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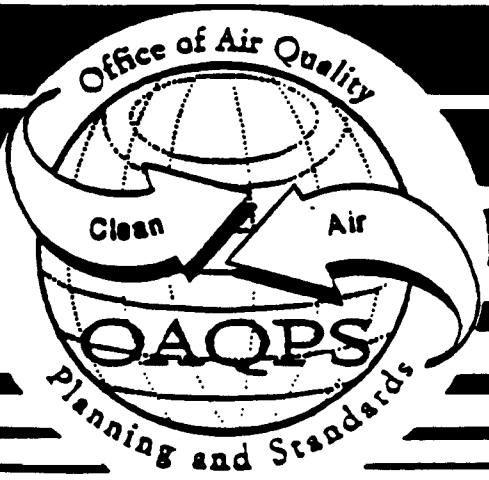
Final Report of Lime Manufacturing Industry Fourier Transform Infrared Spectroscopy

Austin White Lime Company
Austin, Texas



Lime Kiln Source Characterization

Final Report

Contract No. 68-D7-0001
Work Assignment 2-03

Austin White Lime Company
Austin, Texas

Prepared for:

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1.0 INTRODUCTION

The purpose of this testing program is to: (1) quantify hydrogen chloride (HCl) emission levels; and (2) gather screening data on other hazardous air pollutants (HAP) emissions from lime production plants to support a national emission standard for hazardous air pollutants (NESHAP).

Three measurement methods were conducted at this facility:

- Fourier Transform Infrared Spectroscopy (FTIR) (EPA Draft Method 320);
- Gas Filter Correlation - Infrared (GFC-IR) (EPA Method 322); and
- Dioxin/furan manual trains (EPA Method 23).

This report presents data from the FTIR measurements performed by Eastern Research Group. The EPA Method 23, 25A, and 322 measurements were conducted by Pacific Environmental Services, Inc. (PES), and Air Pollution Characterization and Control, Ltd. (APCC), under subcontract to PES, respectively. Process data was collected by Research Triangle Institute, Inc. (RTI), under contract to EPA. Please refer to the report prepared by PES for information and results of the Method 23, 25A, and 322 testing. For this test, screening means a measurement to determine approximate levels of species other than HCl.

The lime kiln facility and sampling locations tested in this program are detailed in the report prepared by PES.

1.1 Objectives

The objective of the FTIR testing of the lime facility was to quantify HCl and perform screening of other HAPs detectable by FTIR, using EPA Draft Method 320.

1.2 Brief Site Discussion

Testing was conducted at the Austin White Lime Company located in Austin, Texas. Testing was performed on the inlet and outlet on Kiln #2 and #3, wet scrubber and a baghouse, respectively. Detailed site information can be found in the report prepared by PES.

1.3 Emissions Measurements Program

This section provides an overview of the emissions measurement program conducted at the Austin White Lime Company, located in Austin, Texas. Included in this section are summaries of the test matrix, test schedule, and authorized deviations from the test plan. Additional detail on these topics are provided in the sections that follow.

1.3.1 Test Matrix

The complete sampling and analytical matrix that was performed is presented in the report prepared by PES. In this report, only FTIR-related test matrix will be provided. FTIR spectroscopy was used, in accordance with EPA Draft Method 320, to quantify HCl and also, in a screening capacity, to measure other HAPs that can be detected by FTIR.

FTIR measurements were conducted in two sets:

- Unconditioned; and
- Conditioned.

Unconditioned sampling was conducted during the extent of the EPA Method 23 dioxin manual train runs. These runs were approximately 3 hours in duration. After completion of a dioxin run, the FTIR measured conditioned sample gas for a one-hour period to screen for aromatic species such as benzene, toluene, etc.

During each run (i.e., unconditioned or conditioned) the FTIR analysis time was divided equally between inlet and outlet samples. Each location was monitored for no less than a total of 90 minutes. Some data points (typically, 5 minutes) were discarded for each set due to inlet/outlet sample mixing in the FTIR analysis cell. The actual amount of data points discarded is given later in this report. This procedure ensures the remaining data points were data truly representing the location being tested in that set.

1.3.2 Test Schedule

The test schedule for EPA Methods 23, 25A, and 322 measurements is given by the report prepared by PES. Section 2.1 gives the test log for the FTIR testing at this site.

1.3.3 Deviations from Test Plan/Schedule

Deviations from the original FTIR Site-Specific Test Plan (SSTP) are listed below:

- Testing was originally planned for 15 minute intervals between the inlet and outlet. The measurements consisted of collecting 20 at the outlet, then 30 minute intervals alternating from the inlet and the outlet, in order to synchronize with the GFC-IR measurements performed by APCC.

- The EPA Work Assignment Manager authorized one hour total sample collection of the conditioned samples, ½ hour each on inlet and outlet. If detection of other HAPs was determined, then the run would extend to the full 2 hours, as originally planned. In this case, no additional HAPs were detected in the conditioned samples.

- Some indicated sampling system temperatures were below the 350°F target that was stated in the test plan. These temperatures are the highest attainable with these sampling system components. It was determined after completion of the test program that the measured temperature of some of the sampling system components was a sensitive function of thermocouple location. When test thermocouples were inserted in the sample-wetted regions of the sampling system, they indicated temperatures above 350°F in all cases.

