s.	Checked in-lab as part of prep work for each project	Adjust pressure offset to remain consistent with Hg manometer or local barometric pressure
Detector Linearity	Not specified	Checked in-lab as part of prep work for each project	Re-set linearity
Resolution Checks	Not specified	Checked in-lab as part of prep work for each project	Clean/replace optics
Line Position	± 15% of resolution	Checked in-lab as part of prep work for each project	Clean/replace optics – verify laser operation
Sampling Line	Sampling degradation after each test less than 1% of test series		Clean with solvent. Flush with gas until dry.

5.9 DATA REDUCTION, VALIDATION, AND REPORTING

Data reduction generally occurs in two phases. Phase I consists of preliminary data reduction on the job site. On-site data reduction may be performed by sampling technicians or the Project Manager. Preliminary calculations may include velocity, moisture, stack flow, emission measurements, and DRE results. Preliminary test results are normally available prior to leaving the job site. Calculations are performed manually, with a calculator or computer. Whenever possible, controlled spreadsheets are used to reduce data.

The second phase of data reduction occurs during the preparation of the source test report. All data are reduced, entered into controlled spreadsheets, or checked for accuracy from the prior entry. Final results are generated after the Project Manager has reviewed the data entry, calculations, and reporting units. The

standard calculations are available in the test method references and in sample calculations included in the report appendices.

All data, data entry, and calculations are double-checked by the originator and reviewed by a second person. Reviews can include re-calculation of results, data entry checks, and calculation audit of known and accepted data sets using the existing spreadsheet. Spectrum promotes the use of a standard reporting format. The format has been developed to be effective in documentation of source test projects.

Spectrum uses audited and controlled spreadsheets to calculate all source test results. Data reduction QA is simplified to ensure proper numerical data entry.

The final report will include the test results of all parameters measured in comparison to the applicable permit limits. Facility process data detailing unit operation during testing will also be included in the final report.

Spectrum promotes the use of a standard reporting format. The format has been developed to be effective in documentation of source test projects.

6.0 REPORTING

6.1 TEST REPORT FORMAT

The Test Report will include the applicable information as described in Appendix A-2 of the ODEQ Source Sampling Manual Volume 1. The Spectrum example source test report format generally consists of the following:

- Cover Page;
- Table of Contents;
- Executive Summary;
- Introduction;
- Equipment and Process Description;
- Sampling Methods and Analytical Procedures;
- Test Results and Test Critique;
- QA/QC; and
- Appendix data (i.e., example calculations, field data sheets, test results, source test results, preliminary data and calculation sheets, laboratory data, and QA/QC data).

The Introduction will include applicable rules, permit conditions, and the comparison source test data computed to satisfy permit requirements. The test critique will also include a summary of the test events and a detailed account of any problems encountered during the testing. A brief equipment and process description will be included in the final report, indicating equipment operating parameters during the testing. A simple schematic of the process will show all sampling locations, including upstream and downstream disturbances.

All sampling and analytical procedures will be described specifically detailing all aspects of sampling and analysis. Diagrams of test equipment will be shown.

The appendix to the final report will include complete raw field data, including production data indicative of the testing interval, lab analysis, and test results. All calculations will be shown. The appendix will also contain current calibration data for all applicable equipment and calibration gases used for the testing.

6.2 DATA REDUCTION

Spectrum uses controlled spreadsheets that have been audited for accuracy to calculate all test results. Data reduction QA is simplified to ensure proper numerical data entry. The final report will include the test results of all parameters measured in comparison to the applicable permit limits. Facility process data detailing unit operation during testing will also be included in the final report.

7.0 PERSONNEL RESPONSIBILITIES AND TEST SCHEDULE

7.1 TEST SITE ORGANIZATION

Spectrum will perform all FTIR analysis, THC measurements and flow measurements associated with this compliance test.

Steve Hall will serve a dual role as project manager and principal investigator for the project. Alex Bellon and Sean Springer will share the principal investigator role with Steve depending on schedules. In this role Steve, Sean, and Alex will be the leads onsite and will communicate the test progress and any sampling issues encountered onsite. Dr. Paul Garrett, Kiersten Barnett, or James Draeger will also serve as a project scientist and will provide support throughout testing.

Several pre-test preparations are required to be in place before commencement of the compliance testing. This section discusses what is required from the facility for successful the testing occur.

7.1.1 SERVICES PROVIDED BY FACILITY

Microchip will record process operations data during testing. A copy of this data will be included in the test report.

7.1.2 ACCESS TO SAMPLING SITES

The facility will provide safe access to the sampling locations. Spectrum will inspect the proposed sampling locations and determine that they are acceptable.

7.2 TEST SCHEDULE

A test date will be arranged following ODEQ approval of the test protocol. The RCTO compliance testing is currently anticipated to be performed on March 26, 2025. Testing is expected to be performed over a single day with a 2nd day reserved for contingency.

Appendix A

Field Data Sheets and Example Calculations

SAMPLED VOLUME OF METERED GAS SAMPLE, DRY STANDARD CUBIC FEET
Vmstd = [(Tstd + 460)/Pstd] * Y * Vm * (Pbar + Delta-H/13.6) / (460 + tm)
= [60 + 460)/29.92] * 1.000 * 37.866 * (28.44 + 1.65/13.6) / (460 + 80.0)
= 34.80773

VOLUME OF WATER VAPOR, STANDARD CUBIC FEET
Vwstd = 0.04707 * Vlc * (460 + Tstd) / 528
= 0.04707 * 1073.9 * (460 + 60) / 528
= 49.78259

MOISTURE CONTENT, PERCENT BY VOLUME
%H2O = Vwstd / (Vwstd + Vmstd)
= 49.783 / (49.783 + 34.808)
= 58.851

DRY MOLE FRACTION, LB-MOLE/LB-MOLE
Mfd = 1 - %H2O / 100
= 1 - 58.9 / 100
= 0.41149

DRY MOLECULAR WEIGHT OF FLUE GAS, LB/LB-MOLE
Md = (%CO2 * (fwtCO2/100) + (%O2 * (fwtO2/100))) + ((100-%CO2-%O2) * (fwtCO&N2/100))
= (0.00 * (44/100) + (20.90 * (32/100))) + ((100-0.00-20.90) * (28/100))
= 28.836

WET MOLECULAR WEIGHT OF FLUE GAS, LB/LB-MOLE
Ms = (Md * Mfd) + (fwtH2O) * (%H20/100)
= (28.84 * 0.411) + ((18.0) * (58.85/100))
= 22.459

ABSOLUTE FLUE GAS PRESSURE, INCHES MERCURY
Ps = Pbar + (Pg/13.6)
= 28.4 + (-0.44/13.6)
= 28.41

FLUE GAS VELOCITY AT SAMPLE POINT, FEET PER SECOND. FOR EXAMPLE, POINT N-8
vp = 2.9 * Cp * SQRT[dP * (460+ts) * (29.92/Ps) * (28.95/Ms)]
= 2.9 * 0.84 * SQRT[0.18 *(460+100) * (29.92/28.4) * (28.95/22.5)]
= 28.50

AVERAGE FLUE GAS VELOCITY, FEET PER SECOND
vs = ∑(vp at each point)/Number of Traversing Points
= (28.50 + 28.50 + 32.18 + …)/16
= 27.24

FLUE GAS VOLUMETRIC FLOW RATE, ACTUAL CUBIC FEET PER MINUTE (ACFM)
Q = (60/144) * vs * A
= (60/144) * 27.24 * 153.9
= 1747

FLUE GAS VOLUMETRIC FLOW RATE, WET STANDARD CUBIC FEET PER MINUTE (WSCFM)

Qws = Q * (Tstd+460) / (ts+460) * (Ps/Pstd)
= 1747 * (60+460) / (100+460) * (28.41/29.92)
= 1541

FLUE GAS VOLUMETRIC FLOW RATE, DRY STANDARD CUBIC FEET PER MINUTE (DSCFM)

Qsd = Qws * Mfd
= 1541 * 0.411
= 634

Wet to Dry Correction (for THC)

PPM, dry = PPM / (1 - (Measured% Moisture / 100))

Conversion of THC to VOC (subtraction of methane concentration from THC results)

THC concentration (ppmv) - (CH_4 concentration (ppmv)/3) - (C_2H_6 concentration (ppmv)*2/3) = VOC Concentration (ppmv)

CEMS Operation Log

Project Name	**Page of**
Project Number	**Operator**
Facility	**Date**
Source	

Time	Activity	Analyzer Response						Sample Flow Rate
	Turn on Analyzers [1]	--	--	--	--	--	--	--

Comments

[1] "Turn On Analyzers" is to document sufficient warm-up time. If applicable, "yesterday" is an accepta ble entry.

Project	Page of
Project Number	Operator
Facility	Date
Source	

Calibration Gases

Component(s) [1]	Supplier [2]	Concentration(s)	Cylinder ID

[1] Indicate multi-component standards appropriately

[2] Code: AG-Airgas; AL-Air Liquide; S-Scott; P-Praxair

Instrument Identification

Analyte	Manufac-turer [3]	Model Number	Serial Number	Instrument Name

[3] Code: T-Thermo; W-Western; C-California; S-Servomex; O-Omega

Calibration Drift

Project Name: _____ **Monitor Make:** _____

Project Number: _____ **Monitor Model:** _____

Location: _____ **Monitor SN:** _____

Source: _____ **Span:** _____

	Day	Date	Time	Calibration Value	Monitor Response	Difference	Percent of Span
Zero/Low Level	1						
	2						
	3						
	4						
	5						
	6						
	7						
High Level	1						
	2						
	3						
	4						
	5						
	6						
	7						

	Cylinder Number	Actual Value
High		
Zero/Low		

Method Performance Checks

Activity	Method	Criterion	Initials
Span Selection	3A, 6C, 7E, 10	Emissions between 20% and 100% of calibration span	
	25A	Span 1.5-2.5 times the emission limit; if no emission limit, span 1.5-2.5 times expected level	
Calibration Gas Selection	3A, 6C, 7E, 10	Protocol gas; calibration span, 40-60% of calibration span, and <20% of calibration span (or zero gas)	
	25A	Protocol gas: 25-35%, 45-55% and 80-90% of span, zero grade air	
Calibration Error	3A, 6C, 7E, 10	Span gas within ±2.0% of calibration span	
		Mid-range gas within ±2.0% of calibration span	
		Zero gas within ±2.0% of calibration span	
	25A	Low-range gas within 5% of certified value	
		Mid-range gas within 5% of certified value	
		Span gas within 5% of certified value	
Converter Check	7E	≥90% converter efficiency	
System Bias Check	3A, 6C, 7E, 10	Gas through system agrees with calibration error value for that gas within ±5.0% of calibration span	
Response Time	3A, 6C, 7E, 10, 25A	No criteria, evaluated to determine duration at sample points	
Sample Flow Rate	3A, 6C, 7E, 10	Stable sample flow rate within 10% of flow rate established during system response time check and bias check	
3 Point Stratification Check [2,3]	3A, 6C, 7E, 10	± 5% of mean at each point – single point ± 5-10% of mean at each point – 3 points > ± 10% of mean at each point 12 points	
Post-Test Calibration Drift Check	3A, 6C, 7E, 10	Selected gas reading within ±3.0% of calibration span of pre-test reading	
		Zero gas within ±3.0% of calibration span of pre-test reading	
	25A	Selected gas reading within ±3% of span of pre-test reading	
		Zero gas within ±3% of span of previous reading	
Hourly Calibration Drift Check	25A	Selected gas reading within ±3% of span of pre-test reading	
		Zero gas within ±3% of span of previous reading	

[2] The stratification check criteria do not apply to RATA.

[3] The stratification check is not required for stacks or ducts <4 inches in diameter

Method 1 – Circular Duct – Determination of Traverse Points

Project _____

Project Number _____

Facility _____

Source _____

Operator _____

Date _____

□ Velocity Only □ Isokinetic Sampling	Upstream Distance (ft/in) _____ □ Measurement □ Plant Information
Number of Ports to be sampled _____	
Duct Diameter (in) _____ □ Measurement □ Plant Information	Downstream Distance (ft/in) _____ □ Measurement □ Plant Information

Total number of Traverse Points (from Figure 2 (velocity) or 1 (all isokinetic sampling))	
Number of traverse points per port	
Port Depth	

Traverse Point	Percent of Diameter	Distance from Wall [4] (in)	Marking Location (in)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Traverse Point	Percent of Diameter	Distance from Wall (in)	Marking Location (in)
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

[4] According to Method 1, for stacks between 12 and 24", no point may be within ½ inch of the wall. For stacks greater than 24", no point may be within 1 inch of the wall.

Determination of Cyclonic Flow
Preliminary Velocity/Temperature Traverse
EPA Methods 1 and 2

Project _____ Console (or Temperature Readout) ID _____

Project Number _____ Barometric Pressure (" Hg) _____

Facility _____ Elevation (Relative to Barometer) (ft) _____

Source _____ Static Pressure (" wc) _____

Operator _____

Date _____

Time _____ **Pitot Tube Leak Check**

Pitot Tube No. _____ Initial (+) _____ (-) _____

PTCF _____ Final (+) _____ (-) _____

Traverse Point	Yaw Angle (°)	Velocity Head (ΔP) (in. wc)	Temperature (°F)

Traverse Point	Yaw Angle (°)	Velocity Head (ΔP) (in. wc)	Temperature (°F)

Average Yaw Angle: _____.(This is the average of the absolute value of the measurements)

If the average yaw angle exceeds 20°, Method 2 is not applicable for the determination of gas velocity.

Method 1– Determination of Cyclonic Flow

Project _____

Project Number _____ Pitot Tube No. _____

Facility _____ PTCF _____

Source _____ **Pitot Tube Leak Check**

Operator _____ Initial (+) _____ (-) _____

Date _____ Final (+) _____ (-) _____

Time _____

Traverse Point	Yaw Angle (°)

Traverse Point	Yaw Angle (°)

Average Yaw Angle: _____.(This is the average of the absolute value of the measurements)

If the average yaw angle exceeds 20°, Method 2 is not applicable for the determination of gas velocity.

Velocity/Temperature Traverse
EPA Method 2

Project _____ Pitot Tube No. _____

Project Number _____ PTCF _____

Facility _____ Console (or Temperature Readout) ID _____

Source _____ Barometric Pressure (" Hg) _____

Operator _____ Elevation (Relative to Barometer) (ft) _____

Date _____ Static Pressure (" wc) _____

Time _____ **Pitot Tube Leak Check**

Condition _____ Initial (+) _____ (-) _____

Run _____ Final (+) _____ (-) _____

Traverse Point	Velocity Head (ΔP) (in. wc)	Temperature (°F)

Traverse Point	Velocity Head (ΔP) (in. wc)	Temperature (°F)

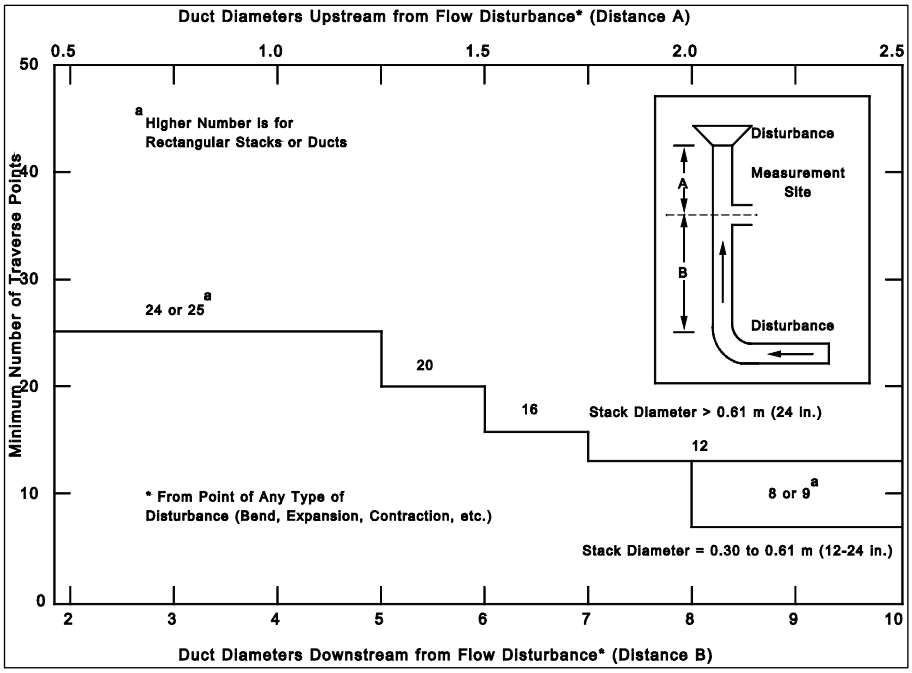


Figure 1 - Traverse Points for Isokinetic Sampling

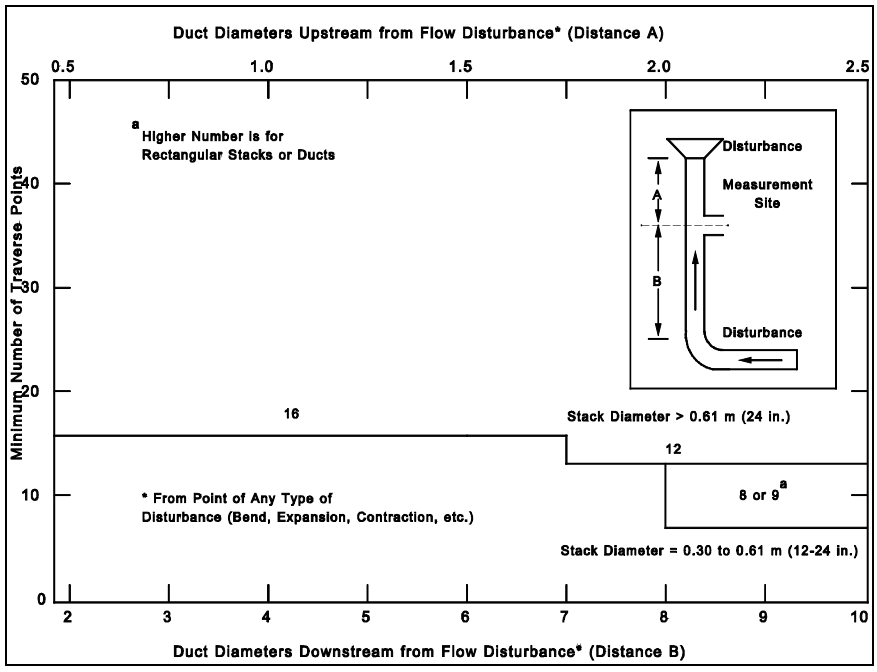


Figure 2 - Traverse Points for Velocity Determination

Traverse Point Number on a Diameter	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												99.9

Figure 3. Location Of Traverse Points In Circular Stacks

Appendix B

Standard Air Contaminant Discharge Permit

Oregon
Tina Kotek, Governor

Department of Environmental Quality
Northwest Region
700 NE Multnomah Street, Suite 600
Portland, OR 97232
(503) 229-5263
FAX (503) 229-6945
TTY 711

February 5, 2025

Becky Kim
Microchip Technology, Inc.
21015 Stark Street
Gresham, OR 97030

Steve Hall
Spectrum Environmental Solutions
2340 West Braker Lane, Suite A
Austin, TX 78758

Microchip Technology Inc.
Permit Number 26-3240-ST-01
New RCTO Unit 3 Initial Compliance
2025 Test Plan Approval_R1

Becky Kim and Steve Hall:

The source test plan received on February 3, 2025, for source testing at the Microchip Technology, Inc. (Microchip) facility located in Gresham has been reviewed. The test plan states that one newly installed Munters rotor concentrator thermal oxidizer (RCTO), which is the last of three new RCTO units installed in 2024 to be tested, will be tested for emissions of volatile organic compounds (VOC) and VOC destruction and removal efficiency (DRE). The new RCTO controls VOC emissions from Fab 4 Buildings 1 & 2. Emission measurement locations for RCTO testing are identified as the rotor concentrator outlet (RCO), thermal oxidizer exhaust (TO) and concentrator inlet. Testing is being conducted to show initial compliance with the VOC typically achievable control technology (TACT) limit of Permit Condition 3.1 and satisfy testing requirements of Permit Condition 6.1.b. The source test plan is approved with the following conditions:

GENERAL CONDITIONS

1. Only regular operating staff may adjust the production process and emission control parameters during the source performance tests and within two (2) hours prior to the tests. Any operating adjustments made during the source performance tests, which are a result of consultation during the tests with source testing personnel, equipment vendors or consultants, may render the source performance test invalid.

