TEST REPORT

QUARTERLY RCTO VOC MONITORING

4th Quarter 2006

RECUPERATIVE THERMAL OXIDIZER STACKS

INTEL CORPORATION

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January 2, 2007

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List of Acronyms/Abbreviations

ACFM	Unit of flow; Actual Cubic Feet Per Minute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
°C	Unit of Temperature; degrees Celsius
C_3H_8	Propane (calibration standard for FID as per EPA RM25A)
CAI	California Analytical Incorporated
CFR	Code of Federal Register
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DAS	Data Acquisition System
DSCFM	Unit of Flow; Dry Std. Cubic Feet Per Minute (corr. to 29.92" Hg & 25°C)
EPA	Environmental Protection Agency
F11X-F-side	Fab 11X Fab Side location designation
F11X B-side	Fab 11X Bridge Side location designation
°F	Unit of Temperature; degrees Fahrenheit
FID	Flame Ionization Detector
FT-IR	Fourier Transform Infrared Spectroscopy
H2Q406	Quarter designation; second half of year (H2), Fourth Quarter (Q4), year (06)
HAPs	Hazardous Air Pollutants
HSL	Heated Sample Line
Impinger	Glass bottle used in collecting entrained moisture in gas stream
IPA	Isopropyl Alcohol
Lbs/hr	Unit of emissions; pounds per hour
MW	Molecular Weight
nbuac	N-Butyl acetate
ND	Non-Detected (value below the analytical/instrument limit of detection)
NIST	National Institute of Standards and Technology
NMED	New Mexico Environmental Department
O_2	Oxygen
THC	Total Hydrocarbon
TPY	Unit of emissions; Tons per Year
OSHA	Occupational Safety and Health Administration
PGMEA	Propylene glycol monomethyl ether acetate
ppm	Unit of concentration ; parts per million
RM	Reference Method
RCTO	Recuperative Thermal Oxidizer
SCFM	Unit of Flow; Std. Cubic Feet Per Minute (corr. to 29.92" Hg & 25°C)
SOP	Standard Operating Procedure
SS	Stainless Steel
QA	Quality Assurance
QC	Quality Control
VOC	Volatile Organic Compound (synonymous with Total Hydrocarbon)

EXECUTIVE SUMMARY

Monitoring was conducted at Intel Corporation's Rio Rancho, New Mexico facility to meet specific air permit quarterly emission testing objectives. This Fourth Quarter 2006 (Q406) test program consisted of the quarterly RCTO VOC monitoring for the four operating recuperative thermal oxidizers (RCTO's) at the facility. Continuous total hydrocarbon (THC) monitoring, using calibrated flame ionization detectors (FID's), and periodic measurement for volatile organic compounds (VOC's), using Fourier Transform Infrared Spectroscopy (FT-IR), was supported for each of the four recuperative thermal oxidizer's (RCTO's) exhaust stacks.

The program was conducted to satisfy the testing requirements of Air Quality Permit #325-M-9 Condition 7C. This condition requires the determination of the emissions from the four RCTO units in use at the facility to support and validate emission estimates. In support of the FID and FT-IR measurements, exhaust gas flow rate was measured at each RCTO stack for converting the measured VOC concentration data to mass emissions. The methods and procedures used in the test program followed that of the approved test plan in place with NMED for the quarterly RCTO field requirements.

The results summary for the normal RCTO testing for all four systems is provided in Table 1. Detailed results for the quarterly measurements for each RCTO exhaust and the reported summary data defined in Table 1 are provided in Section II.A of this document.

Table 1
Quarterly RCTO Evaluation
VOC Emissions Measurement Summary Data
Units On-Line

RCTO ID	STACK ID	Outlet Daily FID Conc. (ppm)	Outlet Daily FID Emissions (lbs/hr)	Outlet FID 8-Hour VOC[1] (ppm)	Outlet FID 8-Hour VOC[1] (lbs/hr)	FT-IR 8-Hour VOC Sum (lbs/hr)	Avg. Exhaust Flow Rate (DSCFM)	Avg. Exhaust Temp (°F)
F11W	9s.8.1a	0.68	0.10	0.65	0.09	0.00	20,593	182.2
F11S	11s.8.1abc	1.04	0.21	1.14	0.22	0.00	28,305	132.5
F11X-B	11s.8.2abc	0.51	0.06	0.50	0.06	0.00	17,176	116.0
F11X-F	10s.8.1a	1.07	0.17	1.60	0.25	0.00	22,870	127.0

[1] Concentration and emissions are reported based on the instrument calibration standard (propane – C_3H_8)

I. Introduction

This test report is written in accordance with the State of New Mexico Environment Department Air Pollution Control Bureau's Standard Operating Procedure *(Ver 2.2 2/18/97-DW)*. The report provides the results of the tests conducted for the four operating recuperative thermal oxidizers (RCTO's) at Intel Corporation's Rio Rancho, New Mexico facility.

A. Reasons for Conducting the Test

The objective of the quarterly program was to meet the specific measurement requirements defined by facility permit Condition 7C for quarterly assessment of the RCTO systems.

B. Concise Statement of Applicable Regulations

In accordance with Air Quality Permit No. 325-M-9 (Permit) Condition 7 (Testing), Intel is required to provide approved testing for specific sources at specifically defined intervals (i.e. initial start-up, quarterly or annually). The specific test requirements that are applicable for this quarterly period are as follows:

> CONDITION 7C. (BAC/RTO) defines that Intel shall operate and maintain an emissions testing system to measure the concentration of total hydrocarbons and VOC's and the air flow from each stack. One solvent exhaust stack at a time must be tested for at least three hundred thirty-six (336) hours each quarter. All solvent exhaust stacks shall be tested during each quarter. Testing includes the operation of an FID for the entire time of the test period to measure total hydrocarbons from each solvent exhaust stack. In addition, measurements of O_2 and CO_2 concentrations, moisture and stack gas flow rate and operation of an FT-IR in 8-hour increments at the start, midpoint, and end of the FID testing (24 hours total) is required to support the analysis of the VOC stack emissions.

*** This applies to all operational RCTO systems (F11W, F11S, F11X F-side and F11X B-side) ***

Permitted emissions are associated with plant site emission limits (PSEL's) for the entire facility or hourly emission rates for individual boilers and RCTO exhausts as follows:

VOC 96.5 tons per year (tpy); based on a 12 month rolling average

C. Dates of Tests

The specific dates for the program tasks, and the corresponding run times for each measurement objective are provided in this following section. In general, RCTO VOC monitoring supported 336 hours of continuous VOC measurements and three 8-hour FT-IR sample periods.

Table 2
Quarterly RCTO VOC Measurement Periods

Location	Start	Stop
RCTO No. 11s.8.2abc (F11X B-side)	11/27/2006 at 23:59	12/12/2006 at 17:00
RCTO No. 11s.8.1abc (F11S)	11/28/2006 at 23:59	12/13/2006 at 8:00
RCTO No. 10s.8.1a (F11X F-side)	11/2/2006 at 0:00	11/16/2006 at 17:15
RCTO No. 9s.8.1a (F11W)	11/6/2006 at 18:00	11/21/2006 at 8:07

Table 3 provides the complete continuous (FID) and semi-continuous (FT-IR) measurement chronology associated with each of the four (4) RCTO systems supported during this quarterly program.