1.4 Test Report

This final report, presenting all data collected and the results of the analyses, has been prepared in four sections, and an appendix as described below:

- Section 1 provides an introduction to the testing effort and includes a brief description of the test site and an overview of the emissions measurements program;
- Section 2 gives a summary of the test results for the FTIR results for HCl and other detected species;
- Section 3 presents detailed descriptions of the sampling and analysis procedures; and;
- Section 4 provides details of the QA/QC procedures used on this program and the QC results.

A detailed description of the site, sampling locations, process and plant operation during the field test is provided in the PES-prepared report. Copies of the field data sheets and FTIR concentration data are contained in the appendices.

Six appendices are found in this report. They are organized as follows:

- Appendix A contains spreadsheet QA/QC review sheets;
- Appendix B contains QC gas cylinder certification sheets;
- Appendix C contains raw FTIR data;
- Appendix D contains FTIR field data sheets;
- Appendix E contains pre-test calculations; and
- Appendix F contains post-test calculations.

2.0 SUMMARY OF RESULTS

This section provides the FTIR results of the emissions test program conducted at the Austin White Lime Company in Austin, Texas from June 30 to July 1, 1998. Results for the extractive FTIR test conducted for HCl and screening for selected HAPs are provided in this section. Other (non-HAP) species detected are also reported. Testing was performed at the inlet and outlet of the wet scrubber from Kiln #2 and the Baghouse from Kiln #3.

2.1 Emissions Test Log

ERG performed extractive FTIR measurements for HCl and other HAPs. Table 2-1 presents the emissions test log that shows the test date, location, run number, test type and run times for each method.

Table 2-1. Emissions Test Log

Date	Location	Run Number	Test Type	Run Time
6/30/98	Baghouse Kiln #3 (inlet/outlet)	Spike 1	FTIR HCl Spike (inlet)/ System QC (outlet)	10:15 - 11:56
6/30/98	Baghouse Kiln #3 (inlet/outlet)	Run 1	FTIR (Unconditioned) FTIR (Conditioned)	12:45 - 16:22 17:36 - 18:31
6/30/98	Baghouse Kiln #3 (inlet/outlet)	Spike 2	FTIR HCl Spike (inlet)/ System QC (outlet)	16:27 - 17:21
7/01/98	Wet Scrubber Kiln #2 (inlet/outlet)	Spike 1	FTIR HCl Spike (inlet)/ System QC (outlet)	11:51 - 13:57
7/01/98	Wet Scrubber Kiln #2 (inlet/outlet)	Run 1	FTIR (Unconditioned) FTIR (Conditioned)	14:15 - 17:35 19:26 - 20:26
7/01/98	Wet Scrubber Kiln #2 (inlet/outlet)	Spike 2	FTIR HCl Spike (inlet)/ System QC (outlet)	17:58 - 19:04

2.2 FTIR Results

2.2.1 Overview

FTIR data for HCl and other species were collected at the inlet and outlet of the wet scrubber and baghouse. FTIR data collection of unconditioned samples was synchronized with EPA Method 23 manual dioxin/furan testing and EPA Method 322 GFC-IR HCl measurements. Conditioned samples were measured by FTIR for other HAP species.

FTIR data were collected by alternating sample analysis between inlet and outlet every 30 minutes for Kiln #2 and every 35 minutes for Kiln #3. Inlet and outlet samples were drawn on a continuous basis; only the FTIR sample analysis was alternated between inlet and outlet. The first five data points from each 30 (Kiln #2) and 35 (Kiln #3) minute inlet/outlet measurement period were discarded to eliminate data for samples containing both inlet and outlet sample gas. Five data points correspond to the measured response time of the complete FTIR sampling and analysis system (details on measurement of system response time are given below). The measurement run contained a total of 74 (Kiln #2) and 79 (Kiln #3) 1-minute average data points for both inlet and outlet measurements, after discarding the transient data points. A 1-minute average data point is generated by analysis of a composite spectrum consisting of an average of 43 FTIR spectra collected over the 1 minute period.

Section 2.1 gives the schedule of the tests performed at the Austin White Lime Company in Austin, Texas. Both unconditioned and conditioned samples were analyzed. Conditioned samples were generated by passing the raw sample gas through a water vapor/carbon dioxide scrubbing system (see Section 3.1.1 for details). Conditioned samples extracted from the wet scrubber were measured after unconditioned sample extraction for the next hour. One minute average data points were generated by analysis of the composite spectrum consisting of an average of 43 FTIR spectra collected over the 1-minute period. These results are reported in Section 2.2.2.2.

The west scrubber and baghouse removal efficiency for HCl was measured from the inlet/outlet data from each location and is reported in Section 2.2.2.1.

2.2.2 FTIR Emission Results

This section contains the FTIR HCl test results for the wet scrubber and baghouse inlet and outlet.

2.2.2.1 FTIR HCl Test Results. The estimated FTIR HCl detection limit for this study was between 0.13 and 0.14 ppmv. Approximately half the FTIR instrument analysis time was split equally between inlet and outlet. Results given below are organized by location. HCl removal efficiency was also calculated for each run. Raw data is presented in Appendix C listing each compounds run values every minute. All HCl emission runs were collected during the unconditioned tests.

Wet Scrubber - Kiln #2, Outlet/Inlet HCl Results—Table 2-2 gives a summary of the wet scrubber outlet/inlet FTIR HCl results. Appendix C provides 1-minute averages for all target species. The measured HCl removal efficiency due to the baghouse was not statistically significant, assuming that the sample gas composition to the inlet of the scrubber did not change significantly during the outlet testing. Figures 2-1 and 2-2 show a real-time graph for the inlet and outlet runs, respectively.