2. It is acceptable to postpone a scheduled test or suspend a test in progress if the discontinuation is due to equipment failure beyond the facility's control, construction delays beyond the facility's control, severe meteorological conditions, and situations that would jeopardize the safety of the testing contractors and/or operators. If the test is underway, the permittee should make every effort to complete the test run. All recoverable test information (process & sample data) must be available for DEQ review.

   It is unacceptable to postpone or suspend a test run in progress if it is discontinued because the source is not able to comply with an emission limit or verify an emission factor.

The permittee must provide DEQ written documentation explaining the reasons for the postponement or stoppage, and any data collected prior to the stoppage.

3. Source testing must be conducted while the facility is operating within 90% its normal operating capacity at the time of the test or at the highest achievable production rate taking market demand into consideration. Production data supporting that the conditions tested are representative of current operating capacity must be included in the source test report. Supporting production data should be from the 12-month period immediately preceding testing.

4. If desired, Microchip may use this testing to establish a lower minimum oxidizer temperature and desorption chamber temperatures to those specified in Condition 4.2.i-ii.

5. During the source test the following process parameters shall be monitored and recorded. All process parameters are to be reported for each individual test run and averaged for all test runs if appropriate. Information deemed proprietary may remain in control of Microchip, but must be made accessible to DEQ upon request.
    - RCTO temperature of the oxidizer and desorption temperature (ºF)
    - Pressure drop across the rotor concentrator wheel (inches of water column)
    - Natural gas consumption rate (scf/hr or MMBtu/hr)
    - Applicable production rate(s) (wafer moves, wafer starts, wafers in progress per day or production moves)

EPA METHODS 1-3 CONDITIONS

6. Whenever possible, sampling locations must meet EPA Method 1 criteria. Documentation including clear diagrams must be provided in the source test report. DEQ understands that the RCO sampling location does not meet the EPA Method 1 disturbance free flow criteria and a 3-dimensiona probe will be used to assess suitability of the planned sampling location. This approach is approved so long as the procedures of Section 11.5 of EPA Method 1 are followed. If a sampling location is determined not to meet the acceptability criteria of the test method (R_{avg} ≤20˚ and S_d ≤10˚), DEQ must be consulted prior to proceeding with testing to decide on an agreeable testing approach.

7. Sampling locations must be checked for cyclonic flow prior to starting testing. Documentation of this must be provided in the test report.

8. DEQ approves of assuming an ambient molecular weight of 29.0 g/g-mole at the RCO and concentrator inlet sampling locations as these locations have gas streams which can be characterized as essentially ambient air.

9. DEQ approves of using measured CO_2 values (by ASTM-D6348-12) and the stoichiometric equation in section 4.3 of the test plan to calculate percent O_2 for the TO sampling location. The calculated O_2 and measured CO_2 (% dry) values will be used to determine the dry molecular weight using equation 3-1 from EPA Method 3. DEQ understands that O_2 will not be directly measured at any test location.

EPA METHOD 25A CONDITIONS

10. Each Method 25A sampling system must be leak-checked before and after the testing program (before the first run and after the last run). Results of the leak check are to be documented within the test report.

11. Methane and ethane measured by FTIR may be subtracted from EPA Method 25A total hydrocarbon (THC) results to determine VOC emissions. Methane and ethane must be converted to a propane basis prior to performing the subtraction from THC (as propane). The use of Equation 1 (section 3.0 of the test plan) for converting to measured THC to non-methane non-ethane VOC is approved.

12. The in-stack detection limit (ISDL) for Method 25A is equal to the sensitivity of the instrument, which is two percent (2%) of the span value. If run average emissions are below the ISDL, they should be reported as less than the ISDL.

13. Results may not be drift corrected.

14. If the calibration drift is more than 3% of the span value the test must be repeated.

15. Non-methane non-ethane VOC emissions must be reported as indicated below for each individual test run and averaged for all three test runs. Hand calculations must be provided for at least one test run.
    - ppmvd as propane
    - lb/hour as propane
    - % destruction efficiency on a mass basis

EPA METHOD 205 CONDITIONS

16. If a gas dilution system is used to provide calibration gases for source test methods, the dilution system shall be evaluated once during the source test program in accordance with the requirements of EPA Method 205.

ASTM D6348-12 CONDITIONS - Methane, Ethane, Moisture & CO_2

17. Spectra collected during testing must be provided to DEQ.

18. The sampling system(s) must be leak-checked before and after the testing program (before the first run and after the last run). Results of the leaks check are to be documented within the test report.

19. Prior to starting testing, the most reactive target analyte must be used for the analyte spiking technique outlined in section A5 of the method. DEQ understands that methane will be spiked for as a surrogate for ethane and CO_2.

20. If the concentration of a target compound is below the detection limit, the value should be reported as less than detection limit. Run average methane and ethane concentrations that are below the detection limit cannot be used for purposes of subtraction from THC.

21. Methane, ethane, CO_2 and moisture must be reported as indicated below for each individual test run and averaged for all three test runs. Hand calculations must be provided for at least one test run.
    - ppmvd or % volume dry

GENERAL REPORTING CONDITIONS

22. The DEQ must be notified of any changes in the source test plan and/or the specified methods prior to testing. Significant changes not acknowledged by the DEQ could be the basis for invalidating a test run and potentially the entire testing program. Documentation of any deviations must include an evaluation of the impact of the deviation on the test data.

23. Method-specific quality assurance/quality control (QA/QC) procedures must be performed to ensure that the data is valid for determining source compliance. This must be done whether or not DEQ representatives are on-site to observe the testing and whether or not a QA/QC requirement has been specifically acknowledged and approved by DEQ. Only method-specific requirements explicitly exempted by the EPA and/or DEQ need not be performed. Documentation of the procedures and results shall be presented in the source test report for review. Omission of this critical information will result in rejection of the data, requiring a retest.

24. STAR Reports: The Certification Form (only) of the Source Test Audit Reports (STAR) shall be completed and submitted with the Source Test Report. Submittal of the method-specific STAR reports is no longer required. Copies of STAR forms are available electronically.

25. The permittee must submit test reports through Your DEQ Online (YDO), DEQ's online portal for environmental permitting programs, within 60 days following the completion of any test. An electronic test report (searchable PDF) including the STAR report must be uploaded to YDO and submitted by the permittee's responsible official. The Your DEQ Online Helpdesk, which can be found at https://yourdeqonlinehelp.oregon.gov is available to help answer questions or concerns. The maximum file size which can be uploaded to YDO is 50 MB.

DEQ understands source testing is scheduled to begin on March 26, 2025.

Please contact me at (971) 349-0956 if you have any questions or concerns.

Sincerely,

Josh Muswieck

Josh Muswieck
Source Test Coordinator
Environmental Engineer
DEQ Portland Office

cc: Weston Li, DEQ: AQ File

Appendix F

Operations Data

Operating Capacity

	Feb '24	Mar '24	Apr '24	May '24	Jun '24	Jul '24	Aug '24	Sep '24	Oct '24	Nov '24	Dec '24	Jan '25	Feb '25
Production Moves Total	7,947,589	4,132,514	7,678,453	7,866,008	3,868,458	7,007,379	4,132,142	5,362,939	6,541,831	4,847,971	4,506,929	4,870,948	3921556
Days	28	31	30	31	30	31	31	30	31	30	31	31	28
Production Moves Daily	283,842	133,307	255,948	253,742	128,949	226,044	133,295	178,765	211,027	161,599	145,385	157,127	140,056
Daily Average													185,314
90% of the Daily Average													**166,783**

Daily Moves (3/26/25)

133,018

72% of max operating capacity

Operating Parameters

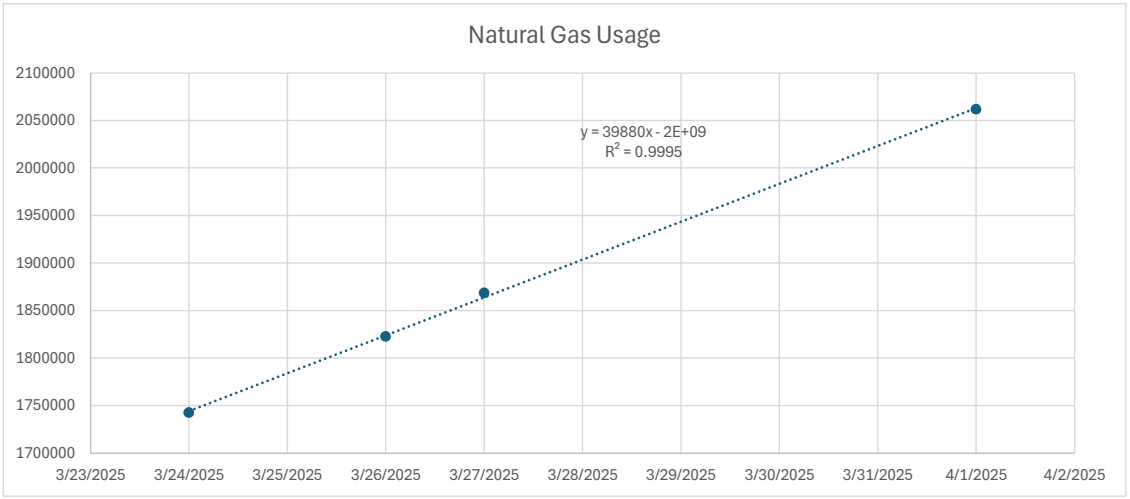
timestamp	Pressure Differential ("H2O)	Oxidizer Temperature (°F)	Desorption Chamber Temperature (°F)
Start Run 1			
2025-03-26 08:10:42.7387128	0.817	1402	389
2025-03-26 08:11:42.7424601	0.813	1397	390
2025-03-26 08:12:42.7446473	0.812	1400	390
2025-03-26 08:13:42.7377531	0.814	1400	390
2025-03-26 08:14:42.7466637	0.818	1400	391
2025-03-26 08:15:42.7330811	0.812	1399	391
2025-03-26 08:16:42.7454619	0.815	1401	390
2025-03-26 08:17:42.7329006	0.812	1402	389
2025-03-26 08:18:42.7346123	0.816	1402	390
2025-03-26 08:19:42.7384422	0.817	1399	390
2025-03-26 08:20:42.7440091	0.814	1400	391
2025-03-26 08:21:42.7340669	0.818	1398	390
2025-03-26 08:22:42.7334483	0.813	1402	392
2025-03-26 08:23:42.7378035	0.817	1397	389
2025-03-26 08:24:42.7335019	0.816	1401	389
2025-03-26 08:25:42.7447882	0.815	1401	389
2025-03-26 08:26:42.7347495	0.816	1399	391
2025-03-26 08:27:42.7460852	0.816	1398	389
2025-03-26 08:28:42.7481455	0.815	1401	390
2025-03-26 08:29:42.7527956	0.807	1402	390
2025-03-26 08:30:42.7553868	0.797	1399	390
2025-03-26 08:31:42.7508738	0.791	1399	390
2025-03-26 08:32:42.7570145	0.799	1402	390
2025-03-26 08:33:42.7620005	0.801	1403	390
2025-03-26 08:34:42.7531310	0.795	1399	391
2025-03-26 08:35:42.7558141	0.803	1400	391
2025-03-26 08:36:42.7506163	0.797	1399	389
2025-03-26 08:37:42.7528856	0.793	1403	393
2025-03-26 08:38:42.7541854	0.795	1397	390
2025-03-26 08:39:42.7496851	0.797	1400	390
2025-03-26 08:40:42.7484730	0.804	1402	389
2025-03-26 08:41:42.7565317	0.804	1401	391
2025-03-26 08:42:42.7498805	0.798	1396	389
2025-03-26 08:43:42.7549585	0.795	1401	390
2025-03-26 08:44:42.7621176	0.798	1398	389
2025-03-26 08:45:42.7481226	0.803	1402	390
2025-03-26 08:46:42.7520402	0.797	1399	389
2025-03-26 08:47:42.7500168	0.797	1402	389
2025-03-26 08:48:42.7515662	0.798	1402	390
2025-03-26 08:49:42.7587925	0.805	1400	390
2025-03-26 08:50:42.7585135	0.803	1401	391
2025-03-26 08:51:42.7571568	0.798	1397	391
2025-03-26 08:52:42.7503284	0.800	1402	391
2025-03-26 08:53:42.7587557	0.799	1398	390
2025-03-26 08:54:42.7560880	0.802	1401	390
2025-03-26 08:55:42.7500228	0.810	1403	390
2025-03-26 08:56:42.7540771	0.802	1402	391
2025-03-26 08:57:42.7594984	0.805	1396	389
2025-03-26 08:58:42.7569623	0.799	1402	390
2025-03-26 08:59:42.7745528	0.799	1398	389
2025-03-26 09:00:42.8075515	0.790	1402	392
2025-03-26 09:01:42.8529115	0.789	1400	389
2025-03-26 09:02:42.8877486	0.779	1400	389
2025-03-26 09:03:42.9186503	0.789	1401	389
2025-03-26 09:04:42.9494886	0.795	1400	390
2025-03-26 09:05:42.9522320	0.787	1401	390
2025-03-26 09:06:42.9790966	0.789	1395	391
2025-03-26 09:07:42.9780844	0.789	1401	391
2025-03-26 09:08:42.9994542	0.793	1397	390
2025-03-26 09:09:43.0025253	0.790	1400	389
Run 1 Average	**0.803**	**1400**	**390**
2025-03-26 09:10:43.0052590	0.797	1399	390
Start Run 2			
2025-03-26 09:20:43.0406450	0.802	1399	390
2025-03-26 09:21:43.0384900	0.807	1401	391
2025-03-26 09:22:43.0371930	0.803	1398	390

Operating Parameters

timestamp	Pressure Differential ("H2O)	Oxidizer Temperature (°F)	Desorption Chamber Temperature (°F)
2025-03-26 09:23:43.0431868	0.800	1400	391
2025-03-26 09:24:43.0415681	0.803	1399	389
2025-03-26 09:25:43.0424195	0.811	1400	389
2025-03-26 09:26:43.0382658	0.808	1401	390
2025-03-26 09:27:43.0451148	0.799	1399	390
2025-03-26 09:28:43.0509658	0.791	1401	390
2025-03-26 09:29:43.0476414	0.791	1398	390
2025-03-26 09:30:43.0510994	0.790	1403	391
2025-03-26 09:31:43.0405545	0.792	1400	391
2025-03-26 09:32:43.0378359	0.790	1401	390
2025-03-26 09:33:43.0375607	0.796	1402	389
2025-03-26 09:34:43.0501579	0.795	1401	390
2025-03-26 09:35:43.0475854	0.796	1399	390
2025-03-26 09:36:43.0509571	0.793	1398	391
2025-03-26 09:37:43.0407085	0.792	1400	390
2025-03-26 09:38:43.0378719	0.792	1401	391
2025-03-26 09:39:43.0513126	0.792	1396	389
2025-03-26 09:40:43.0400637	0.792	1401	389
2025-03-26 09:41:43.0363640	0.794	1399	389
2025-03-26 09:42:43.0415235	0.794	1399	391
2025-03-26 09:43:43.0417013	0.789	1400	389
2025-03-26 09:44:43.0415818	0.788	1399	390
2025-03-26 09:45:43.0380062	0.795	1401	390
2025-03-26 09:46:43.0376092	0.791	1400	391
2025-03-26 09:47:43.0454756	0.792	1400	389
2025-03-26 09:48:43.0375401	0.790	1402	390
2025-03-26 09:49:43.0516943	0.793	1402	390
2025-03-26 09:50:43.0402517	0.790	1400	390
2025-03-26 09:51:43.0484616	0.796	1402	391
2025-03-26 09:52:43.0384588	0.796	1397	390
2025-03-26 09:53:43.0384737	0.785	1403	392
2025-03-26 09:54:43.0463299	0.789	1397	390
2025-03-26 09:55:43.0402489	0.790	1402	389
2025-03-26 09:56:43.0389090	0.794	1400	389
2025-03-26 09:57:43.0438698	0.790	1401	391
2025-03-26 09:58:43.0491138	0.787	1398	389
2025-03-26 09:59:43.0383123	0.786	1401	389
2025-03-26 10:00:43.0370666	0.795	1399	389
2025-03-26 10:01:43.0502316	0.795	1399	391
2025-03-26 10:02:43.0375784	0.787	1400	389
2025-03-26 10:03:43.0477790	0.787	1402	389
2025-03-26 10:04:43.0461801	0.796	1401	389
2025-03-26 10:05:43.0427099	0.794	1398	390
2025-03-26 10:06:43.0461992	0.795	1401	390
2025-03-26 10:07:43.0479147	0.787	1398	391
2025-03-26 10:08:43.0475951	0.785	1401	392
2025-03-26 10:09:43.0435455	0.789	1399	391
2025-03-26 10:10:43.0472345	0.785	1400	389
2025-03-26 10:11:43.0378233	0.790	1400	390
2025-03-26 10:12:43.0475751	0.792	1403	391
2025-03-26 10:13:43.0486953	0.791	1397	390
2025-03-26 10:14:43.0422443	0.788	1402	390
2025-03-26 10:15:43.0389383	0.785	1398	389
2025-03-26 10:16:43.0364162	0.789	1402	391
2025-03-26 10:17:43.0491147	0.784	1398	389
2025-03-26 10:18:43.0419256	0.796	1403	389
2025-03-26 10:19:43.0462841	0.803	1401	389
Run 2 Average	**0.793**	**1400**	**390**
2025-03-26 10:20:43.0371496	0.806	1401	390
Start Run 3			
2025-03-26 10:30:43.0400618	0.860	1398	390
2025-03-26 10:31:43.0375765	0.858	1403	392
2025-03-26 10:32:43.0507723	0.861	1400	390
2025-03-26 10:33:43.0508670	0.861	1400	389
2025-03-26 10:34:43.0365561	0.860	1400	389
2025-03-26 10:35:43.0487204	0.864	1403	390
2025-03-26 10:36:43.0450165	0.867	1401	390