Table 3
RCTO Quarterly Testing - Test Chronology

STACK	RCTO	STATUS	FID (RM25A)	FT-IR (1) (RM320)	FT-IR (2) (RM320)	FT-IR (3) (RM320)
9s.8.1a	Fab 11W	START	11/29/2006 0:00	11/3/06 23:09	11/9/06 11:25	11/17/06 9:37
		STOP	12/13/2006 8:40	11/4/06 7:11	11/9/06 19:27	11/17/06 17:38
11s.8.1abc	Fab 11S	START	11/28/2006 23:59	11/30/06 10:05	12/6/06 9:59	12/12/06 11:00
		STOP	12/13/2006 8:00	11/30/06 18:10	12/6/06 18:00	12/12/06 19:01
11s.8.2abc	Fab 11X B-side	START	11/27/2006 23:59	11/29/06 10:16	12/5/06 10:20	12/11/06 10:41
		STOP	12/12/2006 17:00	11/29/06 18:15	12/5/06 18:22	12/11/06 18:44
10s.8.1a	Fab 11X F-side	START	11/2/2006 0:00	11/2/06 12:41	11/10/06 11:41	11/16/06 9:33
		STOP	11/16/2006 17:15	11/2/06 20:42	11/10/06 19:36	11/16/06 17:33

D. Startup Date

The current quarterly measurement program is being reported to comply with testing requirements defined in the facility permit.

E. Explanation of Delayed Testing.

FID and FT-IR tests were completed following the prescribed time period of 336 hours and 3 independent eight (8) hour test periods for the RCTO's with limited data gaps or maintenance requirements. Refer to *Section V.A., Table 30* of this report, for specific data gaps or monitoring system maintenance activities during the scheduled program.

F. Description of Plant Process and Pollutant Points

Intel Corporation produces a variety of integrated circuits at their facility located in Rio Rancho, New Mexico. The Fab 11 West (F11W), Fab 11 North (F11N) (routed to Fab 11 West RCTO), Fab 11 South (F11S), F11X Fab Side (F11X F-side), and F11X Bridge side (F11X B-side) processes support the manufacture and fabrication of Intel semiconductors.

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K. Unit Description

The Fab operations are designed for the manufacture and fabrication of the Intel semiconductor. The Fab units are comprised of Class 1 to Class 10 clean rooms that house wafer-processing machines. The Fab processing facility selectively exhausts organics and inorganics from a combination of process activities and other sources to common ducts or air handling units where the factory effluent is directed to either the Durr concentrator/thermal oxidizer system (organics) or wet scrubbers (inorganics) to control emissions.

L. Control Equipment Description

The Durr rotary concentrator/oxidizer unit is designed to adsorb VOC's continuously from the Fab exhaust onto an adsorbent wheel and to discharge purified air. The wheel rotates on a vertical axis at a slow rate adsorbing solvent laden air on one section of the wheel concurrently with desorbing to a RCTO on another section of the wheel. The typical turndown is 10:1. The RCTO has an internal heat exchanger capable of recovering more than 50 percent of the waste energy. The desorption air passes through the oxidizer inlet and is preheated by the internal heat exchanger before entering the combustion chamber. The preheated air enters the combustion chamber, where it is raised to a reaction temperature of 1,350°F (min). In the combustion chamber, high temperatures, one-second residence time, and turbulence work together to achieve a high level of VOC destruction. Natural gas is added to ensure that complete combustion occurs under all operating conditions, regardless of the variation in VOC concentrations.

II. SUMMARY

A. Test Results

Summary tables are provided for each RCTO VOC measurement period providing average daily (24 hr) VOC results for the 336-hour minimum continuous monitoring and corresponding FT-IR results for each of the three 8-hour measurement periods. Exhaust stack physical measurements and calculated flow rate are provided for each RCTO to support reporting total VOC and compound specific organic emissions.

Table 4
RCTO No. 9s.8.1a (F11W)
Summary of Quarterly VOC Measurement Data

Date	DAILY FID MEASUREMENTS Outlet FID CONC. (PPM)	VOC (LBS/HR)	Outlet 8-HOUR FID AVERAGE CONC. (PPM)	VOC (LBS/HR)	Outlet 8-HR FT-IR VOC (LBS/HR)
11/04/2006 [a]	0.33	0.05	0.39	0.06	0.00
11/06/2006	0.67	0.10			
11/07/2006	0.51	0.07			
11/08/2006	0.44	0.06			
11/09/2006	0.71	0.10	0.60	0.09	0.00
11/10/2006	0.76	0.11			
11/11/2006	0.57	0.08			
11/12/2006	0.68	0.10			
11/13/2006	0.52	0.07			
11/14/2006	0.67	0.10			
11/15/2006	0.70	0.10			
11/16/2006	0.68	0.10			
11/17/2006	0.77	0.11	0.70	0.09	0.00
11/18/2006	0.96	0.14			
11/19/2006	0.84	0.12			
11/20/2006	0.63	0.09			
Average [b]	0.68	0.10	0.65	0.09	0.00

[a] This sampling was conducted during a period when FID system was not functioning properly. Data not included in averages.
[b] FID averages for the entire monitoring period are based on individual hourly average values for the period, not the block average values reported in the columns for each reporting day. Hourly average values for the entire period are presented in Appendix A.

Table 4a
RCTO No. 9s.8.1a (F11W)
Summary of Corresponding Exhaust Stack Measurements

RUN NO.	1	2	3	Average
DATE	11/03/2006	11/09/2006	11/17/2006	
START TIME	19:00	14:35	13:20	
STOP TIME	19:30	14:55	13:35	
Barometric Pressure, in. Hg	24.74	24.43	24.80	24.66
%Moisture	1.53	1.47	1.51	1.50
%CO_2	0.24	0.20	0.22	0.22
Static Pressure, in. of H_2O	0.27	0.25	0.24	0.25
Avg. Stack Temp, °F	160	177	209	182
Stack Gas Velocity, AFPM	2,447	2,613	2,455	2,505
Stack Flow Rate, DSCFM	20,872	21,445	19,463	20,593

Table 5
RCTO No. 11s.8.1abc (F11S)
Summary of Quarterly VOC Measurement Data

Date	DAILY FID MEASUREMENTS Outlet FID CONC. (PPM)	VOC (LBS/HR)	Outlet 8-HOUR FID AVERAGE CONC. (PPM)	VOC (LBS/HR)	Outlet 8-HR FT-IR VOC (LBS/HR)
11/29/2006	0.85	0.17			
11/30/2006	1.05	0.21	1.05	0.20	0.00
12/01/2006	1.03	0.20			
12/02/2006	1.10	0.22			
12/03/2006	0.93	0.18			
12/04/2006	1.07	0.21			
12/05/2006	1.19	0.23			
12/06/2006	1.21	0.24	1.27	0.26	0.00
12/07/2006	1.14	0.22			
12/08/2006	1.02	0.20			
12/09/2006	1.02	0.20			
12/10/2006	1.09	0.21			
12/11/2006	1.21	0.24			
12/12/2006	1.12	0.22	1.09	0.22	0.00
12/13/2006	1.06	0.21			
Average*	1.04	0.21	1.14	0.22	0.00