Baghouse - Kiln #3, Outlet/Inlet HCl Results—Table 2-3 gives a summary of the Baghouse outlet/inlet FTIR HCl results. The measured HCl removal efficiency due to the Baghouse was 71.0 percent, assuming that the sample gas composition to the inlet of the scrubber did not change significantly during the outlet testing. Figures 2-3 and 2-4 show a real-time graph for the inlet and outlet runs, respectively.

Table 2-2. Wet Scrubber
Kiln #2, FTIR HCl Results, ppmv

	Run 1	
Date	**7/01/98**	
Time	**14:15 - 17:35**	
Location	**Inlet**	**Outlet**
Average	3.30	5.19
SD	2.14	4.23
Maximum	9.53	17.07
Minimum	0.83	0.90
NDP	74	89
RE	NC	

SD = Standard Deviation
NDP = Number of data points measured
RE = Removal Efficiency in percent: 100 X (Avg. inlet- Avg. outlet)/Avg. inlet
NC = Not Calculated due to the outlet being greater than the inlet value, however inlet and outlet levels are statistically equivalent, due to the level of standard deviation.
Note: = Raw data presented in Appendix C.

Table 2-3. Baghouse
Kiln #3, FTIR HCl Results, ppmv

	Run 1	
Date	**6/30/98**	
Time	**12:45 - 16:22**	
Location	**Inlet**	**Outlet**
Average	1.76	0.51
SD	3.97	1.27
Maximum	15.08	6.86
Minimum	< 0.15	< 0.15
NDP	80	110
RE	71.0	

SD = Standard Deviation
NDP = Number of data points measured
RE = Removal Efficiency in percent: 100 X (Avg. inlet- Avg. outlet)/Avg. inlet
Note = Raw data presented in Appendix C.