Operating Parameters

timestamp	Pressure Differential ("H2O)	Oxidizer Temperature (°F)	Desorption Chamber Temperature (°F)
2025-03-26 10:37:43.0478932	0.859	1396	391
2025-03-26 10:38:43.0445737	0.857	1398	389
2025-03-26 10:39:43.0393293	0.861	1399	391
2025-03-26 10:40:43.0387629	0.868	1398	389
2025-03-26 10:41:43.0386355	0.864	1401	389
2025-03-26 10:42:43.0470642	0.859	1402	390
2025-03-26 10:43:43.0377127	0.861	1396	391
2025-03-26 10:44:43.0460975	0.852	1401	391
2025-03-26 10:45:43.0445551	0.863	1398	389
2025-03-26 10:46:43.0429898	0.862	1403	391
2025-03-26 10:47:43.0445929	0.862	1399	391
2025-03-26 10:48:43.0488468	0.863	1401	389
2025-03-26 10:49:43.0480630	0.868	1403	389
2025-03-26 10:50:43.0399474	0.875	1401	390
2025-03-26 10:51:43.0456720	0.867	1398	389
2025-03-26 10:52:43.0396125	0.876	1401	390
2025-03-26 10:53:43.0455325	0.860	1400	390
2025-03-26 10:54:43.0369653	0.852	1400	392
2025-03-26 10:55:43.0436388	0.859	1398	389
2025-03-26 10:56:43.0468197	0.859	1400	389
2025-03-26 10:57:43.0498467	0.859	1402	389
2025-03-26 10:58:43.0484251	0.863	1397	390
2025-03-26 10:59:43.0404382	0.856	1399	389
2025-03-26 11:00:43.0520567	0.853	1399	390
2025-03-26 11:01:43.0647748	0.855	1400	390
2025-03-26 11:02:43.0671262	0.850	1400	392
2025-03-26 11:03:43.0580798	0.847	1399	390
2025-03-26 11:04:43.0584223	0.850	1400	389
2025-03-26 11:05:43.0677472	0.858	1404	390
2025-03-26 11:06:43.0735935	0.853	1399	390
2025-03-26 11:07:43.0769148	0.854	1399	391
2025-03-26 11:08:43.0715360	0.856	1399	390
2025-03-26 11:09:43.0809323	0.845	1402	392
2025-03-26 11:10:43.0709411	0.849	1396	391
2025-03-26 11:11:43.0800906	0.849	1401	389
2025-03-26 11:12:43.0710568	0.853	1401	388
2025-03-26 11:13:43.0711133	0.851	1399	390
2025-03-26 11:14:43.0726921	0.854	1398	390
2025-03-26 11:15:43.0799105	0.849	1401	390
2025-03-26 11:16:43.0748364	0.855	1398	390
2025-03-26 11:17:43.0736443	0.856	1401	391
2025-03-26 11:18:43.0752096	0.854	1399	389
2025-03-26 11:19:43.0817921	0.853	1399	389
2025-03-26 11:20:43.0741785	0.857	1404	389
2025-03-26 11:21:43.0758049	0.854	1402	390
2025-03-26 11:22:43.0716204	0.854	1401	391
2025-03-26 11:23:43.0756617	0.854	1396	391
2025-03-26 11:24:43.0788375	0.855	1402	392
2025-03-26 11:25:43.0758217	0.850	1400	391
2025-03-26 11:26:43.0754247	0.850	1400	389
2025-03-26 11:27:43.0801055	0.853	1402	389
2025-03-26 11:28:43.0768612	0.857	1402	391
2025-03-26 11:29:43.0769419	0.853	1396	389
Run 3 Average	**0.857**	**1400**	**390**
2025-03-26 11:30:43.0708534	0.854	1401	390



Date	Total NG Used (scf)
3/24/2025	1742345
3/26/2025	1822755
3/27/2025	1868317
4/1/2025	2061889

y =	m	b
	39879.95683	-1822365009

39879.95683	cf/day
1661.664868	cf/hr

Appendix G

Calibration Documentation

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

ACCREDITED A2LA Certificate No. 1750.01 Calibration

Cert. No.: 6530-14438968

Traceable® Certificate of Calibration for Digital Barometer

Manufactured for and distributed by : MarketLab 6850 Southbelt Dr,Caledonia,MI,49316

Instrument Identification:

Model: 18246, S/N: 230600150 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Digital Barometer	D4540001	05 Dec 2023	1000486629
Chilled Mirror Hygrometer	44654/2H3737	13 Dec 2023	19994
Climate Chamber	W619.0019		
DIGITAL THERMOMETER	210876694	12 May 2024	4000-14169058

Certificate Information:

Technician: 333 Procedure: CAL-31 Cal Date: 06 Sep 2023 Cal Due Date: 06 Sep 2025

Test Conditions: 63.85%RH 24.13°C 1016mBar

Calibration Data: (New Instrument)

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
%RH	N.A.	N.A.		50.03	49	Y	47	53	0.74	>4:1
°C	N.A.	N.A.		25.29	25.0	Y	24.89	25.69	0.05	>4:1
mb/hPa	N.A.	N.A.		807.19	807	Y	803	811	0.62	>4:1
mb/hPa	N.A.	N.A.		909.49	910	Y	905	913	0.62	>4:1
mb/hPa	N.A.	N.A.		1015.35	1016	Y	1011	1019	0.62	>4:1

This certificate indicates Traceability to standards provided by (NIST) National Institute of Standards and Technology and/or a National Standards Laboratory.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement : (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ± U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2, Min=As Left Nominal(Rounded) – Tolerance; Max= As Left Nominal(Rounded) + Tolerance;

Nicol Rodriguez

Nicol Rodriguez, Quality Manager

Michael Pietronicco, Technical Manager

Note :

Maintaining Accuracy:

In our opinion once calibrated your Digital Barometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Barometer change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

Issue Date : 06 Sep 2023

CONTROL COMPANY 12554 Galveston RD Suite B230 Webster TX USA 77598
Phone 281 482-1714 Fax 281 482-9448 sales@control3.com www.traceable.com

Control Company is an ISO/IEC 17025:2017 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.
Control Company is ISO 9001:2015 Quality Certified by DNV GL, Certificate No. CERT-01805-2006-AQ-HOU-ANAB.
International Laboratory Accreditation Cooperation - Multilateral Recognition Arrangement (ILAC-MRA).

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Airgas Specialty Gases
Airgas USA LLC
6141 Easton Road
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

Part Number:	X04NI99C15A00V5	Reference Number:	160-402710106-1
Cylinder Number:	CC105191	Cylinder Volume:	144.0 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
Analysis Date:	Apr 28, 2023	Valve Outlet:	350
Lot Number:	160-402710106-1		

Expiration Date: Apr 28, 2031

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

ANALYTICAL RESULTS

Component	Req Conc	Actual Concentration (Mole %)	Analytical Uncertainty
ETHYLENE	10.00 PPM	9.718 PPM	+/-5%
METHANE	20.00 PPM	20.56 PPM	+/-5%
R22 CHLORODIFLUOROMETHANE	20.00 PPM	20.24 PPM	+/-5%
NITROGEN	Balance		

Signature on file

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
12722 S. Wentworth Ave.
Chicago, IL 60628
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number:	E02AI99E15A0PY5	Reference Number:	54-402944630-1
Cylinder Number:	CC409652	Cylinder Volume:	146.0 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12024	Valve Outlet:	590
Gas Code:	PPN,BALA	Certification Date:	Jan 23, 2024

Expiration Date: Jan 23, 2032

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig. i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	3.500 PPM	3.586 PPM	G1	+/- 1.0% NIST Traceable	01/23/2024
AIR	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10010119	K023771	9.60 PPM PROPANE/AIR	+/- 0.6%	Dec 02, 2027

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 AUP2110277	FTIR	Dec 28, 2023

Triad Data Available Upon Request

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
9810 BAY AREA BLVD
Pasadena, TX 77507
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer:	SPECTRUM ENVIRONMENTAL SOLUTIONS		
Part Number:	E02AI99E15A1475	Reference Number:	163-402944623-1
Cylinder Number:	CC73607	Cylinder Volume:	146.0 CF
Laboratory:	124 - Pasadena (SG06) - TX	Cylinder Pressure:	2015 PSIG
PGVP Number:	A32024	Valve Outlet:	590
Gas Code:	PPN,BALA	Certification Date:	Jan 25, 2024

Expiration Date: Jan 25, 2032

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	6.000 PPM	5.981 PPM	G1	+/- 0.8% NIST Traceable	01/25/2024
AIR	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	063009	K022245	9.60 PPM PROPANE/AIR	+/-0.63%	Dec 02, 2027

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
C3H8-XL-NICOLET iS50 AUP2010248	FTIR	Dec 27, 2023

Triad Data Available Upon Request

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Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
9810 BAY AREA BLVD
Pasadena, TX 77507
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer:	SPECTRUM ENVIRONMENTAL SOLUTIONS		
Part Number:	E02AI99E15A1734	Reference Number:	163-402944624-1
Cylinder Number:	CC49640	Cylinder Volume:	146.0 CF
Laboratory:	124 - Pasadena (SG06) - TX	Cylinder Pressure:	2015 PSIG
PGVP Number:	A32024	Valve Outlet:	590
Gas Code:	PPN,BALA	Certification Date:	Jan 23, 2024

Expiration Date: Jan 23, 2032

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	10.00 PPM	10.25 PPM	G1	+/- 1.4% NIST Traceable	01/23/2024
AIR	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	063009	K022245	9.60 PPM PROPANE/AIR	+/-0.63%	Dec 02, 2027

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
C3H8-XL-NICOLET iS50 AUP2010248	FTIR	Dec 27, 2023

Triad Data Available Upon Request

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Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
9810 BAY AREA BLVD
Pasadena, TX 77507
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer:	SPECTRUM ENVIRONMENTAL SOLUTIONS		
Part Number:	E02AI99E15A00V9	Reference Number:	163-402944620-1
Cylinder Number:	ALM011565	Cylinder Volume:	146.0 CF
Laboratory:	124 - Pasadena (SG06) - TX	Cylinder Pressure:	2015 PSIG
PGVP Number:	A32024	Valve Outlet:	590
Gas Code:	PPN,BALA	Certification Date:	Jan 23, 2024

Expiration Date: Jan 23, 2032

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	68.00 PPM	69.47 PPM	G1	+/- 0.8% NIST Traceable	01/23/2024
AIR	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	010104-17	1D006278	99.8 PPM PROPANE/	0.6%	May 03, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
C3H8-L-NICOLET iS50 AUP2010248	FTIR	Dec 27, 2023

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Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
9810 BAY AREA BLVD
Pasadena, TX 77507
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer:	SPECTRUM ENVIRONMENTAL SOLUTIONS		
Part Number:	E02AI99E15AC399	Reference Number:	163-402944621-1
Cylinder Number:	CC263887	Cylinder Volume:	146.0 CF
Laboratory:	124 - Pasadena (SG06) - TX	Cylinder Pressure:	2015 PSIG
PGVP Number:	A32024	Valve Outlet:	590
Gas Code:	PPN,BALA	Certification Date:	Jan 23, 2024

Expiration Date: Jan 23, 2032

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	114.0 PPM	116.2 PPM	G1	+/- 0.7% NIST Traceable	01/23/2024
AIR	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	010104-17	1D006278	99.8 PPM PROPANE/	0.6%	May 03, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
C3H8-L-NICOLET iS50 AUP2010248	FTIR	Dec 27, 2023

Triad Data Available Upon Request

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Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
9810 BAY AREA BLVD
Pasadena, TX 77507
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer:	SPECTRUM ENVIRONMENTAL SOLUTIONS		
Part Number:	E02AI99E15A00P7	Reference Number:	163-402944622-1
Cylinder Number:	CC429362	Cylinder Volume:	146.0 CF
Laboratory:	124 - Pasadena (SG06) - TX	Cylinder Pressure:	2015 PSIG
PGVP Number:	A32024	Valve Outlet:	590
Gas Code:	PR,BALN	Certification Date:	Jan 23, 2024

Expiration Date: Jan 23, 2032

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	190.0 PPM	191.0 PPM	G1	+/- 0.6% NIST Traceable	01/23/2024
AIR	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	200602-17	6162702Y	243.3 PPM PROPANE/AIR	+/- 0.5%	Mar 17, 2027

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
C3H8-L-NICOLET iS50 AUP2010248	FTIR	Dec 27, 2023

Triad Data Available Upon Request

Approved for Release

Probe Calibration Report

For

MOSTARDI PLATT

3D Probe #SN1228

AUGUST 28, 2024

Airflow Sciences Corporation
12190 Hubbard Street
Livonia, MI 48150
® www.airflowsciences.com

Probe Calibration Information Sheet

Probe Type: (1D, 2D, 3D): 3D

(Prism, Spherical, Dirty air, S type, fecheimer, Other): Prism

Probe Length: 24”

Probe main body diameter: 1”

Probe serial number: SN1228

Bead blast probe prior to calibration? (yes, no): No

Other clean-up requested: No

Are there known problems that need repair? (yes, no): No

Description: N/a

Requested calibration velocities: 60 and 90 fps

PO number: MP15596

3-D Probe Inspection Sheet

EPA Method 2F Table 2F-1

Probe Type and ID # Prism – SN1228 **Date of most recent calibration:** AUGUST 28, 2024

Inspection of Probe Ports

Port ID	Current Inspection (1=present, 0=absent)			Compared to Previous Calibration (1=changed, 0=unchanged)			Brief Description of Any Item with a Value of "1" in Preceding Columns
	Dents	Scratches	Asymmetries	Dents	Scratches	Asymmetries	
P1	0	0	0				
P2	0	0	0				
P3	0	0	0				
P4	0	0	0				
P5	0	0	0				

Inspection of Probe Surfaces

Port ID	Current Inspection (1=present, 0=absent)		Compared to Previous Calibration (1=changed, 0=unchanged)		Brief Description of Any Item with a Value of "1" in Preceding Columns
	Scratches	Indentations	Scratches	Indentations	
S1	0	0			
S2	0	0			
S3	0	0			
S4	0	0			
S5	0	1			Rounded upper edge

Surface IDs S1 through S5 refer to the surfaces adjacent to pressure ports with the corresponding numbers, e.g., S3 refers to the surface adjacent to pressure port P3.

Calibration Data
60 ft/s

Facility:	ASC Calibration Tunnel - Livonia MI	Probe Head Diameter ("):	1
Client:	Mostardi Platt	Atm Pressure ("Hg):	29.36
Probe SN:	1228	Temperature (F):	78.09
		Air Density (lb/ft^3):	0.0722
Nominal Cal Vel (ft/s):	60	Air Viscosity (lb/ft-s):	1.23E-05
Date:	August 28, 2024	Probe Reynolds # (-):	29,707

Rslo (deg)
-0.5

Run 1								Run 2							Comparison of 1 and 2		Run 3							Average	
Measured					Calculated			Measured				Calculated					Measured				Calculated				
Pitch Angle	P1-P2 [IWC]	P4-P5 [IWC]	P2-P3 (IWC)	Pitot DP [IWC]	F1	F2	Air Velocity (ft/s)	P1-P2 [IWC]	P4-P5 [IWC]	P2-P3 (IWC)	Pitot DP [IWC]	F1	F2	Air Velocity (ft/s)	Pitch Angle	% Diff	P1-P2 [IWC]	P4-P5 [IWC]	P2-P3 (IWC)	Pitot DP [IWC]	F1	F2	Air Velocity (ft/s)	F1	F2
-40	0.616	-0.571	0.000	0.802	-0.927	1.129	61.0	0.589	-0.558	0.004	0.800	-0.948	1.154	60.9	-40	2.21%	0.579	-0.551	0.001	0.776	-0.952	1.146	60.0	**-0.942**	**1.143**
-35	0.634	-0.563	0.000	0.801	-0.888	1.113	61.0	0.614	-0.561	0.003	0.801	-0.913	1.130	61.0	-35	1.58%	-	-	-	-	-	-	-	**-0.901**	**1.122**
-30	0.629	-0.543	-0.005	0.800	-0.863	1.116	60.9	0.617	-0.538	-0.001	0.801	-0.873	1.129	61.0	-30	1.11%	-	-	-	-	-	-	-	**-0.868**	**1.122**
-25	0.635	-0.513	0.000	0.802	-0.807	1.113	61.0	0.621	-0.511	0.000	0.801	-0.822	1.124	61.0	-25	1.03%	-	-	-	-	-	-	-	**-0.815**	**1.119**
-20	0.651	-0.479	0.001	0.802	-0.736	1.099	61.0	0.627	-0.476	0.005	0.802	-0.759	1.119	61.0	-20	1.88%	-	-	-	-	-	-	-	**-0.747**	**1.109**
-15	0.669	-0.436	0.003	0.801	-0.651	1.083	60.9	0.684	-0.457	-0.005	0.803	-0.668	1.072	61.0	-15	0.97%	-	-	-	-	-	-	-	**-0.660**	**1.078**
-10	0.738	-0.378	-0.002	0.802	-0.512	1.032	61.0	0.735	-0.387	0.003	0.801	-0.526	1.034	61.0	-10	0.19%	-	-	-	-	-	-	-	**-0.519**	**1.033**
-5	0.750	-0.283	0.002	0.800	-0.377	1.023	60.9	0.749	-0.278	-0.003	0.801	-0.372	1.024	61.0	-5	0.15%	-	-	-	-	-	-	-	**-0.374**	**1.023**
0	0.756	-0.164	-0.002	0.802	-0.217	1.020	61.0	0.756	-0.171	0.000	0.801	-0.226	1.019	60.9	0	0.11%	-	-	-	-	-	-	-	**-0.221**	**1.019**
5	0.750	-0.050	0.002	0.800	-0.067	1.023	60.9	0.766	-0.055	-0.001	0.803	-0.072	1.014	61.0	5	0.91%	-	-	-	-	-	-	-	**-0.070**	**1.018**
10	0.787	0.038	-0.004	0.802	0.049	0.999	61.0	0.822	0.035	-0.005	0.803	0.043	0.978	61.0	10	2.09%	0.780	0.033	0.001	0.777	0.042	0.988	60.0	**0.045**	**0.988**
15	0.803	0.137	0.000	0.801	0.171	0.989	61.0	0.826	0.145	0.002	0.800	0.175	0.975	60.9	15	1.44%	-	-	-	-	-	-	-	**0.173**	**0.982**
20	0.795	0.300	0.002	0.802	0.378	0.994	61.0	0.818	0.303	-0.001	0.801	0.370	0.980	60.9	20	1.48%	-	-	-	-	-	-	-	**0.374**	**0.987**
25	0.784	0.429	-0.002	0.801	0.548	1.001	60.9	0.802	0.427	0.004	0.800	0.532	0.989	60.9	25	1.20%	-	-	-	-	-	-	-	**0.540**	**0.995**
30	0.765	0.507	-0.003	0.798	0.663	1.011	60.9	0.787	0.509	-0.004	0.800	0.647	0.998	60.9	30	1.35%	-	-	-	-	-	-	-	**0.655**	**1.005**
35	0.720	0.520	0.002	0.798	0.723	1.042	60.8	0.733	0.518	0.003	0.798	0.707	1.033	60.8	35	0.94%	-	-	-	-	-	-	-	**0.715**	**1.037**
40	0.683	0.539	0.005	0.797	0.788	1.069	60.8	0.688	0.538	0.006	0.796	0.782	1.065	60.8	40	0.34%	-	-	-	-	-	-	-	**0.785**	**1.067**

Calibration Data
90 ft/s

Facility:	ASC Calibration Tunnel - Livonia MI	Probe Head Diameter ("):	1
Client:	Mostardi Platt	Atm Pressure ("Hg):	29.35
Probe SN:	1228	Temperature (F):	78.20
		Air Density (lb/ft^3):	0.0719
Nominal Cal Vel (ft/s):	90	Air Viscosity (lb/ft-s):	1.23E-05
Date:	August 28, 2024	Probe Reynolds # (-):	43,984