** FID averages for the entire monitoring period are based on individual hourly average values for the period, not the block average values reported in the columns for each reporting day. Hourly average values for the entire period are presented in Appendix A.*

Table 5a
RCTO No. 11s.8.1abc (F11S)
Summary of Corresponding Exhaust Stack Measurements

RUN NO.	1	2	3	
DATE	11/30/2006	12/06/2006	12/12/2006	
START TIME	9:35	15:25	16:30	Average
STOP TIME	9:50	15:45	16:38	
Barometric Pressure, in. Hg	24.87	24.91	24.96	24.91
%Moisture	1.32	1.36	1.42	1.37
%CO_2	0.23	0.23	0.23	0.23
Static Pressure, in. of H_2O	0.05	-0.05	0.08	0.03
Avg. Stack Temp, °F	137	130	130	132
Stack Gas Velocity, AFPM	2,999	3,141	3,094	3,078
Stack Flow Rate, DSCFM	27,336	28,982	28,599	28,306

Table 6
RCTO No. 11s.8.2abc (F11X B-side)
Summary of Quarterly VOC Measurement Data

Date	DAILY FID MEASUREMENTS Outlet FID CONC. (PPM)	DAILY FID MEASUREMENTS Outlet FID VOC (LBS/HR)	Outlet 8-HOUR FID AVERAGE CONC. (PPM)	Outlet 8-HOUR FID AVERAGE VOC (LBS/HR)	Outlet 8-HR FT-IR VOC (LBS/HR)
11/28/2006	0.14	0.02	0.54	0.06	0.00
11/29/2006	0.40	0.05			
11/30/2006	0.60	0.07			
12/01/2006	0.70	0.08			
12/02/2006	0.52	0.06			
12/03/2006	0.36	0.04			
12/04/2006	0.70	0.08			
12/05/2006	0.75	0.09			
12/06/2006	0.56	0.07	0.73	0.09	0.00
12/07/2006	0.51	0.06			
12/08/2006	0.51	0.06			
12/09/2006	0.31	0.04			
12/10/2006	0.86	0.10			
12/11/2006	0.74	0.09	0.26	0.03	0.00
12/12/2006	0.51	0.06			
Average*	0.51	0.06	0.50	0.06	0.00

** FID averages for the entire monitoring period are based on individual hourly average values for the period, not the block average values reported in the columns for each reporting day. Hourly average values for the entire period are presented in Appendix A.*

Table 6a
RCTO No. 11s.8.2abc (F11X B-side)
Summary of Corresponding Exhaust Stack Measurements

RUN NO. DATE START TIME STOP TIME	1 11/29/2006 17:30 17:45	2 12/05/2006 14:25 14:50	3 12/11/2006 17:45 17:52	Average
Barometric Pressure, in. Hg	24.39	24.95	24.63	24.66
%Moisture	1.18	0.98	1.25	1.14
%CO_2	0.21	0.21	0.21	0.21
Static Pressure, in. of H_2O	-0.39	-0.23	0.32	-0.10
Avg. Stack Temp, °F	116	116	116	116
Stack Gas Velocity, AFPM	2,481	2,412	2,459	2,450
Stack Flow Rate, DSCFM	17,182	17,115	17,230	17,176

Table 7
RCTO No. 10s.8.1a (F11X F-side)
Summary of Quarterly VOC Measurement Data

	DAILY FID MEASUREMENTS Outlet FID		Outlet 8-HOUR FID AVERAGE		Outlet 8-HR FT-IR
Date	CONC. (PPM)	VOC (LBS/HR)	CONC. (PPM)	VOC (LBS/HR)	VOC (LBS/HR)
11/02/2006	1.26	0.20	1.23	0.19	0.00
11/03/2006	1.20	0.19			
11/04/2006	0.95	0.15			
11/05/2006	0.93	0.15			
11/06/2006	1.13	0.18			
11/07/2006	1.01	0.16			
11/08/2006	1.04	0.16			
11/09/2006	0.90	0.14			
11/10/2006	1.21	0.19	1.60	0.25	0.00
11/11/2006	1.35	0.22			
11/12/2006	1.46	0.23			
11/13/2006	1.35	0.21			
11/14/2006	1.21	0.19			
11/15/2006	0.92	0.15			
11/16/2006	1.36	0.22	1.31	0.21	0.00
Average*	1.07	0.17	1.60	0.25	0.00

** FID averages for the entire monitoring period are based on individual hourly average values for the period, not the block average values reported in the columns for each reporting day. Hourly average values for the entire period are presented in Appendix A.*

Table 7a
RCTO No. 10s.8.1a (F11X F-side)
Summary of Corresponding Exhaust Stack Measurements

RUN NO.	1	2	3	Average
DATE	11/02/2006	11/10/2006	11/16/2006	
START TIME	17:25	18:30	11:25	
STOP TIME	17:40	18:53	11:35	
Barometric Pressure, in. Hg	24.83	24.82	24.80	24.82
%Moisture	1.35	1.29	1.29	1.31
%CO_2	0.22	0.24	0.23	0.23
Static Pressure, in. of H_2O	-0.15	-0.13	-0.46	-0.25
Avg. Stack Temp, °F	114	130	138	127
Stack Gas Velocity, AFPM	3,210	3,322	3,400	3,311
Stack Flow Rate, DSCFM	22,696	22,867	23,047	22,870

Table 8
FT-IR Test Results
Run 1 - RCTO No. 9s.8.1a (F11W)

9s.8.1a (Fab 11W) Run 1 Controlled RCTO FT-IR Results 11/03/06 23:09 to 11/04/06 07:11							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (^oF)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,251,840	160	ND	8	ND	ND
Methanol	ND	1,251,840	160	ND	8	ND	ND
PGMEA	ND	1,251,840	160	ND	8	ND	ND
Xylene (o,m,p)	ND	1,251,840	160	ND	8	ND	ND
Isopropyl alcohol	ND	1,251,840	160	ND	8	ND	ND
Ethyl Lactate	ND	1,251,840	160	ND	8	ND	ND
n-butyl acetate	ND	1,251,840	160	ND	8	ND	ND
Total	-	-	-	ND	-	ND	ND

Table 9
FT-IR Test Results
Run 2 - RCTO No. 9s.8.1a (F11W)

9s.8.1a (Fab 11W) Run 2 Controlled RCTO FT-IR Results 11/09/06 11:25 to 11/09/06 19:27							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (^oF)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,286,716	177	ND	8	ND	ND
Methanol	ND	1,286,716	177	ND	8	ND	ND
PGMEA	ND	1,286,716	177	ND	8	ND	ND
Xylene (o,m,p)	ND	1,286,716	177	ND	8	ND	ND
Isopropyl alcohol	ND	1,286,716	177	ND	8	ND	ND
Ethyl Lactate	ND	1,286,716	177	ND	8	ND	ND
n-butyl acetate	ND	1,286,716	177	ND	8	ND	ND
Total	-	-	-	ND	-	ND	ND