Figure 2-1. HCl Inlet Run - Austin White Wet Scrubber - Kiln #2

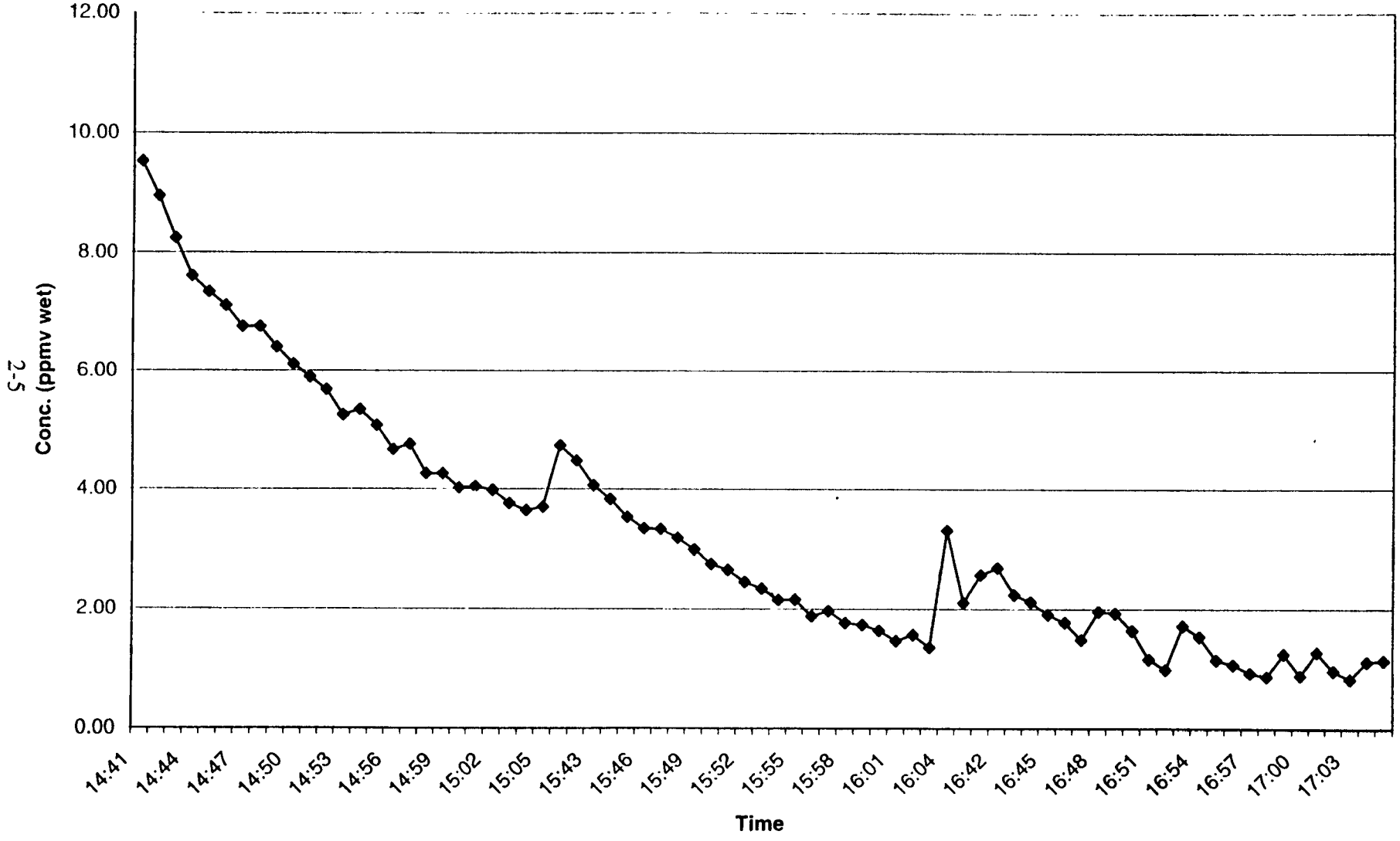


Figure 2-2. HCl Outlet Run - Austin White Wet Scrubber - Kiln #2