Rslo (deg)
-0.3

Run 1								Run 2							Comparison of 1 and 2		Run 3							Average	
Measured					Calculated			Measured				Calculated					Measured				Calculated				
Pitch Angle	P1-P2 [IWC]	P4-P5 [IWC]	P2-P3 (IWC)	Pitot DP [IWC]	F1	F2	Air Velocity (ft/s)	P1-P2 [IWC]	P4-P5 [IWC]	P2-P3 (IWC)	Pitot DP [IWC]	F1	F2	Air Velocity (ft/s)	Pitch Angle	% Diff	P1-P2 [IWC]	P4-P5 [IWC]	P2-P3 (IWC)	Pitot DP [IWC]	F1	F2	Air Velocity (ft/s)	**F1**	**F2**
-40	1.347	-1.253	-0.012	1.761	-0.930	1.132	90.5	1.352	-1.284	0.006	1.766	-0.950	1.132	90.7	-40	0.03%	-	-	-	-	-	-	-	**-0.940**	**1.132**
-35	1.397	-1.236	0.007	1.758	-0.885	1.111	90.4	1.404	-1.258	0.000	1.761	-0.896	1.109	90.5	-35	0.18%	-	-	-	-	-	-	-	**-0.890**	**1.110**
-30	1.413	-1.184	-0.003	1.761	-0.838	1.105	90.5	1.386	-1.185	-0.006	1.763	-0.855	1.117	90.6	-30	1.05%	-	-	-	-	-	-	-	**-0.847**	**1.111**
-25	1.403	-1.128	0.007	1.763	-0.805	1.110	90.6	1.393	-1.133	-0.002	1.763	-0.813	1.114	90.6	-25	0.38%	-	-	-	-	-	-	-	**-0.809**	**1.112**
-20	1.431	-1.058	-0.002	1.762	-0.739	1.099	90.6	1.450	-1.068	0.001	1.763	-0.737	1.092	90.6	-20	0.63%	-	-	-	-	-	-	-	**-0.738**	**1.095**
-15	1.456	-0.966	-0.001	1.762	-0.663	1.089	90.6	1.478	-0.979	0.003	1.762	-0.662	1.081	90.6	-15	0.74%	-	-	-	-	-	-	-	**-0.663**	**1.085**
-10	1.597	-0.835	0.009	1.763	-0.523	1.040	90.6	1.646	-0.869	0.004	1.762	-0.528	1.024	90.5	-10	1.56%	-	-	-	-	-	-	-	**-0.525**	**1.032**
-5	1.627	-0.608	0.001	1.761	-0.373	1.030	90.5	1.646	-0.619	0.002	1.765	-0.376	1.025	90.6	-5	0.46%	-	-	-	-	-	-	-	**-0.375**	**1.028**
0	1.640	-0.376	0.001	1.765	-0.229	1.027	90.6	1.670	-0.381	-0.006	1.767	-0.228	1.018	90.7	0	0.87%	-	-	-	-	-	-	-	**-0.229**	**1.023**
5	1.638	-0.121	0.003	1.767	-0.074	1.028	90.7	1.643	-0.120	0.001	1.765	-0.073	1.026	90.6	5	0.18%	-	-	-	-	-	-	-	**-0.074**	**1.027**
10	1.822	0.094	-0.010	1.766	0.052	0.975	90.7	1.718	0.095	0.006	1.765	0.056	1.004	90.6	10	2.97%	1.594	0.089	0.004	1.769	0.056	1.043	90.7	**0.054**	**1.007**
15	1.783	0.353	0.001	1.763	0.198	0.984	90.6	1.795	0.340	0.003	1.760	0.189	0.981	90.5	15	0.40%	-	-	-	-	-	-	-	**0.194**	**0.982**
20	1.746	0.688	-0.001	1.759	0.394	0.994	90.5	1.754	0.651	-0.002	1.762	0.371	0.992	90.6	20	0.15%	-	-	-	-	-	-	-	**0.383**	**0.993**
25	1.735	0.966	0.000	1.763	0.557	0.998	90.6	1.710	0.936	0.011	1.759	0.547	1.004	90.5	25	0.63%	-	-	-	-	-	-	-	**0.552**	**1.001**
30	1.712	1.092	-0.009	1.759	0.638	1.003	90.5	1.707	1.090	-0.005	1.757	0.638	1.004	90.4	30	0.10%	-	-	-	-	-	-	-	**0.638**	**1.004**
35	1.625	1.008	0.008	1.756	0.621	1.029	90.4	1.609	1.008	-0.002	1.756	0.626	1.034	90.4	35	0.49%	-	-	-	-	-	-	-	**0.623**	**1.032**
40	1.541	1.230	-0.009	1.752	0.798	1.056	90.3	1.541	1.226	-0.012	1.750	0.796	1.055	90.2	40	0.08%	-	-	-	-	-	-	-	**0.797**	**1.055**

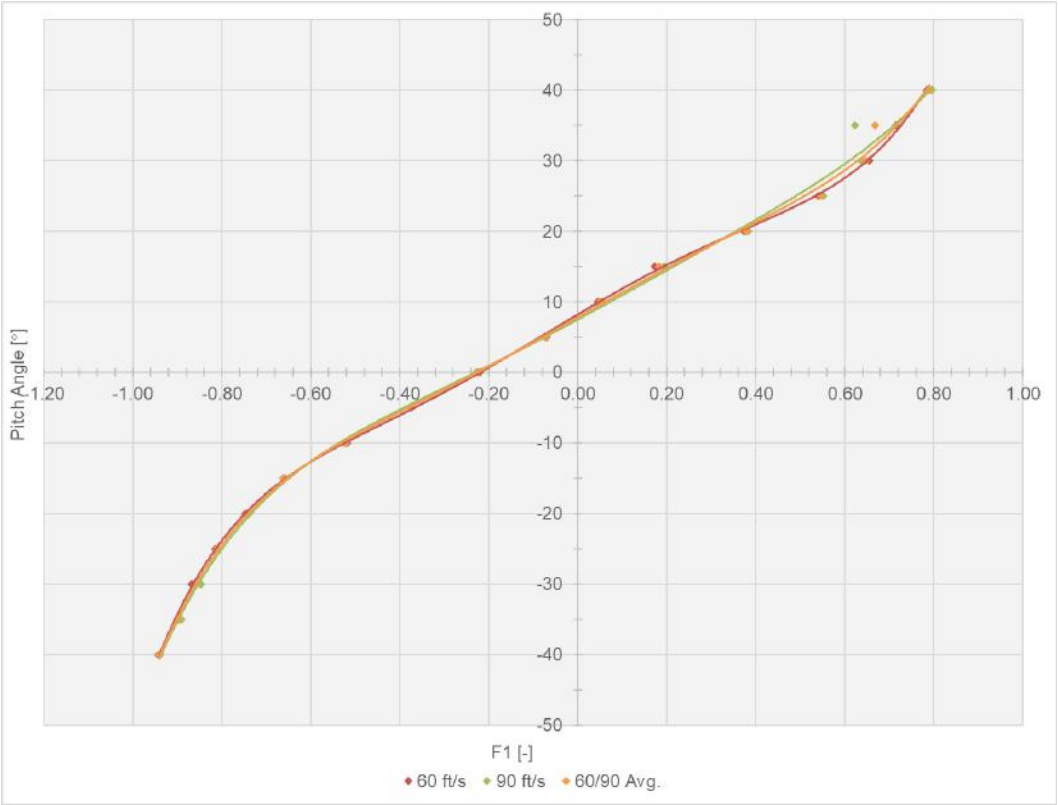
Summary

F1			
Pitch	60 ft/s	90 ft/s	60/90 Avg.
-40	-0.942	-0.940	-0.941
-35	-0.901	-0.890	-0.895
-30	-0.868	-0.847	-0.857
-25	-0.815	-0.809	-0.812
-20	-0.747	-0.738	-0.742
-15	-0.660	-0.663	-0.661
-10	-0.519	-0.525	-0.522
-5	-0.374	-0.375	-0.375
0	-0.221	-0.229	-0.225
5	-0.070	-0.074	-0.072
10	0.045	0.054	0.050
15	0.173	0.194	0.183
20	0.374	0.383	0.378
25	0.540	0.552	0.546
30	0.655	0.638	0.647
35	0.715	0.623	0.669
40	0.785	0.797	0.791

F2			
Pitch	60 ft/s	90 ft/s	60/90 Avg.
-40	1.143	1.132	1.137
-35	1.122	1.110	1.116
-30	1.122	1.111	1.117
-25	1.119	1.112	1.115
-20	1.109	1.095	1.102
-15	1.078	1.085	1.081
-10	1.033	1.032	1.032
-5	1.023	1.028	1.025
0	1.019	1.023	1.021
5	1.018	1.027	1.023
10	0.988	1.007	0.998
15	0.982	0.982	0.982
20	0.987	0.993	0.990
25	0.995	1.001	0.998
30	1.005	1.004	1.004
35	1.037	1.032	1.035
40	1.067	1.055	1.061

		X^6	X^5	X^4	X^3	X^2	X	Constant	Rslo	
60 fps	F1:	0	5.977E+01	1.244E+01	-3.261E+01	-6.607E+00	3.751E+01	8.226E+00	-0.5	
	F2:	2.681E-11	4.756E-11	-6.875E-08	1.421E-06	9.883E-05	-3.255E-03	1.013E+00		
90 fps	F1:	0	2.876E+01	-7.565E+00	-7.567E+00	5.364E+00	3.412E+01	7.522E+00	-0.3	
	F2:	2.534E-11	2.903E-11	-6.116E-08	1.195E-06	7.855E-05	-2.854E-03	1.020E+00		
60/90 Average	F1:	0	4.299E+01	2.125E+00	-1.852E+01	-2.260E-01	3.548E+01	7.829E+00	-0.4	Passes EPA Acceptance Criteria
	F2:	2.607E-11	3.830E-11	-6.496E-08	1.308E-06	8.869E-05	-3.054E-03	1.017E+00		

F1 Calibration Curves



F2 Calibration Curves

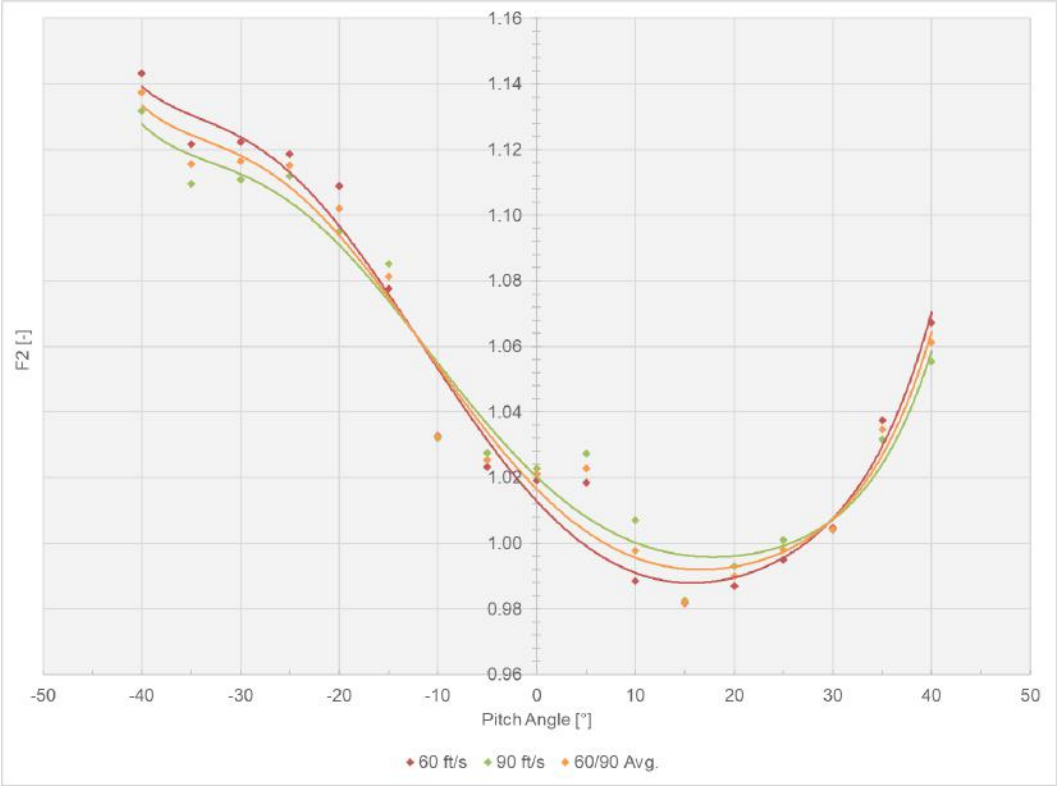


Table 2F-4. Wind Tunnel Velocity Pressure Cross-Check

40 CFR Part 60 Appendix A, Method 2F 10.1.1

Wind tunnel Facility:	Airflow Sciences Corporation (Livonia, MI)
Date:	1-Feb-21
Temperature (F):	73
Barometric Pressure ("Hg):	29.3
Lowest Test Velocity (ft/s):	15
Highest Test Velocity (ft/s):	90

Port	Rep	Velocity Pressure (IWC)	
		Lowest Test Velocity	Highest Test Velocity
Calibration Pitot	1	0.051	1.804
	2	0.052	1.813
	3	0.051	1.811
	Average	*0.051*	*1.809*
3D (side)	1	0.051	1.803
	2	0.052	1.816
	3	0.051	1.805
	Average	*0.051*	*1.808*
MAPs S	1	0.051	1.802
	2	0.052	1.824
	3	0.053	1.804
	Average	*0.052*	*1.810*
MAPs 3D	1	0.050	1.808
	2	0.050	1.821
	3	0.052	1.810
	Average	*0.051*	*1.813*

Table 2F-5. Wind Tunnel Axial Flow Verification

40 CFR Part 60 Appendix A, Method 2F 10.1.2

Wind tunnel Facility:	Airflow Sciences Corporation (Livonia, MI)
Date: 4-Feb-21	
Temperature (F):	73.4
Barometric Pressure ("Hg):	29.06
Probe Type / ID Used:	3DS004
Lowest Test Velocity (ft/s):	15
Highest Test Velocity (ft/s):	90

Port	Lowest Test Velocity		Highest Test Velocity	
	Yaw Angle	Pitch Angle	Yaw Angle	Pitch Angle
Calibration Pitot	1.5	0.0	0.2	0.4
3D (side)	0.6	-1.1	-0.5	-0.4
MAPs S	1.0	-1.2	0.0	-0.5
MAPs 3D	1.0	-1.1	0.0	-0.4

Appendix H
FTIR QAQC Data

ASTM METHOD D6348-12 QAQC Summary

Inlet FTIR: 023LFE032QTX						
Parameter	Gas	Concentration	Path Length	Equilibration Time	Dilution Factor	Recovery (%)
Path Length	C2H4		9.6			
Mechanical Response Time	R22	21.55		30		
System Response	CH4	20.68		30		
Analyte Direct Inject	CH4	19.64				
System Zero	CH4			30		

RCO FTIR: 019LFE003QTX						
Parameter	Gas	Concentration	Path Length	Equilibration Time	Dilution Factor	Recovery (%)
Path Length	C2H4		10.4			
Mechanical Response Time	R22	21.15		30		
System Response	CH4	20.05		30		
Analyte Direct Inject	CH4	20.59				
System Zero	CH4			30		

TO FTIR: 023CFE031QTX						
Parameter	Gas	Concentration	Path Length	Equilibration Time	Dilution Factor	Recovery (%)
Path Length	C2H4		9.1			
Mechanical Response Time	R22	21.04		30		
System Response	CH4	20.11		30		
Analyte Direct Inject	CH4	20.72				
System Zero	CH4			30		