Table 10
FT-IR Test Results
Run 3 - RCTO No. 9s.8.1a (F11W)

9s.8.1a (Fab 11W) Run 3 Controlled RCTO FT-IR Results 11/17/06 09:37 to 11/17/06 17:38							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (^{o}F)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,167,751	209	ND	8	ND	ND
Methanol	ND	1,167,751	209	ND	8	ND	ND
PGMEA	ND	1,167,751	209	ND	8	ND	ND
Xylene (o,m,p)	ND	1,167,751	209	ND	8	ND	ND
Isopropyl alcohol	ND	1,167,751	209	ND	8	ND	ND
Ethyl Lactate	ND	1,167,751	209	ND	8	ND	ND
n-butyl acetate	ND	1,167,751	209	ND	8	ND	ND
Total	-	-	-	ND	-	ND	ND

Table 11
FT-IR Test Results
Run 1 - RCTO No. 11s.8.1abc (F11S)

11s.8.1abc (Fab 11S) Run 1 Controlled RCTO FT-IR Results 11/30/06 10:05 to 11/30/06 18:10							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (^{o}F)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,640,011	137	ND	8.0	ND	ND
Methanol	ND	1,640,011	137	ND	8.0	ND	ND
PGMEA	ND	1,640,011	137	ND	8.0	ND	ND
Xylene (o,m,p)	ND	1,640,011	137	ND	8.0	ND	ND
Isopropyl alcohol	ND	1,640,011	137	ND	8.0	ND	ND
Ethyl Lactate	ND	1,640,011	137	ND	8.0	ND	ND
n-butyl acetate	ND	1,640,011	137	ND	8.0	ND	ND
Total	-	-	-	ND	-	ND	ND

Table 12
FT-IR Test Results
Run 2 - RCTO No. 11s.8.1abc (F11S)

11s.8.1abc (Fab 11S) Run 2 Controlled RCTO FT-IR Results 12/06/06 09:59 to 12/06/06 18:00							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (°F)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,738,924	130	ND	8.0	ND	ND
Methanol	ND	1,738,924	130	ND	8.0	ND	ND
PGMEA	ND	1,738,924	130	ND	8.0	ND	ND
Xylene (o,m,p)	ND	1,738,924	130	ND	8.0	ND	ND
Isopropyl alcohol	ND	1,738,924	130	ND	8.0	ND	ND
Ethyl Lactate	ND	1,738,924	130	ND	8.0	ND	ND
n-butyl acetate	ND	1,738,924	130	ND	8.0	ND	ND
Total	-	-	-	ND	-	ND	ND

Table 13
FT-IR Test Results
Run 3 - RCTO No. 11s.8.1abc (F11S)

11s.8.1abc (Fab 11S) Run 3 Controlled RCTO FT-IR Results 12/12/06 11:00 to 11/29/06 18:15							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (°F)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,715,945	130	ND	8	ND	ND
Methanol	ND	1,715,945	130	ND	8	ND	ND
PGMEA	ND	1,715,945	130	ND	8	ND	ND
Xylene (o,m,p)	ND	1,715,945	130	ND	8	ND	ND
Isopropyl alcohol	ND	1,715,945	130	ND	8	ND	ND
Ethyl Lactate	ND	1,715,945	130	ND	8	ND	ND
n-butyl acetate	ND	1,715,945	130	ND	8	ND	ND
Total	-	-	-	ND	-	ND	ND

Table 14
FT-IR Test Results
Run 1 - RCTO No. 11s.8.2abc (F11X-B side)

11s.8.2abc (Fab 11X) Bridge Side Run 1 Controlled RCTO FT-IR Results 11/29/06 10:16 to 11/29/06 18:15							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (°F)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,030,912	116	ND	8	ND	ND
Methanol	ND	1,030,912	116	ND	8	ND	ND
PGMEA	ND	1,030,912	116	ND	8	ND	ND
Xylene (o,m,p)	ND	1,030,912	116	ND	8	ND	ND
Isopropyl alcohol	ND	1,030,912	116	ND	8	ND	ND
Ethyl Lactate	ND	1,030,912	116	ND	8	ND	ND
n-butyl acetate	ND	1,030,912	116	ND	8	ND	ND
Total	-			ND	-	ND	ND

Table 15
FT-IR Test Results
Run 2 - RCTO No. 11s.8.2abc (F11X-B side)

11s.8.2abc (Fab 11X) Bridge Side Run 2 Controlled RCTO FT-IR Results 12/05/06 10:20 to 12/05/06 18:22							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (°F)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,026,908	116	ND	8	ND	ND
Methanol	ND	1,026,908	116	ND	8	ND	ND
PGMEA	ND	1,026,908	116	ND	8	ND	ND
Xylene (o,m,p)	ND	1,026,908	116	ND	8	ND	ND
Isopropyl alcohol	ND	1,026,908	116	ND	8	ND	ND
Ethyl Lactate	ND	1,026,908	116	ND	8	ND	ND
n-butyl acetate	ND	1,026,908	116	ND	8	ND	ND
Total	-	-	-	ND	-	ND	ND

Table 16
FT-IR Test Results
Run 3 - RCTO No. 11s.8.2abc (F11X-B side)

11s.8.2abc (Fab 11X) Bridge Side Run 3 Controlled RCTO FT-IR Results 12/11/06 10:41 to 12/11/06 18:44							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (^oF)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,033,778	116	ND	8	ND	ND
Methanol	ND	1,033,778	116	ND	8	ND	ND
PGMEA	ND	1,033,778	116	ND	8	ND	ND
Xylene (o,m,p)	ND	1,033,778	116	ND	8	ND	ND
Isopropyl alcohol	ND	1,033,778	116	ND	8	ND	ND
Ethyl Lactate	ND	1,033,778	116	ND	8	ND	ND
n-butyl acetate	ND	1,033,778	116	ND	8	ND	ND
Total	-	-	-	ND	-	ND	ND

Table 17
FT-IR Test Results
Run 1 - RCTO No. 10s.8.1a (F11X-F side)

10s.8.1a (Fab 11X) Fab Side Run 1 Controlled RCTO FT-IR Results 11/02/06 12:41 to 11/02/06 20:42							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (^oF)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,361,742	114	ND	8	ND	ND
Methanol	ND	1,361,742	114	ND	8	ND	ND
PGMEA	ND	1,361,742	114	ND	8	ND	ND
Xylene (o,m,p)	ND	1,361,742	114	ND	8	ND	ND
Isopropyl alcohol	ND	1,361,742	114	ND	8	ND	ND
Ethyl Lactate	ND	1,361,742	114	ND	8	ND	ND
n-butyl acetate	ND	1,361,742	114	ND	8	ND	ND
Total	-	-	-	ND	-	ND	ND

Table 18
FT-IR Test Results
Run 2 - RCTO No. 10s.8.1a (F11X-F side)