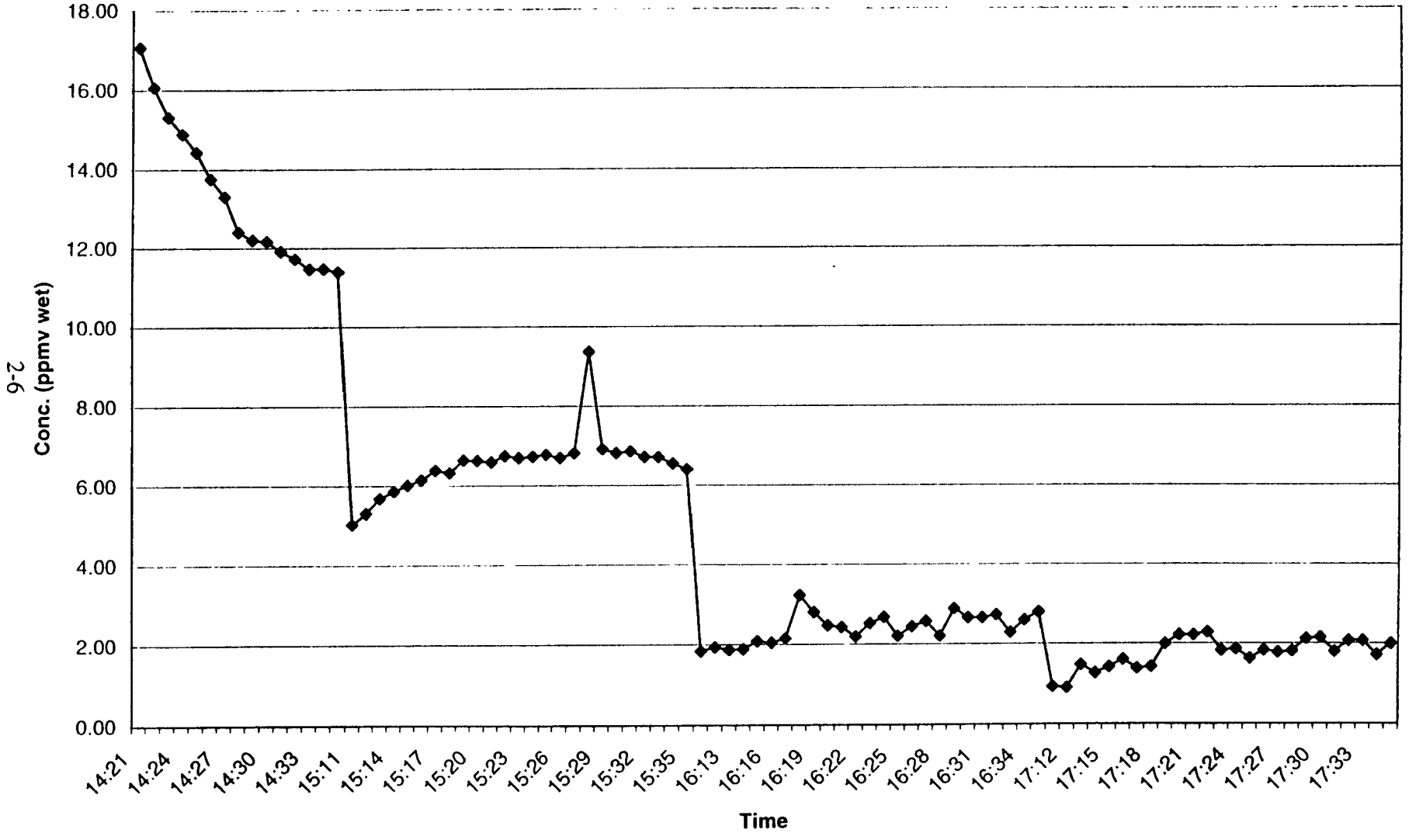


Figure 2-3. HCl Inlet Run - Austin White Baghouse - Kiln #3

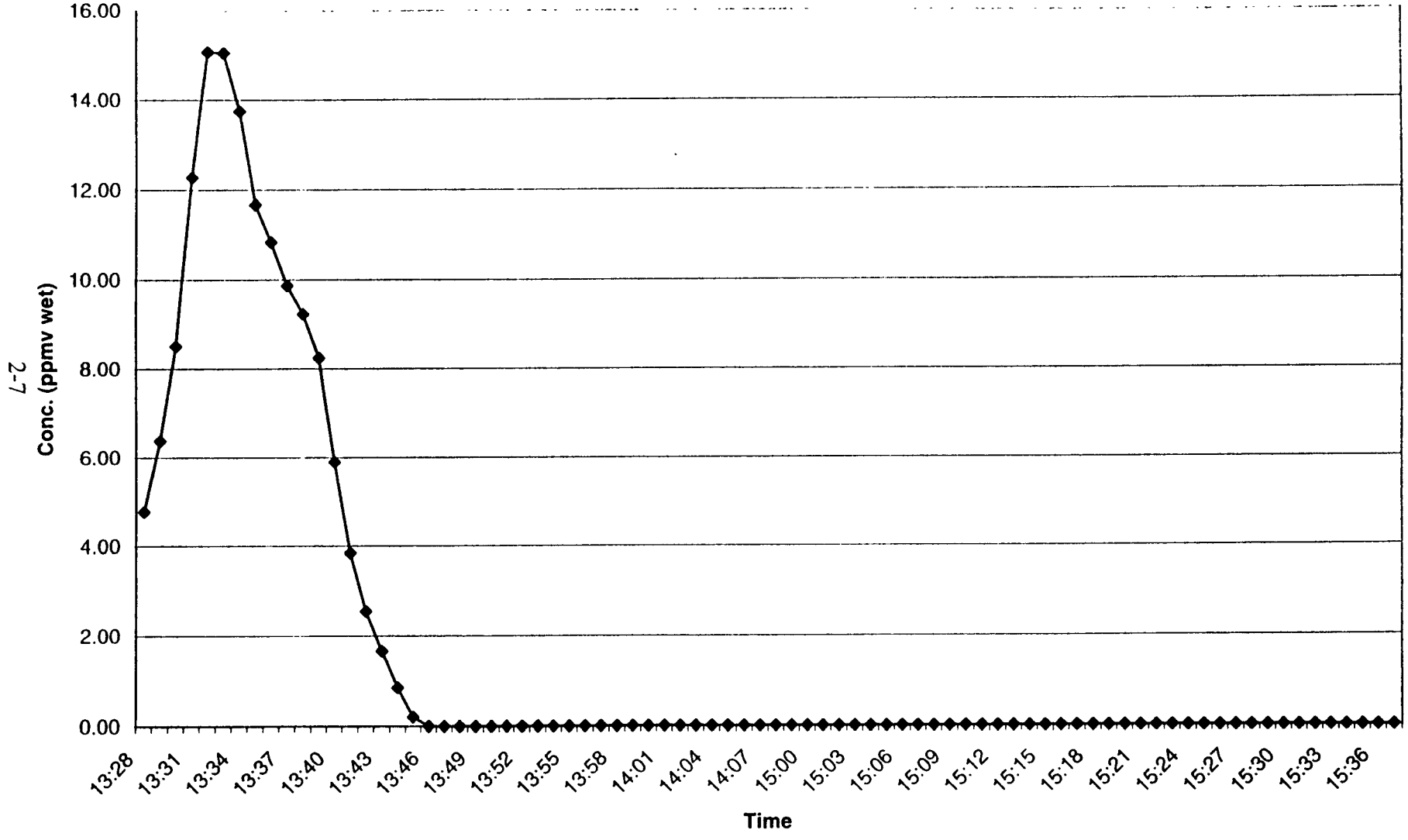
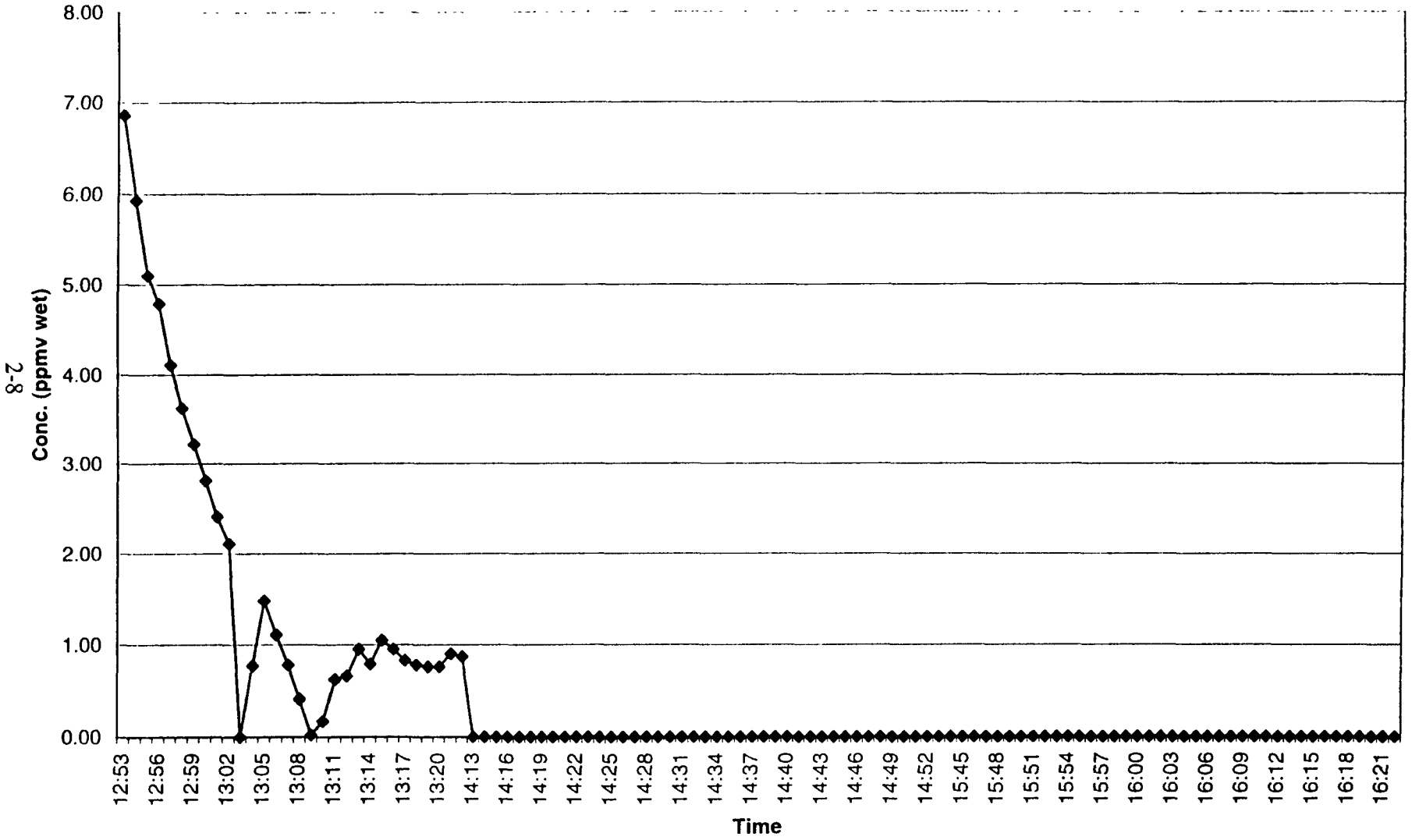