Mechanical and Equilibrium Response Time Tests

Inlet Response Time

Timestamp	Date	Time	Epoch Time	Acetylene	Ammonia	C2H4	C2H6	Carbon dioxide	Carbon mc	Cyclohexanone	Ethyl lactat	Isopropanc	Methane	Nitric Oxid	Nitrogen D	Nitrogen Ti	Nitrous Ox	PGME	PGMEA	Propane	R22	SF6	Water	AcetyleneE	AmmoniaE	C2H4Error	C2H6Error	Carbon dio	Carbon mc	Cyclohexar	Ethyl lactat	Isopropanc	MethaneEr	Nitric Oxid	Nitrogen D
3/25/2025 14:29:43	45741	0.60397	1742938183	3.2637	0.683897	-0.15709	-4.63383	644.714	-0.13235	0.189298	-0.43474	22.665	1.31684	16.3383	0.211066	-0.08043	0.320737	21.0983	7.21221	2.82217	0.000241	0.00547	13113.3	1.0203	0.05119	0.094933	0.256782	4.97815	0.95537	0.054269	0.209532	0.159038	0.437606	6.72847	0.087334
3/25/2025 14:29:56	45741	0.60412	1742938196	2.8062	0.655256	-0.0681825	-4.36466	500.071	0.104667	0.255562	1.57783	20.6052	1.5669	16.006	0.519008	-0.14004	0.365515	23.1275	5.29646	2.26452	-0.01755	-0.00146	13394.8	0.953937	0.046013	0.085193	0.244415	10.4728	0.777174	0.050774	0.199238	0.153917	0.42644	6.51333	0.092851
3/25/2025 14:30:11	45741	0.60429	1742938211	2.48854	0.855195	0.200039	-4.33224	498.18	0.043551	0.303282	1.22655	18.5091	1.55446	15.8739	0.502064	0.004387	0.349326	24.7626	5.73637	1.93702	0.033556	-0.0045	13362.3	0.961693	0.045272	0.088354	0.245972	10.1398	0.771584	0.050556	0.197291	0.155671	0.421279	6.47575	0.09989
3/25/2025 14:30:26	45741	0.60447	1742938226	3.52873	0.769846	-0.218681	-4.08177	498.139	0.08215	0.270483	1.87419	16.8361	1.55042	17.7467	0.344758	-0.08994	0.369012	25.5642	5.35374	2.06675	-0.03369	0.002071	13530.4	0.979852	0.048042	0.090423	0.248439	10.6949	0.803486	0.051954	0.206866	0.159329	0.441207	6.75012	0.100876
3/25/2025 14:30:44	45741	0.60468	1742938244	2.92778	0.849253	-0.140607	-4.14878	495.514	0.072254	0.396206	1.44636	14.8074	1.5556	17.3517	0.556327	-0.11917	0.351189	24.8213	5.12265	2.18458	0.00954	0.006212	13231.8	0.954688	0.046373	0.089293	0.243156	10.3689	0.788395	0.050918	0.200601	0.15451	0.428057	6.36313	0.09042
3/25/2025 14:30:58	45741	0.60484	1742938258	2.56492	0.598002	-0.0709364	-4.33667	504.479	0.03747	0.292367	1.52991	13.4353	1.54709	16.6173	0.208784	-0.08728	0.363738	27.7513	5.75949	1.91941	0.015094	0.011293	13508.6	0.98663	0.044487	0.08597	0.253087	11.0224	0.79346	0.05163	0.205375	0.153036	0.439882	6.72797	0.084442
3/25/2025 14:31:11	45741	0.60499	1742938271	2.58571	0.457691	-0.244037	-4.2316	382.155	0.236135	0.309878	1.30211	10.5614	1.08883	13.3759	0.063467	-0.08544	0.27798	22.9179	4.6337	2.117	0.000202	-0.00837	10943.4	0.866235	0.043869	0.080045	0.226735	8.80823	0.659336	0.044026	0.172253	0.138991	0.372065	5.4387	0.069047
3/25/2025 14:31:29	45741	0.6052	1742938289	2.46521	0.201756	-0.0436631	-4.34543	13.8353	-0.03767	0.523171	0.491255	4.60386	0.287909	1.72324	-0.12229	-0.03591	0.041718	4.19431	0.305269	0.313894	0.011933	0.008891	1647.92	0.568333	0.037962	0.06573	0.159575	1.76525	0.086583	0.026219	0.030712	0.109698	0.082234	0.838916	0.013766
3/25/2025 14:31:44	45741	0.60537	1742938304	1.8074	0.182283	-0.240449	-4.65373	-15.3218	-0.02727	0.461988	0.073286	3.53776	0.176476	0.544646	0.107155	0.000193	0.004835	2.68776	0.057057	0.116212	-0.01529	0.002577	555.228	0.566788	0.041878	0.077931	0.168882	0.803283	0.044657	0.026682	0.024402	0.111508	0.07293	0.476337	0.009823
3/25/2025 14:31:58	45741	0.60553	1742938318	2.13308	-0.0385087	0.0809195	-4.54826	0.132105	0.01607	0.546172	-0.17225	3.80004	0.232692	0.690405	-0.20498	-0.03453	-0.01402	2.44603	0.372715	-0.06497	-0.01908	-0.00056	535.585	0.538228	0.042476	0.080175	0.166392	0.647689	0.033581	0.026149	0.023002	0.107952	0.067789	0.426977	0.018799
3/25/2025 14:32:13	45741	0.60571	1742938333	1.54615	0.0360455	-0.181615	-4.54496	-10.4795	0.020842	0.508514	-0.01798	4.09032	0.216004	0.168092	0.102227	0.018063	0.012204	2.19312	0.523091	0.135287	0.058144	0.00512	403.185	0.563836	0.046122	0.089642	0.166095	0.466195	0.028035	0.026669	0.022901	0.11138	0.06789	0.295656	0.007448
3/25/2025 14:32:27	45741	0.60587	1742938347	2.38283	0.1709	0.0226397	-4.41553	-17.2371	0.012195	0.52645	0.056561	3.69106	0.243512	1.27044	-0.12474	-0.04791	0.012218	2.19618	0.391915	0.159967	-0.05826	0.007965	365.106	0.561329	0.041413	0.082094	0.161749	0.406015	0.029502	0.026639	0.023924	0.118535	0.067699	0.307136	0.00849
3/25/2025 14:32:41	45741	0.60603	1742938361	2.17876	0.0470382	0.0727515	-4.55929	-6.34304	-0.00227	0.561864	0.107267	3.66237	0.227053	0.608584	0.041298	-0.05397	-0.00918	2.32122	0.357632	0.160403	-0.02329	-0.00034	356.699	0.569083	0.041863	0.086701	0.164535	0.38346	0.028535	0.026464	0.022912	0.114637	0.070389	0.268549	0.009325
3/25/2025 14:32:56	45741	0.6062	1742938376	2.25642	-0.100557	-0.166205	-4.44391	-10.5857	-0.0238	0.520748	-0.00273	3.45065	0.282033	0.396753	-0.04158	0.036768	-0.01005	2.15287	0.178957	0.291198	-0.0283	0.012769	244.114	0.5657	0.04093	0.082597	0.165512	0.385302	0.028758	0.026909	0.024138	0.111859	0.069379	0.261347	0.010424
3/25/2025 14:33:14	45741	0.60641	1742938394	2.14336	-0.0481481	0.0416644	-4.50204	-5.4227	-0.00269	0.497906	0.004452	3.95192	0.211244	0.594105	0.077344	-0.12609	-0.00776	1.99666	0.544496	0.170406	-0.0041	0.00044	369.508	0.572255	0.034356	0.067355	0.164279	0.307304	0.027294	0.026707	0.021509	0.110949	0.066828	0.31454	0.008679
3/25/2025 14:33:28	45741	0.60657	1742938408	2.02728	-0.0549034	4.91997	-4.60413	15.0097	0.024116	0.388193	-0.38407	3.70163	9.69846	0.560021	-0.04985	-0.12745	0.030452	1.57423	1.12484	0.228383	9.07369	0.012359	200.181	0.552804	0.043619	0.077563	0.166171	0.371399	0.028842	0.027244	0.034207	0.123908	0.095017	0.287552	0.009762
3/25/2025 14:33:41	45741	0.60672	1742938421	2.07393	0.172768	10.1335	-4.64057	-2.6278	0.003752	0.185389	-1.14244	4.00963	20.1219	0.554257	0.194618	0.013732	0.028799	1.11806	1.4289	0.479228	20.8699	0.015414	-0.52569	0.560379	0.047522	0.089389	0.173456	0.936648	0.026581	0.030487	0.056634	0.143598	0.151634	0.307507	0.007862
3/25/2025 14:33:56	45741	0.6069	1742938436	1.86618	-0.0599305	10.5226	-4.5334	9.30739	-0.01581	0.233301	-1.17384	5.2927	20.6841	0.104461	0.040792	-0.01402	0.000518	1.12353	1.75695	0.740091	21.5498	0.011944	112.616	0.563041	0.047438	0.081862	0.173673	0.529553	0.030365	0.029869	0.05721	0.134719	0.156611	0.22174	0.013899
3/25/2025 14:34:11	45741	0.60707	1742938451	2.16994	0.00616313	9.92392	-4.41686	-2.15084	-0.02867	0.313062	-1.63543	5.36023	20.6558	0.358538	-0.14116	-0.06044	0.014952	0.987553	1.72478	0.434415	21.5577	0.022393	206.61	0.570292	0.058732	0.102196	0.170931	0.462848	0.024802	0.029665	0.057106	0.143293	0.159406	0.224479	0.005617
3/25/2025 14:34:26	45741	0.60725	1742938466	2.09432	0.107307	10.4179	-4.53309	-7.20248	-0.01411	0.22241	-1.33655	4.88559	20.7716	0.772711	0.011943	-0.21882	0.012425	0.898817	1.67334	0.61086	21.5435	0.010437	143.687	0.56501	0.049807	0.08603	0.173531	0.473384	0.032275	0.029988	0.05904	0.140186	0.162829	0.243998	0.010013
3/25/2025 14:34:44	45741	0.60745	1742938484	2.27764	0.159351	10.3896	-4.39855	-13.048	-0.0085	0.244382	-1.35711	4.91723	20.6939	0.449253	-0.15966	-0.03584	0.011889	1.09473	1.45509	0.548463	21.3968	0.012822	161.126	0.567799	0.041676	0.078106	0.172842	0.397319	0.021823	0.02935	0.057314	0.139007	0.15937	0.198053	0.013734
3/25/2025 14:34:56	45741	0.60759	1742938496	1.25234	-0.0698926	10.2063	-4.64477	-5.73952	0.022562	0.272246	-1.17755	4.62506	20.8416	0.754158	-0.05144	-0.00208	0.015891	1.11957	1.62912	0.402349	21.5565	0.020665	173.536	0.567375	0.053296	0.089601	0.17586	0.49164	0.024578	0.029228	0.056079	0.135444	0.157872	0.266674	0.015323
3/25/2025 14:35:11	45741	0.60777	1742938511	1.63037	0.180497	10.5032	-4.52466	-2.42606	-0.01346	0.247215	-1.44014	4.99348	20.8096	0.779285	-0.03646	-0.13194	0.010044	1.04037	1.65898	0.624969	21.5667	0.009037	-83.2575	0.558392	0.052586	0.090463	0.175667	0.44451	0.024833	0.030474	0.057307	0.14182	0.158768	0.219821	0.014993
3/25/2025 14:35:26	45741	0.60794	1742938526	1.30156	0.0479928	10.6494	-4.62232	-5.25022	-0.00665	0.213344	-1.17896	4.44508	20.793	-0.22056	-0.18407	0.043854	-0.0084	1.39366	1.32564	0.615484	21.3392	0.012018	222.501	0.553993	0.048499	0.090059	0.178128	0.445545	0.028545	0.02915	0.057888	0.14206	0.158902	0.238273	0.01922
3/25/2025 14:36:04	45741	0.60838	1742938564	2.0896	-0.00729344	10.4532	-4.6027	-10.6597	0.01479	0.256081	-1.45275	4.96957	20.8124	0.863221	0.034	0.144327	0.002544	0.946831	1.63865	0.611575	21.5508	0.017389	202.611	0.570884	0.048142	0.090591	0.176239	0.43777	0.025224	0.030081	0.057165	0.137148	0.157735	0.251074	0.007491
3/25/2025 14:36:21	45741	0.60858	1742938581	1.80741	0.11913	10.2364	-4.54718	-3.64539	0.003066	0.27571	-1.1537	4.69584	20.7935	-0.01788	-0.01892	0.003101	0.012499	1.01457	1.49349	0.264315	21.4855	0.015783	125.308	0.569265	0.038034	0.070853	0.174594	0.368122	0.024977	0.029764	0.056617	0.131743	0.158375	0.228084	0.008681
3/25/2025 14:36:34	45741	0.60873	1742938594	1.88655	0.0161533	10.6515	-4.5239	4.20623	-0.00537	0.251	-1.26916	5.69098	20.7784	0.19907	0.291735	-0.24003	0.018414	0.98068	1.78763	0.294378	21.6646	0.019463	61.6131	0.565933	0.048021	0.088287	0.175	0.60137	0.022585	0.02971	0.055053	0.144592	0.155116	0.234076	0.009257
3/25/2025 14:36:51	45741	0.60892	1742938611	1.75844	0.122938	10.5111	-4.47888	-2.99351	-0.02983	0.249712	-1.50255	5.07805	20.6733	0.917899	0.095643	-0.03364	0.001525	0.923097	2.03308	0.358041	21.5041	0.017131	89.0854	0.562014	0.039551	0.083535	0.172245	0.358589	0.022851	0.02987	0.05572	0.137987	0.157284	0.286163	0.008815
3/25/2025 14:37:04	45741	0.60907	1742938624	1.89816	0.191984	10.1896	-4.40617	0.894372	0.008613	0.30285	-1.1893	5.89547	20.6282	-0.06459	0.009935	-0.109	0.017134	1.08937	1.80033	0.256873	21.664	0.011697	50.0332	0.570945	0.05058	0.088677	0.173116	0.457801	0.024364	0.029089	0.054459	0.144531	0.15188	0.309569	0.013884
3/25/2025 14:37:21	45741	0.60927	1742938641	1.61185	0.140668	10.441	-4.58875	-3.16746	0.023935	0.266816	-1.23434	4.75823	20.7629	0.516634	-0.22058	-0.00141	0.006215	1.22603	1.33702	0.337621	21.5834	0.013147	-62.0543	0.559902	0.037464	0.074719	0.177075	0.391925	0.021355	0.028842	0.05652	0.133477	0.159214	0.263669	0.009204
3/25/2025 14:37:34	45741	0.60942	1742938654	1.7474	0.110079	10.8508	-4.5153	-6.47923	0.035723	0.235205	-1.57065	5.63134	20.7236	0.415317	0.017665	0.000936	-0.00874	0.97568	1.59072	0.358959	21.4926	0.026703	-63.63	0.583224	0.048926	0.087895	0.172869	0.532018	0.023648	0.029418	0.056926	0.139391	0.159288	0.272086	0.011905
3/25/2025 14:37:52	45741	0.60963	1742938672	1.83393	0.0731673	10.0364	-4.51888	4.70121	0.020082	0.257414	-1.09671	4.65263	20.3653	0.259022	0.178126	-0.01661	0.010657	1.26981	1.5878	0.263877	21.15	0.018801	57.9039	0.560277	0.04289	0.080102	0.173991	0.374288	0.021395	0.029383	0.054417	0.138738	0.153016	0.241028	0.012154
3/25/2025 14:38:05	45741	0.60978	1742938685	2.59463	0.537555	1.00211	-4.41027	484.882	-0.13579	0.493391	-0.33554	9.28093	4.05954	10.2512	0.112379	-0.05459	0.293387	27.0739	7.90593	2.06002	2.96371	-0.00503	9376.63	0.801488	0.050659	0.097844	0.211766	4.13278	0.635903	0.041318	0.139861	0.147706	0.298879	4.38673	0.050346
3/25/2025 14:38:19	45741	0.60994	1742938699	2.54981	0.31007	-0.2111	-4.35703	476.671	0.106797	0.490435	1.18453	8.20618	1.56038	16.6722	0.435921	-0.0889	0.359643	32.554	6.67446	2.11332	0.136735	0.009063	12687.9	0.937635	0.047903	0.089658	0.244407	10.3472	0.745281	0.049038	0.193337	0.15056	0.414894	6.28404	0.082766
3/25/2025 14:38:34	45741	0.61012	1742938714	2.27974	0.682599	-0.125746	-4.63686	474.236	0.011112	0.445616	1.31856	8.2141	1.42394	17.8229	0.204161	-0.09965	0.356136	33.7438	7.22859	2.10201	0.082418	0.01216	12813.8	0.939592	0.042673	0.081453	0.249489	10.4485	0.754044	0.049988	0.196707	0.144854	0.4192	6.45465	0.095133
3/25/2025 14:38:51	45741	0.61031	1742938731	2.77419	0.615749	-0.0249814	-4.35699	488.56	0.069887	0.424042	1.46588	8.67395	1.47858	17.7865	0.320544	-0.14271	0.367679	32.2894	6.74086	2.31428	0.042952	-0.00027	13044.8	0.953315	0.04406	0.078476	0.2481	10.441	0.771304	0.050223	0.200323	0.14558	0.42938	6.8085	0.091364