10s.8.1a (Fab 11X) Fab Side Run 2 Controlled RCTO FT-IR Results 11/10/06 11:41 to 11/10/06 19:36							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (°F)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,372,037	130	ND	8	ND	ND
Methanol	ND	1,372,037	130	ND	8	ND	ND
PGMEA	ND	1,372,037	130	ND	8	ND	ND
Xylene (o,m,p)	ND	1,372,037	130	ND	8	ND	ND
Isopropyl alcohol	ND	1,372,037	130	ND	8	ND	ND
Ethyl Lactate	ND	1,372,037	130	ND	8	ND	ND
n-butyl acetate	ND	1,372,037	130	ND	8	ND	ND
Total	-	-	-	ND	-	ND	ND

Table 19
FT-IR Test Results
Run 3 - RCTO No. 10s.8.1a (F11X-F side)

10s.8.1a (Fab 11X) Fab Side Run 3 Controlled RCTO FT-IR Results 11/16/06 09:33 to 11/16/06 17:331							
Compound	Avg. Conc. (ppm_{dry})	Exhaust Flow Rate (dscf/hr)	Exhaust Temp. (°F)	Emission Rate (lbs/hr)	Total Hours	Total for Period (lbs)	Total for Period (tons)
Ethanol	ND	1,382,820	138	ND	8	ND	ND
Methanol	ND	1,382,820	138	ND	8	ND	ND
PGMEA	ND	1,382,820	138	ND	8	ND	ND
Xylene (o,m,p)	ND	1,382,820	138	ND	8	ND	ND
Isopropyl alcohol	ND	1,382,820	138	ND	8	ND	ND
Ethyl Lactate	ND	1,382,820	138	ND	8	ND	ND
n-butyl acetate	ND	1,382,820	138	ND	8	ND	ND
Total	-	-	-	ND	-	ND	ND

B. Unit Operating Parameters

For Engines	N/A	For Residue Turbines	N/A
For Heaters, Boilers, Furnaces	N/A	Engine/Turbine Pump Driven	N/A

C. Control Equipment Operating Parameters

During the continuous VOC monitoring, the RCTO combustion chamber temperature (°F) was monitored and recorded according to Intel standard operating and reporting procedures. Separate observations were not conducted for this program.

D. Comparison of Measured vs. Modeled Parameters

This is not applicable to this source measurement program.

III. Test Procedures

A. Schematic Drawing of the Sample Train

Two sampling configurations, one semi-automated and one manual, were used in supporting this monitoring program. The semi-automated system configuration, supported the FID and FT-IR measurements with a sample system comprised of: (1) stainless steel extraction probe, (2) three-way calibration valve, (3) 3/8" heated Teflon™ sample line (maintained at 150°C), (4) heated Teflon™ lined sample pump, (5) 1/4" heated Teflon™ sample line (maintained at 150°C), (6) MKS Model 2030 FT-IR, CAI Heated FID; (7) separate PC based DAS system for the FT-IR and FID, and (8) NIST certified calibration gases. The sample gas was kept hot during transport to both the FID and FT-IR systems. *Figure 1* provides a general block diagram of the instrument setup and system configuration for the semi-automated FID/FT-IR measurement system.

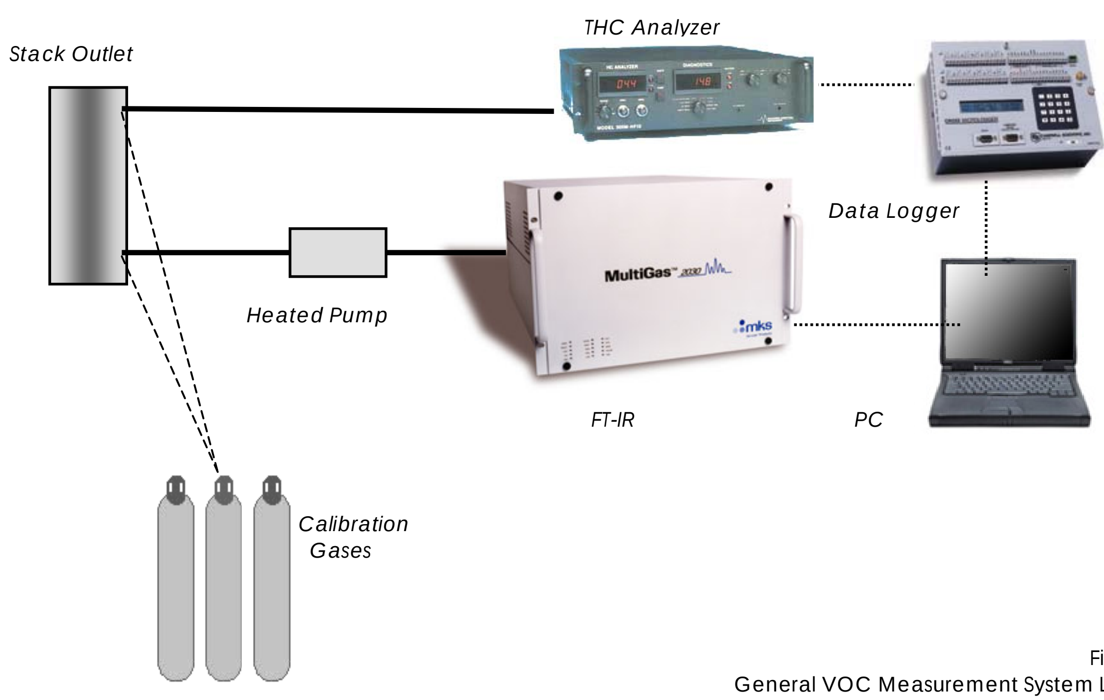

Figure 1
General VOC Measurement System Layout

The manual system was used in the periodic measurement of exhaust gas velocity and temperature (at each of the FID/FT-IR measurement points). This system was comprised of a calibrated Type-S Pitot and inclined manometer for measuring stack pressure differential (velocity), and a calibrated Type-K thermocouple for documenting exhaust gas temperature.

B. Brief Description of Test Methods

Two primary test methods were used for the measurement of VOC's. Total hydrocarbons were measured with the use of calibrated flame ionization detectors (FID's) during the minimum 336-hour continuous tests, which were further supported by three 8-hour test runs using a fully calibrated continuous FT-IR. Manual measurements for exhaust gas temperature and stack gas velocity are derived from calibrated instrumentation using appropriate transfer standards. The measured concentration data, coupled with the calculated flow rate, supported the data for reporting emissions in pounds per hour.

1. Overview

This section offers a brief overview of the test methods that were followed by TRC's field personnel. The discussions of the individual methods are abbreviated to reduce the overall volume of this document. Individual subsections are devoted to general discussions addressing physical duct measurement methods and instrumented gas measurements. Specifically, *EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods*, and *40CFR60 Appendix A* Reference Methods 1-4, EPA Reference Method 320, and EPA Performance Specification 8, where referenced, or their approved alternatives. A brief discussion of the procedures used is given below. The primary methods applied in this program were as follows:

EPA RM1	"Selection of Traverse Points"
EPA RM2	"Determination of Duct Gas Velocity and Volumetric Flow Rate"
EPA RM3	"Gas Analyses for Carbon Dioxide and/or Oxygen, Instrumental Method"
EPA RM4	"Determination of Moisture Content in-Stack Gases"
EPA RM25A	"Measurement of Total Hydrocarbon Emissions from Stationary Sources"
EPA RM320	"Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared (FT-IR) Spectroscopy"

2. Physical Parameter Measurement Methods

The determination of exhaust duct gas characteristics requires the performance of a number of methods and measurement procedures. The Reference Methods listed above were integrated into the field measurements for each series performed for each source. These methods supported the necessary parameters used in the determination of the pollutant emissions.