Figure 2-4. HCl Outlet Run - Austin White Baghouse - Kiln #3



2.2.2.2 Other Species Detected by FTIR. Other species were detected during the unconditioned and conditioned FTIR test runs. Species in Table 2-4 thorugh 2-7 indicated with a "U" were measured concurrently with HCl. Species in Table 2-4 through 2-7 indicated with a "C" were measured during the conditioned sample test run. Results given below were are organized by location.

Wet Scrubber - Kiln #2, Outlet/Inlet for Other Species Results—Table 2-4 and 2-5 gives the summary of the wet scrubber for the inlet and outlet FTIR results for other species found during the standard Draft Method 320 extractive analysis, respectively.

Baghouse - Kiln #3, Outlet/Inlet for Other Species Results—Table 2-6 and 2-7 respectively gives the summary of the baghouse for the inlet and outlet FTIR results for other species found during the standard Draft Method 320 extractive analysis.

Table 2-4. Other Species Detected by FTIR - Wet Scrubber - Kiln #2, Inlet

(all values are ppmv, except CO_2 and H_2O in percent)

Parameter	C_6H_6	C_2H_4	C_3H_6	CO_2	NH_3	CO	NO	H_2CO	C_4^+	H_2O
U/C	C	C	C	U	U	U	U	U	U	U
Average	0.89	2.68	1.66	13.3	2.17	131	133	2.03	1.73	21.5
Std. Dev.	0.07	0.12	0.24	1.65	2.22	5.79	14.4	0.13	0.11	2.46
Max.	1.09	2.85	2.07	16.0	7.04	141	159	2.39	1.91	25.6
Min.	0.76	2.27	1.05	11.7	< 0.32	119	104	1.66	1.46	19.3
NDP	25	25	25	89	89	89	89	89	89	89
EDL	0.16	0.11	0.32	0.057	0.32	0.66	7.6	0.10	0.30	0.13

U/C - Unconditioned (U) or Conditioned (C) Sample
C_4+ - Total aliphatic hydrocarbons larger than 3 carbons (ppmv hexane equivalent)
NDP - Number of data points; the total number for the inlet was 7 5-minute intervals, not the standard 1-minute intervals used during the unconditioned sampling.
EDL - Estimated detection limit for spectral region used for analysis
Std. Dev. = Standard Deviation
Max. = Maximum
Min. = Minimum
Note: Raw data presented in Appendix C.

Table 2-5. Other Species Detected by FTIR - Wet Scrubber - Kiln #2, Outlet

(All values are ppmv, except CO_2 and H_2O in percent)

Parameter	C_6H_6	C_2H_4	C_3H_6	CO_2	CO	NO	NH_3	H_2O
U/C	C	C	C	U	U	U	U	U
Average	0.44	1.64	0.94	12.4	66.1	125	0.59	35.1
Std. Dev.	0.09	0.07	0.22	1.31	2.78	15.7	1.05	3.73
Max.	0.63	1.82	1.43	14.3	71.0	152	4.72	39.6
Min.	0.31	1.46	0.56	11.0	62.2	95.3	< 0.47	30.7
NDP	25	25	25	89	89	89	89	89
EDL	0.16	0.11	0.32	0.085	0.79	7.2	0.47	0.22

U/C - Unconditioned (U) or Conditioned (C) Sample
NDP - Number of data points; the total number for the inlet was 7 5-minute intervals, not the standard 1-minute intervals used during the unconditioned sampling.
EDL - Estimated detection limit for spectral region used for analysis
Std. Dev. = Standard Deviation
Max. = Maximum
Min. = Minimum
Note: Raw data presented in Appendix C.

Table 2-6. Other Species Detected by FTIR - Baghouse - Kiln #3, Inlet

(All values are ppmv, except CO_2 and H_2O in percent)

Parameter	C_6H_6	C_2H_4	C_2H_2	CO_2	NH_3	CO	NO	H_2CO	C_4^+	H_2O
U/C	C	C	C	U	U	U	U	U	U	U
Average	0.77	2.05	0.23	14.8	7.40	<9.36	243	118	1.54	4.23
Std. Dev.	0.07	0.11	0.03	1.85	5.28	0.02	66.6	20.5	0.31	0.54
Max.	0.94	2.22	0.27	15.8	13.4	0.21	400	148	1.87	4.88
Min.	0.65	1.79	0.16	5.86	< 0.36	< 9.36	114	42.8	< 0.96	< 2.06
NDP	20	20	20	80	80	80	80	80	80	80
EDL	0.14	0.12	0.07	0.0657	0.36	9.36	2.52	8.64	0.96	2.06

U/C - Unconditioned (U) or Conditioned (C) Sample
C_4+ - Total aliphatic hydrocarbons larger than 3 carbons (ppmv hexane equivalent)
NDP - Number of data points; the total number for the inlet was 7 5-minute intervals, not the standard 1-minute intervals used during the unconditioned sampling.
EDL - Estimated detection limit for spectral region used for analysis
Std. Dev. = Standard Deviation
Max. = Maximum
Min. = Minimum
Note: Raw data presented in Appendix C.