RCO Response Time

Timestamp	Date	Time	Epoch Time	C2H4	C2H6	CH4	CO	CO2	Cyclohexar	Ethyl lactate	Formaldeh	H2O	Isopropanc	N2O	NO	NO2	PGME	PGMEA	Propane	R22	C2H4Error	C2H6Error	CH4Error	COError	CO2Error	Cyclohexar	Ethyl lactat	Formaldeh	H2OError	Isopropanc	N2OError	NOError	NO2Error	PGMEError	PGMEAErr
3/25/2025 14:30:08	45741	0.60426	1742931008	-0.184828	-0.0540192	1.0329	0.481038	468.918	-0.08318	-2.01346	-0.01401	12113	0.15208	0.096396	-0.57747	0.220755	0.227868	1.01989	1.63404	0.021432	0.081899	0.088789	0.156355	0.219457	4.75164	0.025279	0.094109	0.038394	62.9854	0.074148	0.020534	0.198669	0.020682	0.057598	0.075496
3/25/2025 14:30:23	45741	0.60443	1742931023	0.0316197	-0.20229	1.54923	0.393816	466.456	-0.13206	-0.278052	-0.0226	12062.9	0.236713	0.106792	-0.11331	0.333834	-0.27119	0.124947	1.76658	0.073831	0.071724	0.074071	0.149025	0.15854	6.29039	0.020269	0.078687	0.036877	52.7011	0.066208	0.017817	0.148215	0.01638	0.047156	0.063063
3/25/2025 14:30:38	45741	0.60461	1742931038	0.121959	-0.288242	1.47949	0.340698	496.578	-0.28551	-0.985164	-0.05288	12083	0.143165	0.101163	-0.34817	0.336653	0.024183	0.196928	1.02028	0.012157	0.07058	0.074275	0.141079	0.158236	6.01689	0.02018	0.077145	0.040098	49.9299	0.062872	0.017423	0.14196	0.012395	0.046372	0.061723
3/25/2025 14:30:55	45741	0.6048	1742931055	0.201049	-0.188485	1.25942	0.310304	485.329	-0.26526	-0.464942	0.005213	12035.1	0.011382	0.119194	-0.24661	0.209849	0.092919	0.752475	0.943998	0.016616	0.066579	0.069942	0.134113	0.152948	4.77834	0.018564	0.073654	0.030846	41.6984	0.060755	0.015563	0.135507	0.011279	0.043549	0.058332
3/25/2025 14:31:08	45741	0.60495	1742931068	0.0745486	-0.390319	1.3401	0.272127	492	-0.27006	-0.635848	-0.04301	11945.1	-0.35488	0.111847	0.233217	-0.0798	-0.66187	1.18076	1.3919	-0.00916	0.077138	0.069777	0.12391	0.155733	6.3651	0.019177	0.07343	0.040955	47.0591	0.058531	0.016692	0.140093	0.008925	0.043931	0.057812
3/25/2025 14:31:23	45741	0.60513	1742931083	0.142133	-0.392081	1.47318	0.331818	471.232	-0.20044	-0.955042	0.084556	12230.8	-0.67584	0.119498	-0.54399	0.576488	-0.19032	0.197054	1.76026	-0.01826	0.07697	0.068559	0.130874	0.147807	5.65771	0.018505	0.071904	0.038139	45.4527	0.057675	0.017455	0.155578	0.012416	0.042258	0.055971
3/25/2025 14:31:39	45741	0.60531	1742931099	0.274419	-0.155019	1.11121	0.277809	357.37	-0.00216	0.554118	0.079078	9478.36	-0.48124	0.067375	-0.29662	0.263099	0.494858	-0.7417	0.800238	0.096708	0.077806	0.06482	0.12042	0.124271	5.00438	0.018043	0.068086	0.038678	48.9516	0.056131	0.017328	0.11767	0.005845	0.041106	0.054515
3/25/2025 14:31:54	45741	0.60549	1742931114	0.191032	-0.208429	-0.144867	0.0386545	4.62717	0.003265	-0.990216	0.176617	902.871	0.430452	-0.00186	0.317641	-0.28141	-0.02304	1.13509	-0.02285	0.019011	0.07967	0.042821	0.065826	0.040588	3.72791	0.013978	0.044111	0.040224	45.7295	0.03817	0.012147	0.089236	0.006743	0.029928	0.03813
3/25/2025 14:32:09	45741	0.60566	1742931129	0.119804	-0.196834	0.0169378	0.195108	-40.899	-0.03513	0.515554	-0.01606	338.832	-0.32265	-0.00862	0.110373	0.265528	-0.06164	-0.33015	-0.14434	0.055771	0.082442	0.043122	0.064817	0.047719	1.03235	0.013913	0.045352	0.035861	42.8998	0.039171	0.012758	0.073757	0.005663	0.02981	0.03872
3/25/2025 14:32:23	45741	0.60582	1742931143	0.0835324	-0.362817	-0.410014	0.116941	-9.719	0.069413	0.347062	-0.06067	228.37	-0.66122	0.001387	0.710479	-0.03709	-0.12306	0.499064	0.024649	-0.03473	0.079628	0.040729	0.068638	0.045145	1.08943	0.013383	0.041929	0.037104	45.1732	0.036683	0.013667	0.068294	0.014823	0.028641	0.036706
3/25/2025 14:32:40	45741	0.60602	1742931160	-0.044602	-0.288274	-0.106235	0.0245702	-4.89064	-0.00922	0.226469	-0.07246	215.216	-0.12334	0.00206	0.480089	0.245106	-0.16971	0.096573	-0.07581	0.006306	0.066175	0.034288	0.049131	0.03585	0.926218	0.011148	0.03576	0.030508	35.5818	0.030913	0.010584	0.069979	0.00461	0.024305	0.030914
3/25/2025 14:32:53	45741	0.60617	1742931173	0.0915519	-0.136394	-0.0777344	0.0316863	21.5959	0.090051	0.0390288	-0.04308	161.468	0.44891	-0.01833	-0.00763	-0.17738	-0.29284	0.315884	-0.21743	-0.05661	0.078167	0.042506	0.071647	0.048751	1.12932	0.013823	0.044831	0.037113	36.669	0.039601	0.011954	0.091524	0.00211	0.029817	0.038687
3/25/2025 14:33:08	45741	0.60634	1742931188	0.0355341	-0.0595813	-0.192812	-0.102549	-27.4651	0.065275	-0.600186	0.131593	11.3898	0.106297	-0.00642	0.702182	-0.31982	-0.13653	0.286705	0.614545	0.119203	0.081284	0.042819	0.068142	0.046902	3.37004	0.014261	0.045531	0.038127	41.6048	0.04017	0.011862	0.082782	0.005109	0.030783	0.03985
3/25/2025 14:33:24	45741	0.60653	1742931204	-0.063029	-0.240272	-0.0225782	-0.0117135	7.00213	-0.00345	-0.493813	-0.04525	159.151	-0.3965	0.008536	0.203077	-0.02582	0.456118	-0.49523	0.360322	0.020033	0.063582	0.035413	0.053611	0.037777	0.894072	0.011459	0.036263	0.033845	39.1365	0.030846	0.010212	0.066016	0.011452	0.024661	0.031307
3/25/2025 14:33:38	45741	0.60669	1742931218	0.081241	-0.205952	-0.375834	0.0984404	-43.1787	0.124941	0.675095	-0.14094	124.043	-0.38348	0.007585	0.02331	0.214191	0.499346	-1.3775	0.113989	0.016143	0.082458	0.042483	0.070686	0.04329	0.94749	0.014023	0.045153	0.035592	44.3772	0.03969	0.013463	0.068548	0.004835	0.030119	0.039177
3/25/2025 14:33:53	45741	0.60686	1742931233	1.04976	-0.0471857	2.03976	-0.0761633	12.6763	-0.12158	-0.599235	0.081829	157.806	0.130909	-0.00042	-0.03174	-0.57293	-0.34633	0.635832	0.314932	1.80744	0.073099	0.043642	0.07053	0.049149	1.22974	0.014386	0.046226	0.03978	40.722	0.04003	0.01221	0.081937	0.006983	0.030753	0.039449
3/25/2025 14:34:08	45741	0.60704	1742931248	10.0594	-0.0837913	18.5065	0.110993	9.94799	-0.21377	0.259004	0.014789	148.215	0.113492	0.003519	0.110064	0.108608	-1.25284	0.300341	0.2768	19.8312	0.082266	0.057623	0.100048	0.052453	2.52355	0.016525	0.059069	0.04197	62.3412	0.050076	0.011992	0.079282	0.007852	0.037235	0.049002
3/25/2025 14:34:23	45741	0.60721	1742931263	10.61	-0.080841	20.0486	-0.0733574	22.3834	-0.37023	0.0623875	-0.07406	204.432	0.390387	-0.008	0.106691	0.310534	-1.2716	1.34268	0.55134	21.1495	0.072823	0.058569	0.111696	0.049651	0.931593	0.016314	0.058515	0.037542	67.3444	0.050412	0.012739	0.091495	0.006703	0.036811	0.048452
3/25/2025 14:34:39	45741	0.6074	1742931279	10.2886	-0.401109	19.81	-0.0677271	-11.2397	-0.38124	0.270249	-0.20017	108.743	-0.45277	0.002259	-0.06022	0.050049	-0.71796	-0.08868	1.00067	21.2035	0.07851	0.0597	0.11807	0.04018	4.002	0.017036	0.058972	0.038976	70.1577	0.051845	0.013896	0.08955	0.010116	0.037731	0.050209
3/25/2025 14:34:53	45741	0.60756	1742931293	10.7032	-0.148029	20.0541	0.0301054	-12.2154	-0.2486	-0.0651776	0.010876	147.184	0.199458	0.013982	0.020778	-0.2358	-1.05688	0.481475	0.390258	21.4276	0.08079	0.058091	0.111616	0.050446	0.935804	0.01667	0.058259	0.042567	61.3574	0.050187	0.012675	0.098049	0.005104	0.038013	0.049026
3/25/2025 14:35:08	45741	0.60773	1742931308	10.6397	-0.0689993	19.8164	-0.0676481	-30.8422	-0.28873	0.329516	0.027977	120.55	-0.22545	0.01823	0.500622	0.009455	-0.56778	-0.05082	-0.17699	21.386	0.080351	0.057918	0.116768	0.045575	0.972919	0.016688	0.059607	0.037414	61.2397	0.052313	0.013717	0.083339	0.008704	0.038094	0.050116
3/25/2025 14:35:23	45741	0.60791	1742931323	10.4195	-0.196199	19.7758	0.0277362	13.8379	-0.38136	-0.127874	0.196697	15.6298	-0.19721	-0.01164	-0.34968	-0.24796	-1.42133	1.23732	0.486075	21.0941	0.080499	0.061706	0.11515	0.047284	0.967239	0.017039	0.060218	0.03863	69.6826	0.052838	0.011445	0.067492	0.012536	0.038159	0.050303
3/25/2025 14:35:38	45741	0.60808	1742931338	10.3453	-0.213569	19.8629	-0.0328917	46.7303	-0.37817	-0.0784426	-0.01326	51.3289	0.105861	-2.78E-03	0.377533	-0.28897	-1.52098	1.658	0.121262	21.1842	0.080321	0.058093	0.10891	0.049451	2.28065	0.016641	0.058096	0.03825	67.9877	0.051614	0.01137	0.096734	0.019162	0.037319	0.049337
3/25/2025 14:35:53	45741	0.60825	1742931353	10.5705	-0.316436	19.9143	-0.016392	4.79848	-0.34159	0.10253	0.063029	41.5977	0.258239	0.006709	0.500833	0.22545	-1.28795	1.04294	1.38077	21.2516	0.078436	0.056686	0.10655	0.047766	4.05569	0.016572	0.057505	0.038828	68.1492	0.050566	0.012416	0.087451	0.016403	0.037059	0.04912
3/25/2025 14:36:14	45741	0.6085	1742931374	10.5809	-0.203097	19.8225	0.0734292	-17.7053	-0.25147	-0.0392232	0.256155	19.1552	0.261193	-0.00342	0.214703	-0.11691	-1.24018	1.0917	0.027723	21.3104	0.065718	0.050879	0.102724	0.039779	0.907086	0.014296	0.051248	0.030947	57.7039	0.045599	0.010944	0.071308	0.005657	0.032175	0.04284
3/25/2025 14:36:23	45741	0.6086	1742931383	10.6735	-0.300645	20.3012	-0.121052	22.3815	-0.30699	0.0027973	-0.03492	212.891	0.142061	-0.00185	0.533272	0.191728	-1.05911	0.541629	1.68786	21.1903	0.116816	0.076845	0.143142	0.066284	1.29741	0.021636	0.07766	0.054539	95.6623	0.066788	0.017429	0.112329	0.008453	0.049446	0.064239
3/25/2025 14:36:38	45741	0.60877	1742931398	10.6948	-0.0978949	19.6597	-0.101508	-14.1159	-0.26544	0.128471	-0.05327	-37.3694	0.087267	0.008503	0.277279	-0.15471	-1.25289	0.681768	0.680531	21.3851	0.076208	0.062648	0.123544	0.043098	3.4839	0.017398	0.062519	0.036234	71.2963	0.055103	0.012418	0.082229	0.006746	0.03946	0.051898
3/25/2025 14:36:53	45741	0.60895	1742931413	9.96539	-0.0267249	20.2608	-0.0486611	-8.4345	-0.41674	0.430053	-0.08933	134.465	-0.33193	-0.00602	0.206161	0.685204	-0.95764	-0.08311	0.739927	21.2294	0.078218	0.058597	0.109512	0.053019	0.916919	0.016534	0.057047	0.039527	62.3967	0.050075	0.012687	0.071196	0.007173	0.036912	0.048262
3/25/2025 14:37:08	45741	0.60912	1742931428	10.4162	-0.444961	20.11	-0.00837116	8.73247	-0.31454	0.141302	-0.23891	59.1357	0.120286	0.005288	0.219089	0.368953	-1.09789	0.992955	0.571725	21.4775	0.085004	0.057883	0.111562	0.046184	1.10748	0.016239	0.057636	0.036904	68.42	0.050227	0.0126	0.078388	0.00546	0.03657	0.048187
3/25/2025 14:37:24	45741	0.60931	1742931444	10.5681	-0.160307	19.7299	0.0348533	-33.5634	-0.29855	-0.0259932	-0.17367	101.85	0.060735	-0.00444	-0.10607	-0.46033	-1.20045	1.59497	0.380066	21.1186	0.079445	0.057473	0.109768	0.050078	1.13135	0.016537	0.057862	0.039621	61.8818	0.050166	0.012799	0.079641	0.014252	0.036928	0.048327
3/25/2025 14:37:41	45741	0.6095	1742931461	10.4631	-0.21024	19.9483	-0.0529735	15.8711	-0.2459	0.127953	-0.27911	162.474	0.153549	-0.00883	0.360853	0.32298	-0.95135	1.00592	0.344452	21.1981	0.065656	0.054632	0.107105	0.044217	0.810065	0.015044	0.054531	0.033372	57.9389	0.047639	0.011169	0.059831	0.009455	0.034371	0.045145
3/25/2025 14:37:54	45741	0.60965	1742931474	10.7556	-0.119102	19.8922	0.00453435	8.74852	-0.37615	0.00616468	-0.18713	107.256	-0.1804	4.41E-03	0.313778	0.394527	-0.6946	0.791697	0.06472	21.275	0.077976	0.057879	0.110343	0.039355	2.54526	0.016507	0.057781	0.037209	68.7202	0.050319	0.012889	0.075531	0.007142	0.036855	0.048221
3/25/2025 14:38:10	45741	0.60984	1742931490	10.5882	0.116273	19.8865	0.0421121	-8.0969	-0.32739	0.618937	0.124957	99.6506	-0.14166	-0.00252	0.214892	-0.17962	-1.23296	0.542302	0.458708	21.1575	0.06666	0.059106	0.112785	0.040052	0.843129	0.015684	0.056608	0.031847	59.0492	0.049184	0.011371	0.057981	0.006063	0.035407	0.047102
3/25/2025 14:38:23	45741	0.60999	1742931503	9.33078	-0.286944	17.5031	-0.0025183	79.142	-0.30563	0.146381	-0.12369	1163.51	-0.2505	0.011037	-0.31261	0.095724	-0.78614	0.61945	0.829703	17.8813	0.076707	0.053483	0.103406	0.060331	1.39528	0.016007	0.055954	0.036271	58.0852	0.049001	0.014559	0.090568	0.009705	0.035802	0.047326
3/25/2025 14:38:39	45741	0.61017	1742931519	1.19729	-0.0161604	3.44045	0.310565	388.633	-0.04015	-0.910953	-0.06289	10200.4	-0.18146	0.098486	-1.06785	0.271409	-0.22941	1.36199	0.182991	2.59465	0.077049	0.077752	0.140799	0.173239	7.37876	0.022233	0.081176	0.039107	57.2607	0.065916	0.021853	0.176987	0.010979	0.049323	0.065162
3/25/2025 14:38:53	45741	0.61034	1742931533	0.406528	-0.0562463	2.10555	0.332818	468.521	-0.11418	-0.601019	-0.1485	11799.4	-0.17888	0.107454	-0.43591	-0.19664	-0.32792	0.656216	0.69123	0.470407	0.070072	0.071544	0.133764	0.145937	5.87894	0.019741	0.07536	0.040401	46.4736	0.063189	0.017964	0.14963	0.008261	0.045416	0.06005
3/25/2025 14:39:08	45741	0.61051	1742931548	0.374371	-0.192897	2.05722	0.279501	464.803	-0.26214	-0.822085	-0.21548	11923	-0.28529	0.137622	-0.17775	0.089609	0.24181	-0.31967	0.936629	0.432125	0.075897	0.071721	0.135964	0.147911	5.79677	0.019495	0.07573	0.040926	47.711	0.062142	0.01745	0.131319	0.005415	0.045669	0.06031
3/25/2025 14:39:25	45741	0.61071	1742931565	0.357457	-0.121898	1.39495	0.351646	455.154	-0.20408	-0.41451	0.017156	11972.6	-0.30384	0.113959	-0.50245	0.175141	-0.19679	0.069261	1.00854	0.488937	0.062141	0.070308	0.139302	0.151112	4.78763	0.018851	0.075085	0.035258	40.2746	0.062084	0.016781	0.128201	0.010293	0.04415	0.058917
3/25/2025 14:39:38	45741	0.61086	1742931578	0.16936	0.0353509	1.8025	0.377491	449.672	-0.14005	-0.92513	0.033592	12035	0.249855	0.098594	-0.85089	-0.02764	0.132129	0.548252	0.476296	0.420186	0.071114	0.07294	0.145073	0.143774	5.69229	0.019721	0.077416	0.034929	48.4439	0.064302	0.017818	0.141248	0.008644	0.046247	0.06133

TO Response Time

Timestamp	Date	Time	Epoch Time	C2H4	C2H6	CH4	CO	CO2	Cyclohexar	Ethyl lactate	Formaldeh	H2O	H2OInt	HF	N2O	NO	NO2	PGME	PGMEA	Propane	R22	C2H4Error	C2H6Error	CH4Error	COError	CO2Error	Cyclohexar	Ethyl lactat	Formaldeh	H2OError	H2OIntErr	HFError	N2OError	NOError	NO2Error
3/25/2025 14:30:05	45741	0.60422	1742938205	2.0536	-0.542019	0.610421	313.861	19226	-0.76162	-9.00275	2.02405	54769.7	0.032734	0.167636	0.368166	-0.68708	13.5062	-1.35586	7.36377	7.7857	0.455699	0.216615	0.360061	0.574753	1.38905	217.155	0.094489	0.371631	0.043696	290.366	0.001129	0.366876	0.599137	0.394559	0.006829
3/25/2025 14:30:20	45741	0.6044	1742938220	2.19628	-0.473488	2.20002	313.276	19660.8	-0.29887	-1.82893	2.03691	54652	0.03038	0.167778	0.074956	-0.35216	13.7873	0.454545	0.388513	0.682849	0.02944	0.080025	0.125399	0.208201	2.01675	74.2643	0.029805	0.130348	0.012966	121.162	0.001076	0.116167	0.547748	0.392476	0.010218
3/25/2025 14:30:38	45741	0.60461	1742938238	1.97666	-0.450286	2.04729	310.703	19978.7	-0.26823	-1.68902	1.86145	54812.7	0.033576	0.147054	0.095609	-0.42485	14.2577	0.132443	0.390057	0.987768	0.011059	0.079438	0.120762	0.200285	1.98667	74.2121	0.028824	0.125603	0.013136	120.527	0.00113	0.11559	0.548285	0.404332	0.009527
3/25/2025 14:30:53	45741	0.60478	1742938253	1.74241	-0.559563	1.81319	295.235	20183.2	-0.29398	-1.86518	1.65211	54939.2	0.032655	0.15521	0.150442	-0.39352	14.8476	0.065404	0.610816	1.05306	0.034727	0.077018	0.124252	0.203341	1.96671	72.7067	0.029081	0.127373	0.013057	121.293	0.001134	0.117978	0.542565	0.394313	0.011422
3/25/2025 14:31:05	45741	0.60492	1742938265	0.594829	-0.152133	0.69986	75.6877	6035.92	-0.17178	-0.181026	0.624944	21453.3	0.147945	0.045555	-0.0422	-0.07274	3.6444	0.112712	0.021343	0.649614	0.050877	0.043389	0.034843	0.063374	0.522474	44.8706	0.010266	0.038846	0.008716	64.9901	0.000227	0.035806	0.225421	0.11971	0.011215
3/25/2025 14:31:20	45741	0.60509	1742938280	0.0444358	-0.046243	0.0154644	16.0891	432.93	-0.18887	-0.189283	0.056816	3437.19	0.010988	0.01852	-0.01528	-0.07856	0.268349	0.038224	0.017247	0.093513	0.017801	0.029793	0.013438	0.021343	0.067598	29.6484	0.005798	0.013876	0.007552	17.4447	9.60E-05	0.016687	0.037644	0.036714	0.001344
3/25/2025 14:31:36	45741	0.60528	1742938296	0.0862316	-0.137591	-0.0886427	14.6667	46.5332	-0.13814	-0.212877	-0.00245	687.572	0.0039	0.018625	-0.00176	-0.19597	0.06789	0.009175	0.165159	0.183024	0.004337	0.023687	0.010472	0.014677	0.018174	23.4422	0.00467	0.010201	0.00689	10.6212	6.02E-05	0.010357	0.006784	0.029352	0.002799
3/25/2025 14:31:50	45741	0.60544	1742938310	0.0725816	-0.114656	-0.00691098	14.6391	18.6024	-0.11095	-0.236236	0.019825	469.058	0.00308	-0.0023	0.001677	-0.04787	0.1121	0.093598	0.066072	0.189609	-0.00484	0.028102	0.011079	0.016477	0.015197	29.4719	0.004442	0.011111	0.007669	12.8122	3.81E-05	0.010793	0.005106	0.032564	0.002917
3/25/2025 14:32:07	45741	0.60564	1742938327	0.0614806	-0.0741078	-0.0583958	14.6337	46.5945	-0.12176	-0.218488	0.013246	401.201	0.003033	-0.01362	0.00149	-0.15941	0.047142	0.021711	0.040737	0.139876	0.00637	0.023025	0.010201	0.013687	0.013685	24.1302	0.004031	0.009973	0.006742	11.1325	3.67E-05	0.010616	0.00447	0.036326	0.001551
3/25/2025 14:32:20	45741	0.60579	1742938340	0.0894069	-0.116848	-0.0100712	14.6325	26.3513	-0.09529	-0.178937	0.014071	374.654	0.002946	-0.01188	-0.00167	-0.25493	0.083541	0.129749	-0.24008	0.095725	0.035173	0.030461	0.01119	0.014909	0.018533	28.9603	0.004175	0.010912	0.007212	13.1819	4.56E-05	0.011176	0.004655	0.039823	0.006307
3/25/2025 14:32:37	45741	0.60598	1742938357	0.127719	-0.0564762	-0.0625221	14.629	43.0654	-0.10372	-0.199446	0.035828	356.619	0.002899	0.004924	-0.00193	-0.29557	-0.05936	0.053053	-0.02128	0.089578	0.011983	0.024738	0.010023	0.013274	0.01592	24.0696	0.003657	0.009841	0.006555	10.8172	3.92E-05	0.010362	0.00367	0.035321	0.001652
3/25/2025 14:32:50	45741	0.60613	1742938370	0.0575283	-0.107354	-0.0147186	14.6187	12.3589	-0.105	-0.239598	0.003357	322.855	0.002843	0.010948	0.001944	-0.32855	-0.18015	-0.07181	0.278836	0.056334	0.009234	0.029841	0.011324	0.014523	0.016758	27.9317	0.003646	0.010826	0.008136	12.5226	4.30E-05	0.011133	0.00441	0.037154	0.002444
3/25/2025 14:33:05	45741	0.60631	1742938385	0.0978909	-0.0804891	-0.0299618	14.648	2.8089	-0.10022	-0.264825	-0.00391	345.049	0.002814	0.015601	0.000986	-0.24641	0.065374	0.017163	0.153563	0.11386	-0.00955	0.029081	0.01109	0.016306	0.015736	28.2604	0.003832	0.011181	0.007467	11.3936	3.64E-05	0.011798	0.003923	0.03386	0.001767
3/25/2025 14:33:23	45741	0.60652	1742938403	5.34234	-0.0864299	10.4241	14.6495	4.66944	-0.27771	-0.229618	0.012952	412.529	0.002708	0.009807	0.001121	-0.03194	0.01626	-0.5687	0.635581	0.438162	9.52291	0.035874	0.040584	0.070885	0.022488	31.4069	0.009011	0.037096	0.007082	30.0667	3.99E-05	0.027229	0.003962	0.02814	0.001886
3/25/2025 14:33:35	45741	0.60666	1742938415	10.8081	0.0810884	19.82	14.6094	-127.454	-0.44452	-0.127933	-0.02	234.366	0.002312	-0.01504	-0.00301	-0.14821	-0.0537	-0.92309	0.810442	1.19991	20.752	0.061777	0.098979	0.178862	0.037948	43.4545	0.019857	0.085264	0.009857	46.401	5.71E-05	0.042323	0.004941	0.040563	0.002907
3/25/2025 14:33:50	45741	0.60683	1742938430	10.8684	0.156069	20.1052	14.6432	-114.127	-0.40891	-0.183902	0.048461	266.873	0.002293	-0.01424	0.00143	-0.2239	-0.14131	-1.0858	0.977824	0.779479	21.0419	0.06341	0.1006	0.188725	0.036752	42.3814	0.019952	0.085885	0.007384	42.9855	4.99E-05	0.042363	0.003762	0.033892	0.003395
3/25/2025 14:34:06	45741	0.60701	1742938446	10.877	0.152561	20.075	14.6444	-173.253	-0.4106	-0.00755144	0.00833	250.482	0.002267	-0.00208	-0.00103	-0.21878	-0.06555	-0.9513	0.773986	0.737766	21.0029	0.061663	0.100779	0.187171	0.035955	42.9139	0.019833	0.085681	0.007746	43.1648	5.24E-05	0.04231	0.003997	0.034543	0.002941
3/25/2025 14:34:20	45741	0.60718	1742938460	11.0196	0.151381	20.2173	14.6354	-75.9584	-0.41902	-0.160721	-0.05622	257.23	0.002491	-0.00286	-0.00316	-0.20438	-0.01336	-0.99058	0.973928	0.841794	21.0887	0.068437	0.100586	0.188375	0.034958	46.8112	0.019861	0.085565	0.009472	48.0275	6.20E-05	0.042087	0.003919	0.036793	0.00166
3/25/2025 14:34:38	45741	0.60738	1742938478	11.0004	0.204807	20.1213	14.5996	-97.0105	-0.41533	-0.164023	0.013442	234.201	0.002227	-0.00126	0.003379	-0.2167	-0.00659	-1.00884	0.887628	0.69755	21.0364	0.064307	0.100134	0.187094	0.035354	42.3839	0.019694	0.085149	0.007277	45.645	4.73E-05	0.041105	0.003786	0.0335	0.002595
3/25/2025 14:34:50	45741	0.60752	1742938490	10.9547	0.0719	20.0942	14.6342	-119.24	-0.43395	-0.115516	0.016182	230.386	0.002174	-0.00822	-0.00212	-0.02563	-0.04817	-1.04534	0.904906	0.860956	21.097	0.065979	0.103992	0.193823	0.034808	45.6533	0.020388	0.088101	0.009088	43.8061	5.76E-05	0.042879	0.00376	0.044616	0.002116
3/25/2025 14:35:07	45741	0.60772	1742938507	11.0431	0.1219	20.0709	14.6309	-146.757	-0.41209	-0.182076	-0.00235	219.184	0.001951	-0.00918	-0.00358	-0.26676	-0.06007	-0.95223	0.778875	0.742129	21.0548	0.062947	0.101898	0.190147	0.035612	40.8229	0.020024	0.08663	0.007144	44.631	5.89E-05	0.04222	0.004088	0.034587	0.001914
3/25/2025 14:35:20	45741	0.60787	1742938520	10.9654	0.092382	20.143	14.6379	-142.977	-0.39952	-0.00826102	0.014701	263.477	0.00206	0.000577	-0.00168	-0.18848	0.040641	-1.02406	0.940965	0.773163	21.0594	0.063859	0.10109	0.18934	0.035651	44.5115	0.019966	0.086213	0.008496	43.91	5.09E-05	0.04158	0.004476	0.035915	0.004705
3/25/2025 14:35:35	45741	0.60804	1742938535	10.9689	0.165498	20.0852	14.5995	-165.064	-0.3873	0.0533689	0.001175	241.438	0.002168	-0.01811	-0.00498	0.046863	-0.11308	-0.99028	0.684346	0.736651	21.0415	0.066071	0.102735	0.190948	0.034579	45.2429	0.020056	0.087196	0.008438	43.0454	5.25E-05	0.043144	0.004305	0.040932	0.003463
3/25/2025 14:35:51	45741	0.60823	1742938551	11.0256	0.130794	20.1165	14.6304	-123.782	-0.42783	-0.0242193	0.011358	216.518	0.002176	-0.0227	-0.00287	-0.19607	-0.04973	-1.09073	0.847392	0.806801	21.1089	0.065414	0.10096	0.188292	0.034672	43.966	0.019881	0.085938	0.008499	45.2056	4.68E-05	0.041832	0.003756	0.037181	0.003234
3/25/2025 14:36:06	45741	0.6084	1742938566	11.0456	0.119832	20.1449	14.6367	-147.046	-0.41554	-0.149492	0.043252	196.674	0.002037	0.002552	-0.00098	-0.13547	0.099623	-1.03695	0.746407	0.798114	21.0389	0.064859	0.103224	0.193451	0.035708	44.6332	0.020267	0.087677	0.008304	44.1699	5.95E-05	0.042678	0.004055	0.034735	0.006972
3/25/2025 14:36:20	45741	0.60856	1742938580	11.0963	0.113128	20.0514	14.6349	-166.53	-0.40931	-0.0665117	0.00277	193.081	0.002046	0.005048	-0.00416	-0.02996	-0.09717	-1.00603	0.737598	0.777776	21.0633	0.066847	0.103117	0.192956	0.03499	47.2535	0.020286	0.087619	0.009041	47.6022	6.42E-05	0.042302	0.004429	0.041369	0.008156
3/25/2025 14:36:35	45741	0.60874	1742938595	11.0184	0.207675	20.2214	14.6351	-76.2995	-0.39287	-0.143192	0.010253	187.48	0.002309	-0.01498	-0.00333	-0.10308	-0.01923	-1.07246	0.989354	0.544572	21.1104	0.067116	0.103581	0.194383	0.035379	44.9507	0.020441	0.088558	0.009361	46.8416	5.23E-05	0.043393	0.00428	0.041448	0.003022
3/25/2025 14:36:51	45741	0.60892	1742938611	11.004	0.144139	20.1719	14.6327	-35.2508	-0.40166	-0.163941	-0.00384	169.89	0.002317	-0.01233	-0.00108	-0.27368	-0.18554	-0.93872	0.854683	0.786562	21.0772	0.068883	0.103415	0.193108	0.033437	46.0094	0.02021	0.088005	0.008479	47.2327	5.99E-05	0.043231	0.003895	0.034425	0.004213