3. Flow Rate Determination

EPA Reference Method 2 Determination of Duct Gas Velocity and Volumetric Flow rate (Type S Pitot Tube), amended June 1986, was used to measure the average velocity at each exhaust (or stack) location. In this procedure, a Pitot tube was connected to a manometer and the velocity pressure was recorded as the Pitot was traversed across the exhaust stack. The velocity measurement points were guided by EPA RM1 and insured that a representative data set was obtained at the cross section of the measurement location. Table 19 provides the final RM1 data used for each of the four operating RCTO systems exhaust stacks that were measured during this program. Concurrent with the measurement of velocity pressure, gas temperature was also recorded. Gas temperatures were measured using a Type-K thermocouple attached to the Pitot, oriented in the same measurement plane as the velocity measurements. The Type-K thermocouple was connected to a calibrated digital pyrometer for recording temperature. Data derived from the stack pressure and temperature records were used in the determination of the exhaust gas velocity and flow rate.

Table 20
Exhaust Stack Dimensions and Traverse Point Layout
H2Q406 Program

Parameters	RCTO F11W 9.8.1a	RCTO F11S 11.8.1a	RCTO F11X-F 10.8.1a	RCTO F11X-B 11.8.2a
Stack Dia. (in)	47.5	48	41.5	41.5
Port Depth (in)	3.5	4	3	3
Dia. Upstream	0.8	1.2	6.7	6.7
Dia. Downstream	2.6	7.0	3.5	10.6
Point 01	4.5	5.0	4.3	4.8
Point 02	6.7	7.2	7.4	9.1
Point 03	9.1	9.7	11.1	15.3
Point 04	11.9	12.5	16.4	32.2
Point 05	15.4	16.0	31.1	38.4
Point 06	20.4	21.1	36.4	42.7
Point 07	34.1	34.9	40.1	-
Point 08	39.1	40.0	43.2	-
Point 09	42.6	43.5	-	-
Point 10	45.4	46.3	-	-
Point 11	47.8	48.8	-	-
Point 12	50.0	51.0	-	-

4. Molecular Weight Determination

Molecular weight determinations were conducted as part of the FT-IR measurements. For the RCTO tests, the FT-IR measured carbon dioxide (CO_2) concentration was used. For these RCTO tests, the oxygen (O_2) level was assumed to be 20.9 percent minus the measured CO_2 concentration.

5. Percent Moisture Determination

For the RCTO testing, the FT-IR measured water concentration was used in lieu of conducting EPA RM4, as approved by NMED. Batch sampling was not required for the RCTO moisture assessments as the FT-IR support integrated and continuous moisture measurements for each 8 hour run period that resulted in more accurate and representative moisture data for these sources.

6. Total Hydrocarbon Measurements

The VOC measurements were conducted using California Analytical Instruments (CAI) Model 300H FID's. The FID monitors operate and measure total hydrocarbon concentration on a continuous basis. The Model 300H measurement system is a totally heated FID, which has all key gas interface components (pump, SS filter, and sample line) heated at or above one hundred and fifty degrees Celsius (150˚C). By heating all components that contact the sample as it is delivered to the system, the potential for condensation or contamination of the gas is minimized. This also eliminates any bias that may come from variation in the humidity or temperature of the gas sample.

In the general application of RM25A, a gas sample is transported from the source to a flame ionization detector through a heated sample line. Ions formed in the combustion of a specific hydrogen-carbon compound in a H_2-O_2 enriched flame establish a current that is proportional to the mass rate of the hydrocarbons to the flame. This current (flame response) is compared with a calibration curve based on certified propane (C_3H_8) gases. The response of the instrument and subsequent output was in terms of the instrument calibration standard (propane).

The flame ionization analyzer used in this program demonstrates linearity over its entire operating range, yielding accurate measurements of total hydrocarbon concentrations. The 300H was operated in the 0-100 ppm range. The operating range is based upon the relative response of the calibration standards. For this monitoring program, the FID instruments were calibrated on-site with NIST traceable propane (C_3H_8) compressed gas standards.

The signal output of the FID analyzer was connected to a Campbell Scientific data acquisition system (DAS). The output voltage that was sent to the digital data acquisition system, for each operating FID, was linear and directly proportional to the organic concentration being measured. The DAS system processed the output of each analyzer signal and stored continuous one-minute average values. The stored data was entered imported into standardized spreadsheets for determining final hourly, daily, and monitoring period averages for reporting.

The reported total hydrocarbon data, developed from this measurement program, was derived from the relative FID hydrocarbon response, based on propane calibrations, for each respective system. This measured concentration was then used in the calculation of total hydrocarbon emission rate in pounds per hour as propane (lbs/hr as C_3H_8) incorporating the measured flow rate for each source.

7. FT-IR Measurements

Total hydrocarbons measurements derived from the continuous 336 hour tests using FID, were complemented with three discrete 8-hour test runs using a Model 2030 FT-IR system. Test runs were conducted at the beginning, middle, and end of the 336 hour FID monitoring periods. In this measurement application, stack gas was extracted through a heated probe assembly and pump, and transported through heated lines to the FT-IR gas cell. The sample line, pump, and FT-IR sample cell were all kept at a nominal 150°C to prevent condensation of the gas sample. The sample cell temperature and pressure were recorded on a continuous basis and used to correct the sample concentrations on a real time basis, when appropriate.

The Model 2030 MultiGas™ Analyzer employed a 2102 Process FT-IR Spectrometer, On-Line's patented high throughput sampling cell, applications specific analysis software, and a pre-calibrated transferable reference library. On-Line's spectrometer is a fast, sensitive, and stable monitoring system. The spectrometer is permanently aligned and requires minimal adjustments. The spectrometer obtains high-resolution infrared spectra, which are compared to the quantitative library reference spectra for high sensitivity and accurate analysis of most gases and vapors.

Infrared absorption spectroscopy was performed by directing an infrared beam through the sample to the detector. The frequency-dependent infrared absorbance of the sample was measured by comparing this detector signal (single beam spectrum) to a signal obtained without a sample in the beam path (background). Most molecules absorb infrared radiation and the absorbance occurs in a characteristic and reproducible pattern. The infrared spectrum measures fundamental molecular properties and a compound can be identified from its infrared spectrum alone.

C. Deviations from Methods

No variations from the approved test plan occurred. As specifically defined in the Test Plan, approved by NMED, the following method approach and data collection activities that were approved are provided below for clarity.