Table 2-7. Other Species Detected by FTIR - Baghouse - Kiln #3, Outlet

All values are ppmv, except CO_2 and H_2O in percent

Parameter	C_6H_6	C_2H_4	C_2H_2	CO_2	CO	NO	NH_3	H_2CO	C_4^+	H_2O
U/C	C	C	C	U	U	U	U	U	U	U
Average	0.72	1.69	0.22	< 0.59	< 0.36	3.37	1.06	14 8	< 9.36	218
Std. Dev.	0.12	0.28	0.04	0.13	0.17	0 40	0.18	1.86	4.72	97.4
Max.	0.97	2.04	0.26	0.64	0.67	4.26	1.55	16.1	34.4	468
Min.	0.48	1.08	0.13	< 0.59	< 0.36	2.77	0.77	5.48	< 9.36	52.6
NDP	25	25	25	25	25	25	25	110	110	110
EDL	0.14	0.12	0.07	0.59	0.36	0.64	0.51	0.0658	9.36	2.52

U/C - Unconditioned (U) or Conditioned (C) Sample
C_4+ - Total aliphatic hydrocarbons larger than 3 carbons (ppmv hexane equivalent)
NDP - Number of data points; the total number for the inlet was 7 5-minute intervals, not the standard 1-minute intervals used during the unconditioned sampling.
EDL - Estimated detection limit for spectral region used for analysis
Std. Dev. = Standard Deviation
Max. = Maximum
Min. = Minimum

3.0 SAMPLING AND ANALYTICAL PROCEDURE

The sampling and analytical procedure used by ERG for the lime plant test program is extractive FTIR spectroscopy, conducted in accordance with EPA Draft Method 320. In this section, description of the FTIR method used is provided.

3.1 Determination of Gaseous Organic HAPs, HCl, and Criteria Pollutants by Fourier Transform Infrared Spectroscopy (FTIR)

The extractive FTIR measurement method is based on continuous extraction of sample gas from the stack, transporting the sample to the FTIR spectrometer and performing real-time spectral measurement of the sample gas. The sample gas spectra are analyzed in real time for target analytes, archived and possibly re-analyzed at a later date for other target analytes. This section provides details on the FTIR sampling and measurement system.

3.1.1 FTIR Sampling Equipment

The FTIR measurement system meets the sampling and analysis requirements set forth in EPA Draft Method 320, "Measurement of Vapor Phase Organic and Inorganic Emissions By Extractive Fourier Transform Infrared Spectroscopy." This system has been used with complete success with many source categories, and can also be adapted to switch quickly between two sources (i.e., inlet and outlet) with a single FTIR spectrometer.

The sampling and measurement system consists of the following components:

- Heated probe;
- Heated filter;
- Heat-traced Teflon® sample line;
- Teflon® diaphragm, heated-head sample pump;

- FTIR spectrometer;
- FTIR sample conditioning system; and
- QA/QC apparatus.

Figure 3-1 illustrates the extractive unconditioned FTIR sampling and measurement system. In operation at a stationary source, the sample is continuously extracted from the stack through the heated probe. Sample gas is then sent into a heated filter assembly that will remove any particulate matter from the sample stream to protect the remainder of the sampling and analysis system. The probe liner and filter body consist of glass, and the filter element is polytetrafluoroethylene (PTFE or Teflon®). In addition to providing an inert surface, the glass filter holder allows the operator to observe the filter loading during sampling operations. The probe and filter are contained in a heated box mounted on the stack and maintained at a temperature of 177° C (350° F). A second probe/filter, heat-traced sample line, and heated head pump used are not shown in Figure 3-1.

After passing through the filter assembly, a primary heat-traced PTFE sample line transports the sample gas to the FTIR spectrometer maintained at approximately 177° C (350° F) driven by a heated- head PTFE diaphragm sample pump maintained at approximately 204° C (400° F). The sampling flow rate through the probe, filter, and sampling line is a nominal 20 standard liters per minute (LPM). Sample gas then enters an atmospheric pressure heated PTFE distribution manifold where it is sent to the FTIR spectrometer via a slipstream flowing at 9 LPM. Other slipstreams can be sent to other instruments, if necessary. Excess sample gas not used by instruments is vented to atmosphere.

A secondary heated-head PTFE diaphragm sample pump takes FTIR spectrometer sample gas from the distribution manifold maintained at approximately 204° C (400° F) and directed into the FTIR sample cell maintained at 185° C (365° F) for real-time analysis. The cell consists of nickel-plated aluminum, with gold-plated glass substrate mirrors and potassium chloride windows. Exhaust gas from the cell is vented to the atmosphere.