FTIR Spike Gas Direct Inject

Inlet Direct Inject

NuWave - concentrations file

Pathlength: 9.6

Method: G:/.shortcut-targets-by-id/1X-t-IPUjoEYqNn720hyJT-JnRaPXiFrU/Monitoring Raw Data/225-01-2501M Microchip Gresham RCTO4/Inlet Method

Client / Site / Pathway:

Timestamp	Date	Time	Epoch Time	Ethylene	Methane	R22	Water	EthyleneError	IethaneErr	R22Error	WaterError	Signal	Temp(C)	Press(atm)	QAQC	umber Scans
3/24/2025 16:22	45740	0.68204861	1742858529	4.60358	8.52763	7.843	613.92	0.0377706	0.073496	0.014726	77.2809	6.63919	150.765	0.956726	0	48
3/24/2025 16:23	45740	0.68274306	1742858589	10.1393	19.7353	20.1718	-383.707	0.0511645	0.147664	0.0269446	280.845	6.62771	150.708	0.956726	0	48
3/24/2025 16:24	45740	0.6834375	1742858649	10.2002	19.614	20.1843	-309.485	0.0538455	0.153666	0.0236697	243.779	6.61677	151.006	0.960952	0	48
3/24/2025 16:25	45740	0.68413194	1742858709	10.1153	19.7583	20.2473	-210.732	0.053544	0.151709	0.0257646	275.631	6.61736	151.247	0.956726	0	48
3/24/2025 16:26	45740	0.68482639	1742858769	10.0664	19.7313	20.2675	-167.968	0.0550814	0.148035	0.0258004	277.336	6.61501	151.132	0.956726	0	48
3/24/2025 16:27	45740	0.68552083	1742858829	10.2443	19.6634	20.2407	-170.624	0.0528813	0.147297	0.0248193	266.388	6.62086	151.074	0.958839	0	48
3/24/2025 16:28	45740	0.68666667	1742858928	10.076	19.6365	20.1808	-315.115	0.0526496	0.147632	0.0262365	278.675	6.6266	151.016	0.960952	0	44
3/24/2025 16:29	45740	0.68736111	1742858988	10.1192	19.6456	20.2269	-259.601	0.0515343	0.15007	0.0260127	278.833	6.63401	150.901	0.958839	0	48
3/24/2025 16:30	45740	0.68805556	1742859048	10.0974	19.6365	20.1722	-215.462	0.0526413	0.150647	0.0264021	283.9	6.62454	150.844	0.960952	0	48
3/24/2025 16:31	45740	0.68875	1742859108	10.1146	19.6674	20.1728	-235.821	0.0496873	0.15329	0.0259277	272.802	6.62154	150.786	0.960952	0	48
					19.64	**20.20**										

RCO Direct Inject

NuWave - concentrations file

Pathlength: 10.4

Method: G:/.shortcut-targets-by-id/1X-t-IPUjoEYqNn720hyJT-JnRaPXiFrU/Monitoring Raw Data/225-01-2501M Microchip Gresham RCTO4/Inlet Method

Client / Site / Pathway:

Timestamp	Date	Time	Epoch Time	Ethylene	Methane	R22	Water	EthyleneError	IethaneErr	R22Error	WaterError	Signal	Temp(C)	Press(atm)	QAQC	umber Scans
3/24/2025 16:20	45740	0.68118056	1742851254	0.0707128	0.0179325	0.0132989	21.5243	0.0630969	0.038788	0.00681353	69.8064	4.14998	150	1.02848	0	16
3/24/2025 16:21	45740	0.68152778	1742851284	0.0207474	-0.0314421	-0.0100239	-22.6471	0.0644121	0.042322	0.00623981	63.4734	4.14732	150	1.02854	0	16
3/24/2025 16:21	45740	0.681875	1742851314	0.0134791	-0.0959559	-0.024074	-21.2458	0.0611979	0.038694	0.00664069	68.8386	4.14495	150	1.02862	0	16
3/24/2025 16:22	45740	0.6822338	1742851345	3.23537	6.24717	5.49576	1474.19	0.0598913	0.053657	0.0114819	104.69	4.00291	150	1.02873	0	16
3/24/2025 16:22	45740	0.68256944	1742851374	10.1217	20.5597	21.0889	-46.7876	0.0653493	0.101394	0.0120232	138.186	4.0801	150	1.02887	0	16
3/24/2025 16:23	45740	0.68291667	1742851404	10.5948	20.5409	21.1939	-3.62704	0.0621522	0.101124	0.0138627	152.334	4.08591	150	1.0289	0	16
3/24/2025 16:23	45740	0.68326389	1742851434	10.4532	20.5521	21.2159	-12.5854	0.0626014	0.106336	0.0140564	153.624	4.0854	150	1.02887	0	16
3/24/2025 16:24	45740	0.68361111	1742851464	10.4854	20.5583	21.2086	84.3314	0.0599294	0.104664	0.0144965	150.638	4.08795	150	1.02893	0	16
3/24/2025 16:24	45740	0.68395833	1742851494	10.5855	20.6049	21.1432	-140.544	0.0600257	0.117047	0.0132226	143.809	4.09268	150	1.02902	0	16
3/24/2025 16:25	45740	0.68430556	1742851524	10.5174	20.5676	21.1322	110.651	0.060325	0.105779	0.0129384	149.185	4.09324	150	1.02907	0	16
3/24/2025 16:25	45740	0.68465278	1742851554	10.6358	20.5663	21.1794	69.8388	0.0631253	0.10398	0.0140635	146.375	4.09096	150	1.02915	0	16
3/24/2025 16:26	45740	0.68503472	1742851587	10.6027	20.5238	21.1713	162.636	0.0634401	0.109625	0.0147762	150.965	4.08468	149.9	1.02927	0	16
3/24/2025 16:26	45740	0.68534722	1742851614	10.4926	20.6271	21.1527	23.9801	0.0633296	0.11566	0.0143643	169.299	4.09093	150	1.02938	0	12
3/24/2025 16:27	45740	0.68569444	1742851644	10.7873	20.6613	21.173	31.7406	0.0665787	0.106743	0.0146552	162.865	4.09264	150	1.02944	0	16
3/24/2025 16:27	45740	0.68604167	1742851674	10.5072	20.6221	21.1645	26.8504	0.0629068	0.107125	0.0138852	156.475	4.08848	150	1.02949	0	16
3/24/2025 16:28	45740	0.68640046	1742851705	10.4979	20.5931	21.0795	-68.2973	0.0600551	0.114764	0.0133717	136.365	4.09279	150	1.02961	0	16
3/24/2025 16:28	45740	0.68673611	1742851734	10.5526	20.5576	21.2312	147.069	0.0614869	0.104891	0.0147575	152.809	4.09984	150	1.02973	0	16
3/24/2025 16:29	45740	0.68708333	1742851764	10.5434	20.5723	21.1033	71.4782	0.0624892	0.105594	0.0132889	135.869	4.09036	150	1.02982	0	16
3/24/2025 16:30	45740	0.68751157	1742851801	10.4611	20.5901	21.1889	-115.522	0.0588226	0.111078	0.0129508	138.064	4.10014	150	1.02997	0	20
3/24/2025 16:30	45740	0.68778935	1742851825	10.805	20.5812	21.1654	-149.359	0.0669206	0.105093	0.0146811	155.561	4.0997	150	1.03007	0	12
3/24/2025 16:30	45740	0.688125	1742851854	10.698	20.6482	21.1658	110.292	0.0552077	0.104317	0.0129367	139.898	4.09885	150	1.03014	0	16
					20.59	**21.18**										

TO Direct Inject

NuWave - concentrations file

Pathlength: 9.1

Method: G:/.shortcut-targets-by-id/1X-t-IPUjoEYqNn720hyJT-JnRaPXiFrU/Monitoring Raw Data/225-01-2501M Microchip Gresham RCTO4/Inlet Method

Client / Site / Pathway:

Timestamp	Date	Time	Epoch Time	Ethylene	Methane	R22	Water	EthyleneError	IethaneErr	R22Error	WaterError	Signal	Temp(C)	Press(atm)	QAQC	umber Scans
3/24/2025 16:21	45740	0.68166667	1742858496	0.183373	0.375578	0.251897	487.245	0.0132594	0.006804	0.00142114	14.7381	6.48612	150.991	1.00196	0	48
3/24/2025 16:22	45740	0.68236111	1742858556	10.3541	20.3199	20.6364	236.899	0.0219217	0.218497	0.0111127	132.047	6.45024	151.588	1.00196	0	48
3/24/2025 16:23	45740	0.68305556	1742858616	10.6042	20.7432	21.198	-12.7061	0.0245561	0.239393	0.0109202	122.355	6.48662	151.53	1.00196	0	48
3/24/2025 16:24	45740	0.68375	1742858676	10.6564	20.8039	21.2484	-24.9748	0.0243357	0.241279	0.0111969	125.924	6.48725	151.713	0.999806	0	48
3/24/2025 16:25	45740	0.68447917	1742858739	10.5824	20.7639	21.1801	-24.9951	0.0225144	0.239688	0.0116369	131.517	6.47056	151.357	1.00196	0	48
3/24/2025 16:26	45740	0.68513889	1742858796	10.6118	20.7609	21.1791	-14.1069	0.0213899	0.239715	0.0118483	131.457	6.47937	151.597	1.00196	0	44
3/24/2025 16:27	45740	0.68585648	1742858858	10.554	20.7616	21.1803	-18.1767	0.0229967	0.239677	0.011676	129.328	6.50027	151.597	1.00196	0	48
3/24/2025 16:28	45740	0.6865625	1742858919	10.581	20.7286	21.1651	-11.6615	0.0232455	0.242145	0.0115813	128.645	6.50639	151.424	1.00196	0	48
3/24/2025 16:29	45740	0.68722222	1742858976	10.5736	20.7132	21.1871	-6.75584	0.0228035	0.241362	0.0116213	128.432	6.50859	151.665	1.00196	0	44
3/24/2025 16:30	45740	0.68792824	1742859037	10.3757	20.3485	20.6219	262.012	0.0223435	0.223852	0.0110052	127.915	6.48237	151.492	1.00196	0	48
					20.72	**21.18**										

Spike Raw Data

Inlet Spike

Timestamp	Methane	R22	Temp(C)	Press(atm)	
3/25/2025 14:40:41	1.51	0.08	150.3	0.998	
3/25/2025 14:40:56	1.54	0.08	150.3	0.998	
3/25/2025 14:41:11	1.45	0.05	150.3	0.998	
3/25/2025 14:41:26	1.48	0.01	150.3	0.998	
3/25/2025 14:41:41	1.65	0.08	150.3	0.998	
3/25/2025 14:41:56	1.48	0.11	150.3	0.995	
3/25/2025 14:42:11	1.75	0.07	150.3	0.998	
3/25/2025 14:42:27	1.68	0.09	150.3	0.998	
3/25/2025 14:42:43	1.66	0.08	150.3	0.995	
3/25/2025 14:42:58	1.66	0.14	150.4	0.998	
3/25/2025 14:43:11	1.66	0.08	150.4	0.998	
3/25/2025 14:43:26	1.72	0.10	150.4	0.998	
3/25/2025 14:43:43	1.68	0.08	150.4	0.998	
3/25/2025 14:43:58	1.75	0.07	150.1	0.998	
3/25/2025 14:44:12	1.68	0.12	150.2	0.995	Native
3/25/2025 14:44:26	1.67	0.07	150.2	0.998	Native
3/25/2025 14:44:42	1.63	0.06	150.2	0.998	Native
3/25/2025 14:44:56	1.55	0.02	150.2	0.995	Native
3/25/2025 14:45:11	1.66	0.01	150.2	0.998	Native
3/25/2025 14:45:26	1.57	0.04	150.2	0.995	Native
3/25/2025 14:45:44	1.60	-0.01	150.2	0.995	Native
3/25/2025 14:45:56	1.61	0.01	150.3	0.998	Native
3/25/2025 14:46:11	1.58	-0.10	150.3	0.998	
3/25/2025 14:46:27	1.61	-0.03	150.0	0.998	
3/25/2025 14:46:43	2.68	1.27	150.4	0.995	
3/25/2025 14:46:59	5.55	4.43	150.4	0.995	
3/25/2025 14:47:11	5.61	4.54	150.4	0.995	
3/25/2025 14:47:28	5.65	4.59	150.1	0.995	
3/25/2025 14:47:41	4.92	3.69	150.4	0.998	
3/25/2025 14:47:56	4.29	3.06	150.1	0.995	
3/25/2025 14:48:11	4.29	3.02	150.1	0.995	
3/25/2025 14:48:26	4.20	3.05	150.1	0.998	
3/25/2025 14:48:44	4.22	2.92	150.1	0.998	
3/25/2025 14:48:58	2.91	1.59	150.1	0.998	
3/25/2025 14:49:11	2.70	1.28	150.1	1.000	
3/25/2025 14:49:26	2.69	1.20	149.8	0.998	
3/25/2025 14:49:42	2.68	1.22	149.8	0.998	
3/25/2025 14:49:56	2.57	1.17	149.8	0.998	
3/25/2025 14:50:11	2.74	1.24	150.1	0.998	
3/25/2025 14:50:28	2.63	1.26	149.9	0.998	
3/25/2025 14:50:44	2.51	1.25	149.9	0.995	
3/25/2025 14:50:56	2.56	1.23	149.9	0.998	
3/25/2025 14:51:11	2.66	1.24	150.0	0.995	
3/25/2025 14:51:26	2.48	1.17	149.7	0.998	
3/25/2025 14:51:42	2.50	1.23	149.7	0.998	
3/25/2025 14:51:58	2.44	1.21	149.8	0.998	
3/25/2025 14:52:11	2.50	1.17	149.8	0.995	
3/25/2025 14:52:27	2.44	1.22	149.8	0.995	
3/25/2025 14:52:44	2.46	1.24	149.8	0.998	
3/25/2025 14:52:56	2.42	1.17	149.8	0.995	Spike
3/25/2025 14:53:11	2.52	1.17	149.9	0.998	Spike
3/25/2025 14:53:27	2.51	1.26	149.9	0.998	

RCO Spike

Timestamp	CH4	R22	Temp(C)	Press(atm)	
3/25/2025 14:41:12	1.91	0.46	150.0	1.012	
3/25/2025 14:41:27	2.07	0.45	150.0	1.013	
3/25/2025 14:41:39	1.80	0.40	150.0	1.013	
3/25/2025 14:41:55	1.78	0.41	150.0	1.013	
3/25/2025 14:42:09	1.38	0.09	150.0	1.013	
3/25/2025 14:42:25	1.55	0.06	150.0	1.013	Native
3/25/2025 14:42:42	1.66	-0.02	150.0	1.013	Native
3/25/2025 14:42:56	1.41	-0.06	150.0	1.013	Native
3/25/2025 14:43:09	1.57	-0.05	150.0	1.013	Native
3/25/2025 14:43:24	1.57	0.04	150.0	1.013	Native
3/25/2025 14:43:39	1.49	-0.01	150.0	1.013	Native
3/25/2025 14:43:54	1.35	-0.02	150.0	1.013	Native
3/25/2025 14:44:11	1.64	0.10	150.0	1.013	Native
3/25/2025 14:44:24	1.23	-0.06	150.0	1.013	
3/25/2025 14:44:41	1.67	-0.05	150.0	1.013	
3/25/2025 14:44:54	1.33	0.01	150.0	1.013	
3/25/2025 14:45:11	1.30	-0.07	150.0	1.013	
3/25/2025 14:45:26	1.24	-0.03	150.0	1.013	
3/25/2025 14:45:39	1.71	-0.13	150.0	1.013	
3/25/2025 14:45:57	1.53	-0.03	150.0	1.013	
3/25/2025 14:46:09	1.39	0.03	150.0	1.013	