The approach in the approved Test Plan was based on the monitoring requirements stipulated in the facilities air permit and the currently accepted monitoring plan submitted for the calendar year 2006 measurements. Therefore, the initial quality assurance and quality control procedures completed for the instrumental FT-IR confirmations were not repeated. The following items were addressed in the approach to conducting the quarterly VOC testing requirements relating to the three 8-hour test runs with FT-IR conducted concurrently with the FID monitoring:

- Under the system monitoring configuration applied to this quarterly program, the FT-IR sampling system used an in-stack 20 micron filter and a heated 1 micron filter after the pump and before the FT-IR instrument in lieu of the heated 1 micron filter at the end of the sampling probe.

- Operationally, daily instrument checks and calibration transfer standard runs, for the FT-IR system, were conducted as per the manufacturer recommendations. These procedures were guided by RM 320, but are tailored to meet the specifics of the instrument. In all cases, the FT-IR used in this program (a MKS-OnLine Model 2030) meets EPA specifications, and in most cases exceeds these basic specifications.

D. Make and Model of Test Instrumentation

The following primary equipment and instrumentation was used in the sampling program and is reviewed in the following sections with detail of type, make, model and tolerance in Table 21.

Table 21
Field Instrumentation and Equipment Applied in the Program

Support Equipment	Model	Tolerance
FT-IR	MKS On-Line Model 2030	Compound specific
FID	CAI HC300	± 2.5%
Data Acquisition	Campbell Scientific	NA
Heated Sample Line	Technical Heaters	± 5° F
Calibration Gases	Scott Specialty	NIST ± 1%
Type-S Pitot	NuTech Model 0306	N/A
Pressure Gauge (manometer)	Dwyer	0.01" H_2O
Temperature (Type-K)	Datel (NuTech 2010.04)	0.1°F

Heated sample line. A heat traced sample line constructed of a Teflon™ core in a protective neoprene wrap is used to transport of effluent (stack) gas to the heated instrumentation. The sample line temperature is maintained at 150˚C.

Three-way sample tee. A stainless steel sample tee is integrated into the sampling system to provide: (1) controlled injection of reference gases, and (2) sampling of effluent gas through the sampling probe. The gas sample valve is constructed of 316 stainless steel and is attached to the sample probe, span gas lines, and heated sample line that passes the extracted stack gas to the instruments.

THC (FID) analyzer. The measurement of total hydrocarbons was performed using a CAI Model 300H flame ionization detector (FID). The system was operated in the 0-100 ppm range.

FT-IR analyzer. The VOC analysis was performed using an MKS Online Multi-gas Model 2030's FT-IR system with a 5.11 meter path length. A heated pumping system was used to direct the sample from the heated sample lines at the stack to the instrument. The Model 2030 operates on the principle of infrared absorbance. Each FT-IR unit was operated using the MKS On-Line MG2000 instrument and gas analysis software running on a portable PC. The software controls and records all operational parameters of the FT-IR and stores the sample spectrums and interferograms on the connected PC.

E. Methods for Unit Operating

RCTO Unit operations were based upon the approved thermal oxidizer operating conditions and facility OM&M program. All RCTO's were maintained within the prescribed operating parameters and temperatures throughout the monitoring program.

IV. DATA AND CALCULATIONS

A. Raw Data Used in the Emissions Calculations

Appendix A includes all raw field data used in the source calculations.

B. Laboratory Data

All gas measurements were provided instrumentally, providing immediate concentration information and no further analysis was required.

C. Strip Chart Records

Digital data recorders were used for the data collection for this program. The hard copy printouts and summaries of the digital data for both the FID and FT-IR measurements are provided in *Appendix A*.

D. Example Calculations

The following section will explain the primary calculations and equations used to complete this program. The primary calculations involve the conversion of pollutant concentrations to emissions in lbs/hr, and the conversion of the FT-IR results into FID equivalent propane concentrations.

1. Volumetric Flow Rate Data Reduction

Calculated flow rate data is a required component for calculating emissions. Data collected following EPA Reference Method 1 and RM 2, where applicable, is used to calculate volumetric flow rate. Gas velocity, gas molecular weight, gas temperature, and gas pressure are measured parameters used for calculating flow rate in actual cubic feet per minute (ACFM) and standard cubic feet per minute (SCFM).

Nomenclature

A	=	Cross-sectional area of stack, (ft^2)	
B_{ws}	=	Water vapor in the gas stream proportion by volume	
C_p	=	Pitot tube coefficient, dimensionless.	
K_p	=	Pitot tube constant,	
		$85.49 \times \frac{ft\,(lb/lb\text{-}mole)(in.\,Hg)^{1/2}}{sec\,(°R)(in.\,H_20)}$	Eq. 1
M_d	=	Molecular weight of stack gas, dry basis (lb/lb-mole).	
M_s	=	Molecular weight of stack gas, wet basis (lb/lb-mole).	
	=	$M_d\,(l - B_{ws}) + 18.0\,B_{ws}$	Eq. 2
P_{bar}	=	Barometric pressure at measurement site (in. Hg).	
P_g	=	Stack static pressure (in. Hg).	
P_s	=	Absolute stack pressure (in. Hg); $P_{bar} + P_g$	Eq. 3
P_{std}	=	Standard absolute pressure (29.92 in. Hg).	
Q_{std}	=	volumetric stack gas flow rate corrected to standard conditions (dscf/hr).	
t_s	=	Stack temperature, (°F).	
T_s	=	Absolute stack temperature, (°R); $460 + t_s$	Eq. 4
T_{std}	=	Standard absolute temperature (528°R).	
V_s	=	Average stack gas velocity (ft/sec).	
Dp	=	Velocity head of stack gas (in. H_20).	
3,600	=	Conversion factor, sec/hr.	
18.0	=	Molecular weight of water (lb/lb-mole).	

Average Stack Gas Velocity (FPS)

$$V_S = K_p \text{ x } C_p \text{ x } (D_p)^{1/2}_{avg} \text{ x } \sqrt{\frac{T_{S(avg)}}{P_S \text{ x } M_S}} \qquad \text{Eq. 5}$$

Example Calculation Fab 11X-F Run #1.

$$53.495 = 85.49 \text{ x } 0.84 \text{ x } 0.8303 \text{ x } \sqrt{\frac{573.8}{24.82 \text{ x } 28.72}}$$

Average Stack Gas Dry Standard Volumetric Flow Rate (DSCFH).

Eq. 6

$$Q_{std} = 3600 \times V_S \times A \times (1 \quad B_{WS}) \times \frac{T_{std} \times P_S}{T_S(avg) \times P_{std}}$$

Example Calculation Fab 11X-F Run #1.

$$1{,}361{,}742 = 3{,}600 \times 53.495 \times 9.3934 \times (1 - 0.0135) \times \frac{527.79 \times 24.82}{573.8 \times 29.92}$$

2. *Gas Emission Equation*

The effluent gas emissions calculation incorporates the measured flow rate and the measured pollutant (gas) concentration. Both flow rate and gas concentration are handled on a dry basis when determining emissions for this application.

Lbs/hr = DSCFM * PPM * MW * 60 min/hour * 2.59396E $^{-09}$ ppm/lbs/dscf

where;

SCFM	=	Flow Rate during the test period (wet standard cubic feet per minute)
MW	=	Molecular weight of gas (C_3H_8 = 44.0962)
ppm	=	Measured pollutant concentration (wet basis)
60	=	Minutes in an hour
2.5967E-09	=	Conversion factor from ppm to lbs/dscf 40CFR60 Appendix A Method 19 (average)

Example Calculation: Fab 11X-F 1st 24-Hour Period Result

THC

0.194 Lbs/hr = 23,007 * 1.23 * 44.0962 * 60 min/hour * 2.5967E^{-09} ppm/lbs/dscf

E. Analysis and Certification Documents

Certifications for the gas standards used in the program are provided in *Appendix C*.

F. Audit Sample Results (where applicable)

Audit samples were not a required component of this program. Certified gases were used for all instrument calibrations and verifications**.**

G. *Visible Emissions (where applicable)*

Visible Emissions observations were not required as a component of this program.

H. *Sample Chain of Custody*

Chain of custody forms were not required for this instrumental measurement program. All results were recorded digitally including the FT-IR inteferograms and absorbance spectra's.

V. APPENDIX

A. *Any Complications*

The FID used at the F11X-F RCTO suffered from intermittent electronic noise for the first seven days of testing. This ranged from short periods of noise to total signal loss. This resulted in six periods of data loss greater than 15 minutes (four periods of approx. 30 min., one period of 1hr:21 min, and one period of 4hr:30 min). An effective repair was made and 353 total hours of data were collected that resulted in 342 hours of valid data.

An intermittent leak at the probe calibration tee assembly caused the first three days of testing data at the F11-W RCTO to be called into question. The test period was restarted after the leak was identified and repaired. This added three days to the total testing period and resulted in 349 hours of useable FID data for this source.

The FID used at the F11-S RCTO suffered from a data loss of six hours due to the failure of a component of its hydrogen fuel generator. This failure was caused by the normal, ongoing depletion of a drying agent that was not changed in a timely manner. An additional period of data loss was caused by a routine calibration that exceeded the maximum15-minute window allowed for a gap in the data.

Table 22 provides activity data for each Fab RCTO outlet monitoring period that resulted in missing a 15 minute (¼ hour) or greater increment period. Activities causing data gaps were predominately associated with extended calibration periods or routine maintenance (changing of combustion air cylinder for FID, etc.). Any excessive periods of instrument downtime or data loss that could potentially affect the ability to support 336 hours of data collection, the overall recovery statistics by source, or general data quality issues, resulted in extending the monitoring time beyond the initially designated 336 hours to meet the minimum collection requirement. *Table 23* further details the data availability statistics by source.

Table 22
RCTO Outlet Quarterly Measurements – 336 hours
FID Data Gaps / Maintenance Activities

Start Time	Stop Time	Data Gap HR:MM	Reason	Description
F11W – 9s.8.1a				
11/9/2006 10:25	11/9/2006 10:53	00:28	F	Replaced calibration line connections
F11X B -11s.8.2abc				
11/29/2006 07:20	11/29/2006 07:36	0:16	C	Calibration Check
11/30/2006 14:25	11/30/2006 18:19	3:54	G	Zero Air Generator Failure
11/30/2006 18:20	11/30/2006 18:31	0:11	C	Calibration Check
12/04/2006 07:28	12/04/2006 07:47	0:19	F	FID Electrometer ground transient
12/05/2006 13:03	12/05/2006 15:06	2:03	C/F	Excess drift / Calibration Check
F11S -11s.8.1abc				
12/02/2006 13:35	12/02/2006 19:00	5:25	F	Excessive Drift
12/02/2006 19:01	12/02/2006 19:06	0:05	C	Calibration Check
12/02/2006 19:07	12/02/2006 19:30	0:23	F	Hydrogen Dryer Change
12/5/2006 18:52	12/05/2006 19:10	0:18	C	Calibration Check
F11X F -10s.8.1a				
11/02/2006 06:07	11/02/2006 06:44	0:37	F	FID Electrometer ground transient
11/02/2006 08:18	11/02/2006 08:45	0:27	F	FID Electrometer ground transient
11/02/2006 13:46	11/02/2006 15:07	1:21	F	FID Electrometer ground transient
11/04/2006 08:23	11/04/2006 08:45	0:22	C/F	Calibration/Repair
11/05/2006 09:19	11/05/2006 09:48	0:29	C/F	Calibration/Repair
11/09/2006 07:12	11/09/2006 11:43	4:31	C/F	Calibration/Repair

REASON CODES	
A	Process Off-Line (Down)
B	Scheduled Maintenance
C	CEM in Calibration mode
D	DAS program Maintenance
E	Error in DAS record information
F	Failure of Minor CEM System Component
G	Failure of Major CEM System Component
NA	Not Applicable – All activities below reporting threshold

Table 23
RCTO Quarterly Measurements; Data Availability

Source	Total System Offline Time HR:MM	Total Valid Run HRS	% Available (15 min. Basis)	Description
F11W - 9s.8.1a	4:04	349	104.1%	Twice Daily Zero/Calibration Checks FID Instrument Calibration Line Repair
F11S - 11s.8.1abc	9:27	337	100.8%	Twice Daily Zero/Calibration Checks Instrument Fuel Depletion
F11X B - 11s.8.2abc	11:08	345	103.3%	Twice Daily Zero/Calibration Checks FID Flame Out, Air Source Failure
F11X F - 10s.8.1a	11:34	342	103.2%	Twice Daily Zero/Calibration Checks Instrument Detector Intermittent problems

B. Special Information

No special information was generated from this program outside that specifically defined in the reporting requirements of the monitoring plan. All monitoring followed prescribed EPA Reference Method procedures defined in the approved monitoring plan.

C. Brief Resume of Test Personnel

Michael Krall
TITLE Operations Manager, Senior Program Manager
EDUCATION B.S. Chemistry, State Univ. of New York at Oswego, 1979
SPECIALTIES EPA Sampling Methods, CEMs, Reference Methods, Field Measurements
YEARS of EXP. 26 years of experience

John Glass
TITLE Senior Scientist
EDUCATION B.S. Chemistry, Southwestern Univ., 1979; BS Chemical Engineering, Univ. of Texas Austin 1983
SPECIALTIES EPA Sampling Methods, CEMs, Reference Methods, Field Measurements
YEARS of EXP. 25 years of experience

Mike Silvers
TITLE Project Scientist
EDUCATION BS Chemistry, Univ. of Texas Austin 1986
SPECIALTIES EPA Sampling Methods, CEMs, Reference Methods, Field Measurements
YEARS of EXP. 20 years of experience

Michael Riley
TITLE Environmental Scientist
EDUCATION B.S., Ecology, University of Rochester 1988; MS Environmental Management, Duke 1994
SPECIALTIES Reference Method Source Sampling
YEARS of EXP. 12 years of experience

Will McKibben
TITLE Environmental Scientist
EDUCATION Bachelor of Science, Engineering Mechanics, NMI Mining and Technology, 2003
SPECIALTIES Reference Method Source Sampling
YEARS of EXP. 2 years of experience