Spike Raw Data

Timestamp	Methane	R22	Temp(C)	Press(atm)	
3/25/2025 14:46:25	1.09	0.03	150.0	1.013	
3/25/2025 14:46:39	1.71	0.08	150.0	1.013	
3/25/2025 14:46:57	1.82	0.00	150.0	1.013	
3/25/2025 14:47:09	3.54	2.66	150.0	1.013	
3/25/2025 14:47:24	4.64	3.53	150.0	1.013	
3/25/2025 14:47:40	4.48	3.51	150.0	1.013	
3/25/2025 14:47:54	4.78	3.55	150.0	1.013	
3/25/2025 14:48:09	4.65	3.38	150.0	1.013	
3/25/2025 14:48:24	3.57	2.56	150.0	1.013	
3/25/2025 14:48:41	3.72	2.47	149.9	1.013	
3/25/2025 14:48:55	3.72	2.43	150.0	1.013	
3/25/2025 14:49:09	3.78	2.46	150.0	1.013	
3/25/2025 14:49:24	3.75	2.42	150.0	1.013	
3/25/2025 14:49:40	3.55	2.44	150.0	1.013	
3/25/2025 14:49:54	3.57	2.20	149.9	1.014	
3/25/2025 14:50:09	3.39	2.19	149.9	1.015	
3/25/2025 14:50:24	3.65	2.19	149.9	1.016	
3/25/2025 14:50:42	3.72	2.23	149.9	1.017	
3/25/2025 14:50:56	3.27	1.95	149.9	1.017	
3/25/2025 14:51:10	2.26	0.95	149.9	1.017	
3/25/2025 14:51:24	2.40	0.96	149.9	1.017	
3/25/2025 14:51:39	2.78	1.32	149.9	1.017	
3/25/2025 14:51:54	3.33	2.00	149.9	1.017	
3/25/2025 14:52:09	2.95	2.08	149.9	1.017	
3/25/2025 14:52:24	3.20	2.06	149.9	1.017	
3/25/2025 14:52:39	3.18	2.04	149.9	1.017	
3/25/2025 14:52:54	2.63	1.30	149.9	1.017	
3/25/2025 14:53:09	2.65	1.19	150.0	1.017	
3/25/2025 14:53:24	2.28	1.12	150.0	1.017	
3/25/2025 14:53:39	2.77	1.12	150.0	1.017	
3/25/2025 14:53:54	2.42	1.17	150.0	1.017	
3/25/2025 14:54:09	2.34	1.11	150.0	1.017	
3/25/2025 14:54:26	2.52	1.19	150.0	1.017	Spike
3/25/2025 14:54:39	2.68	1.15	150.0	1.017	Spike
3/25/2025 14:54:54	2.48	1.19	150.0	1.017	
3/25/2025 14:55:09	2.68	1.15	150.0	1.017	

TO Spike

Timestamp	CH4	R22	Temp(C)	Press(atm)	
3/25/2025 14:40:30	1.81	0.04	149.4	0.998	
3/25/2025 14:40:47	2.37	0.03	149.5	0.998	
3/25/2025 14:41:00	2.44	0.03	149.5	0.998	
3/25/2025 14:41:15	2.40	0.02	149.5	1.000	
3/25/2025 14:41:30	2.19	0.03	149.5	0.998	
3/25/2025 14:41:48	2.13	0.02	149.2	0.998	
3/25/2025 14:42:03	1.95	0.04	149.5	0.998	
3/25/2025 14:42:15	1.77	0.04	149.5	0.998	
3/25/2025 14:42:32	1.89	0.03	149.6	0.996	
3/25/2025 14:42:48	2.27	0.03	149.3	0.998	
3/25/2025 14:43:00	2.24	0.03	149.3	0.996	
3/25/2025 14:43:17	2.25	0.03	149.6	0.998	
3/25/2025 14:43:33	2.28	0.05	149.3	0.998	
3/25/2025 14:43:45	2.20	0.03	149.3	0.998	
3/25/2025 14:44:01	1.78	0.02	149.3	0.998	
3/25/2025 14:44:16	1.81	0.03	149.1	0.998	Native
3/25/2025 14:44:32	1.89	0.03	149.2	0.998	Native
3/25/2025 14:44:48	2.33	0.02	149.2	0.998	Native
3/25/2025 14:45:00	2.45	0.00	149.2	0.998	Native
3/25/2025 14:45:17	2.24	0.02	149.2	0.998	Native
3/25/2025 14:45:31	2.10	0.03	148.9	0.998	Native
3/25/2025 14:45:45	1.99	0.03	148.9	0.998	
3/25/2025 14:46:03	1.63	0.01	148.9	0.998	
3/25/2025 14:46:16	1.77	0.04	149.2	0.998	
3/25/2025 14:46:30	2.59	0.37	148.9	0.998	
3/25/2025 14:46:45	5.40	3.38	149.2	0.998	
3/25/2025 14:47:00	5.69	3.67	148.9	0.998	
3/25/2025 14:47:16	5.56	3.76	148.9	0.998	
3/25/2025 14:47:33	5.30	3.60	149.2	0.998	
3/25/2025 14:47:48	4.38	3.02	149.2	0.998	
3/25/2025 14:48:00	4.21	2.96	149.2	0.998	
3/25/2025 14:48:16	4.16	2.96	149.2	0.998	
3/25/2025 14:48:30	4.42	2.96	149.2	0.998	
3/25/2025 14:48:46	4.09	2.59	149.6	0.998	
3/25/2025 14:49:02	4.01	2.50	149.3	0.998	
3/25/2025 14:49:15	4.06	2.47	149.0	0.996	
3/25/2025 14:49:32	3.98	2.44	149.4	0.998	
3/25/2025 14:49:45	3.83	2.44	149.1	0.996	
3/25/2025 14:50:03	3.84	2.44	149.1	1.000	

Spike Raw Data

Timestamp	Methane	R22	Temp(C)	Press(atm)	
3/25/2025 14:50:16	3.74	2.38	149.2	0.998	
3/25/2025 14:50:31	3.51	2.14	149.2	1.000	
3/25/2025 14:50:45	3.15	1.98	149.2	0.998	
3/25/2025 14:51:00	3.21	1.99	149.2	0.998	
3/25/2025 14:51:15	3.09	1.93	148.9	0.998	
3/25/2025 14:51:30	3.24	1.93	148.9	0.998	
3/25/2025 14:51:46	3.10	1.92	148.9	0.998	
3/25/2025 14:52:00	3.44	1.93	149.0	0.998	
3/25/2025 14:52:15	3.66	1.94	149.0	0.998	
3/25/2025 14:52:30	3.75	1.97	149.1	0.998	
3/25/2025 14:52:45	3.72	1.97	149.0	0.998	
3/25/2025 14:53:01	3.47	1.95	149.1	0.998	
3/25/2025 14:53:15	3.42	1.98	149.1	0.998	
3/25/2025 14:53:30	3.24	1.98	149.2	0.996	
3/25/2025 14:53:50	3.23	2.00	149.3	0.998	
3/25/2025 14:54:01	3.64	1.93	149.3	0.998	
3/25/2025 14:54:15	3.92	1.96	149.3	0.998	
3/25/2025 14:54:30	3.92	1.93	149.3	1.000	Spike
3/25/2025 14:54:46	3.96	1.93	149.3	0.998	Spike
3/25/2025 14:55:01	3.72	1.94	149.3	0.996	
3/25/2025 14:55:15	3.75	1.95	149.3	1.000	
3/25/2025 14:55:30	3.52	1.93	149.3	0.998	

CTS Raw Data

Inlet CTS

Timestamp	C2H4	CH4	R22	Temp(C)	Press(atm)
3/26/2025 7:39:00	-0.084	0.054	-0.020	150.9	0.989
3/26/2025 7:40:00	0.021	0.064	0.000	150.9	0.991
3/26/2025 7:41:00	-0.039	0.678	0.009	150.7	0.993
3/26/2025 7:44:01	-0.068	1.638	0.057	150.7	0.991
3/26/2025 7:45:03	-0.117	1.286	-0.043	150.9	0.991
3/26/2025 7:46:02	-0.002	0.021	-0.021	150.8	0.993
3/26/2025 7:47:03	-0.060	0.014	-0.020	151.1	0.993
3/26/2025 7:48:02	-0.097	0.070	0.005	150.9	0.991
3/26/2025 7:49:02	-0.109	1.642	0.052	151.1	0.993
3/26/2025 7:50:02	-0.096	1.882	0.032	151.0	0.993
3/26/2025 7:51:00	-0.214	1.822	-0.022	151.0	0.989
3/26/2025 7:52:01	-0.344	0.350	-0.066	150.8	0.993
3/26/2025 7:53:00	-0.105	0.305	0.010	150.7	0.993
3/26/2025 7:54:00	-0.201	1.772	0.051	150.7	0.991
3/26/2025 7:55:00	-0.133	1.637	-0.028	150.8	0.991
3/26/2025 7:56:00	-0.194	0.060	-0.021	151.0	0.993
3/26/2025 7:57:00	-0.033	0.060	-0.007	150.9	0.991
3/26/2025 7:58:00	-0.072	0.380	-0.009	150.9	0.993
3/26/2025 7:59:00	-0.149	1.793	0.028	150.9	0.991
3/26/2025 8:00:00	-0.146	1.970	0.032	151.1	0.991
3/26/2025 8:01:00	-0.164	0.791	-0.038	151.1	0.993
3/26/2025 8:02:00	0.096	0.690	0.501	150.7	0.991
3/26/2025 8:03:00	9.922	19.116	20.080	150.3	0.993
3/26/2025 8:04:00	10.062	20.018	20.773	150.3	0.991
3/26/2025 8:05:02	10.026	20.010	20.751	150.9	0.991
3/26/2025 8:06:00	4.093	8.848	7.086	150.9	0.991
3/26/2025 8:07:00	-0.368	1.765	0.056	150.9	0.993
3/26/2025 8:08:00	-0.178	2.003	-0.022	150.6	0.991
3/26/2025 8:09:00	-0.093	1.980	-0.034	150.5	0.991
3/26/2025 8:10:02	-0.033	1.933	0.002	150.2	0.989
3/26/2025 8:11:03	-0.049	1.955	-0.034	150.5	0.991
3/26/2025 8:12:03	-0.217	1.967	-0.014	150.5	0.991
3/26/2025 8:13:00	-0.027	1.968	-0.030	150.2	0.991
3/26/2025 8:14:00	-0.076	1.990	-0.022	150.2	0.993
3/26/2025 8:15:02	-0.140	2.002	-0.015	150.4	0.993
3/26/2025 8:16:00	-0.172	1.961	0.003	150.7	0.991
3/26/2025 11:28:00	-0.314	2.007	-0.004	150.1	0.989
3/26/2025 11:29:00	-0.261	1.974	-0.031	150.2	0.989
3/26/2025 11:30:00	-0.259	1.999	-0.021	150.5	0.989
3/26/2025 11:31:03	-0.262	1.374	-0.023	150.2	0.987
3/26/2025 11:32:00	-0.289	0.176	0.022	150.3	0.987
3/26/2025 11:33:00	-0.180	0.173	-0.002	150.1	1.013
3/26/2025 11:34:02	-0.184	0.163	0.035	150.4	0.993
3/26/2025 11:35:01	-0.168	0.709	0.015	150.4	0.989

CTS Raw Data

Timestamp	C2H4	CH4	R22	Temp(C)	Press(atm)
3/26/2025 11:36:03	-0.235	0.008	0.014	150.4	0.989
3/26/2025 11:37:00	-0.115	0.527	0.029	150.4	0.989
3/26/2025 11:38:00	-0.121	1.641	0.066	150.1	0.989
3/26/2025 11:39:00	-0.083	2.030	0.044	149.8	0.991
3/26/2025 11:40:00	-0.090	2.099	0.032	149.8	0.989
3/26/2025 11:41:00	0.080	2.593	0.433	149.8	0.989
3/26/2025 11:42:01	9.640	19.522	20.035	149.9	0.987
3/26/2025 11:43:00	9.890	20.048	20.758	150.0	0.991
3/26/2025 11:44:00	9.839	20.145	20.782	150.0	0.989
3/26/2025 11:45:02	4.777	10.681	8.405	150.3	0.993
3/26/2025 11:46:00	-0.268	1.778	0.073	150.4	0.993
3/26/2025 11:47:00	-0.190	2.021	0.045	150.0	0.993
3/26/2025 11:48:02	-0.280	1.980	0.028	150.4	0.991
3/26/2025 11:49:00	-0.212	2.030	0.042	150.3	0.991
3/26/2025 11:50:00	-0.088	2.067	0.025	150.3	0.991
3/26/2025 11:51:00	-0.183	2.043	0.010	150.4	0.991
3/26/2025 11:52:00	-0.110	2.036	0.006	150.4	0.993
3/26/2025 11:53:00	-0.141	2.068	0.012	150.1	0.991
3/26/2025 11:54:02	-0.079	2.016	0.050	150.4	0.991
3/26/2025 11:55:00	-0.237	2.109	0.018	150.4	0.991

RCO CTS

Timestamp	C2H4	CH4	R22	Temp(C)	Press(atm)
3/26/2025 8:00:00	-0.050	-0.007	0.025	149.9	1.010
3/26/2025 8:01:02	-0.020	1.156	0.043	150.0	1.010
3/26/2025 8:02:00	-0.088	1.769	0.000	150.0	1.010
3/26/2025 8:03:01	9.085	17.118	17.495	150.0	1.010
3/26/2025 8:04:01	10.403	18.936	21.219	150.0	1.010
3/26/2025 8:05:03	10.344	19.118	21.223	149.9	1.009
3/26/2025 8:06:00	4.011	8.586	6.186	149.9	1.010
3/26/2025 8:07:00	0.084	1.519	0.060	149.9	1.010
3/26/2025 8:08:00	0.051	1.711	0.058	149.9	1.010
3/26/2025 8:09:00	0.068	1.722	0.060	149.9	1.010
3/26/2025 8:10:01	-0.026	1.721	0.039	149.9	1.010
3/26/2025 11:31:00	0.028	1.031	0.047	149.9	1.018
3/26/2025 11:32:01	-0.041	-0.131	0.019	150.0	1.018
3/26/2025 11:33:03	0.025	-0.053	0.034	149.9	1.018
3/26/2025 11:34:00	-0.010	-0.041	0.020	149.9	1.018
3/26/2025 11:35:00	-0.043	1.031	0.042	149.9	1.019
3/26/2025 11:36:03	-0.067	1.494	0.051	150.0	1.019
3/26/2025 11:37:00	-0.013	1.050	0.045	150.0	1.019
3/26/2025 11:38:00	0.005	-0.119	0.048	150.0	1.019
3/26/2025 11:39:01	-0.059	-0.148	0.019	150.0	1.022
3/26/2025 11:40:00	0.040	-0.073	0.007	149.9	1.022
3/26/2025 11:41:03	0.600	2.108	0.824	150.0	1.012

CTS Raw Data

Timestamp	C2H4	CH4	R22	Temp(C)	Press(atm)
3/26/2025 11:42:01	10.339	19.095	21.091	150.0	1.022
3/26/2025 11:43:00	10.333	19.111	21.153	149.9	1.022
3/26/2025 11:44:01	10.284	18.953	21.170	150.0	1.022
3/26/2025 11:45:00	4.950	9.901	7.633	150.0	1.022
3/26/2025 11:46:00	-0.007	1.337	0.069	150.0	1.031
3/26/2025 11:47:02	-0.037	1.699	0.032	150.0	1.032
3/26/2025 11:48:02	0.021	1.698	0.026	150.0	1.032
3/26/2025 11:49:00	-0.082	1.569	0.014	150.0	1.033
3/26/2025 11:50:03	-0.070	1.652	0.046	149.9	1.006
3/26/2025 11:51:00	-0.127	1.679	0.049	150.0	0.994
3/26/2025 11:52:00	0.069	1.474	0.056	150.0	0.994
3/26/2025 11:53:01	0.078	1.532	0.061	150.1	0.994
3/26/2025 11:54:00	0.026	1.573	0.027	150.1	0.994
3/26/2025 11:55:00	-0.030	1.468	0.041	150.1	0.994

TO CTS

Timestamp	C2H4	CH4	R22	Temp(C)	Press(atm)
3/26/2025 7:58:00	0.771	-0.527	0.331	150.4	0.991
3/26/2025 7:59:00	-0.010	0.054	0.011	150.6	0.991
3/26/2025 8:00:01	0.020	0.040	0.013	150.6	0.991
3/26/2025 8:01:00	1.344	-0.653	0.471	150.5	0.991
3/26/2025 8:02:00	1.627	1.732	0.831	150.1	0.991
3/26/2025 8:03:01	10.753	19.830	20.821	150.4	0.991
3/26/2025 8:04:00	10.819	19.957	21.039	150.5	0.991
3/26/2025 8:05:03	11.052	20.097	21.302	150.5	0.991
3/26/2025 8:06:00	3.431	4.614	4.085	150.2	0.991
3/26/2025 8:07:03	1.405	0.921	0.161	150.5	0.991
3/26/2025 8:08:00	1.422	1.059	0.052	150.5	0.991
3/26/2025 8:09:06	1.577	1.186	0.046	150.1	0.991
3/26/2025 8:10:00	1.408	1.041	0.041	150.4	0.991
3/26/2025 11:31:02	0.284	0.546	0.103	149.4	0.991
3/26/2025 11:32:00	-0.319	0.017	0.052	149.5	0.991
3/26/2025 11:33:00	-0.285	0.000	0.051	149.5	0.991
3/26/2025 11:34:00	-0.294	0.024	0.045	149.3	0.991
3/26/2025 11:35:00	-0.279	1.366	0.133	149.6	0.991
3/26/2025 11:36:04	-0.287	1.957	0.060	149.7	0.991
3/26/2025 11:37:00	-0.326	0.965	0.057	149.8	0.991
3/26/2025 11:38:01	-0.311	0.006	0.053	149.8	0.991
3/26/2025 11:39:00	-0.313	0.004	0.045	149.5	0.991
3/26/2025 11:40:00	-0.317	0.280	0.046	149.5	0.991
3/26/2025 11:41:00	1.049	4.329	2.333	149.8	0.991
3/26/2025 11:42:01	10.494	19.951	21.027	149.8	0.991
3/26/2025 11:43:00	10.598	20.017	21.115	149.5	0.989
3/26/2025 11:44:02	10.515	20.031	21.050	149.5	0.991
3/26/2025 11:45:00	2.878	7.753	5.502	149.5	0.991

CTS Raw Data

Timestamp	C2H4	CH4	R22	Temp(C)	Press(atm)
3/26/2025 11:46:00	-0.281	1.970	0.062	149.6	0.985
3/26/2025 11:47:01	-0.327	1.784	0.139	149.6	0.991
3/26/2025 11:48:01	-0.290	2.105	0.059	149.7	0.991
3/26/2025 11:49:00	-0.307	1.938	0.056	149.4	0.989
3/26/2025 11:50:00	-0.457	1.730	0.081	149.4	0.985
3/26/2025 11:51:00	-0.404	1.750	0.100	149.2	0.985
3/26/2025 11:52:00	-0.418	1.801	0.035	149.5	0.985
3/26/2025 11:53:00	-0.395	1.812	0.037	149.5	0.985
3/26/2025 11:54:03	-0.399	1.834	0.033	149.9	0.985
3/26/2025 11:55:00	-0.394	1.800	0.030	149.6	0.983