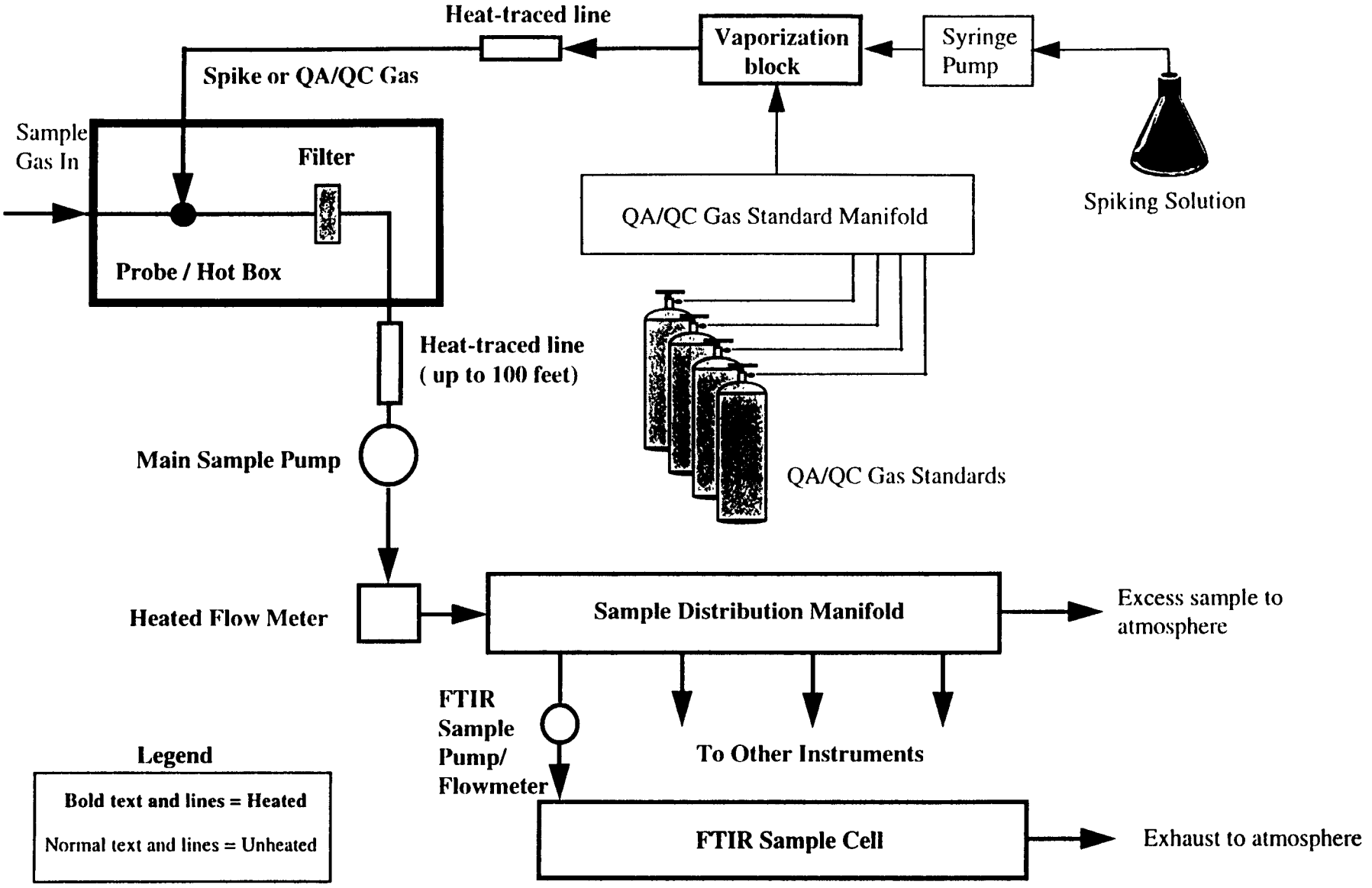


Figure 3-1. FTIR Sampling and Measurement System

Sample conditioning (when required) is achieved by passing raw sample gas through a PermaPure® dryer and a series of impingers filled with sodium (or lithium) hydroxide pellets. The PermaPure® drier selectively removes water vapor and the sodium hydroxide pellets remove CO_2 and other acid gases. The sample conditioning apparatus is switched into the FTIR sample path by a valving system. Lower detection limits for some compounds can be achieved with a conditioned sample.

3.1.2 Preparation for Sampling

Before commencement of daily sampling operations, the following tasks were carried out:

- System leak check;
- Measurement of FTIR background spectrum;
- Instrumental QC; and
- Sampling and measurement system QC spike run.

Detailed descriptions of these tasks are described in the paragraphs below.

The heated sampling lines, probes, and a heated filter were positioned at the inlet and outlet locations. All heated components were brought to operating temperature, and a leak check of both inlet and outlet sampling systems were performed. The leak check was performed by plugging the end of the probe and watching the main sample rotameter to observe the reading. Positive leak check was confirmed when the rotameter reading was zero.

A background spectrum was measured using zero nitrogen through the cell. Next the QC gases were measured. They agreed to within ±6 percent (±10 percent for HCl) of target value. The QC gases used for this program include:

- Halocarbon 22 (H22), used to calibrate the pathlength. Halocarbon 22 is used for its highly linear response due to the lack of sharp spectral features, and is an extremely stable compound.

- Carbon monoxide (CO) used for frequency calibration. Carbon monoxide is directly injected into the sample cell to measure photometric accuracy, validity of the non-linear correction algorithm and serve as a frequency (i.e., wavelength) calibration. Acceptable limits for CO standard analysis are ±6 percent of certified concentration;

- Methane/nitric oxide/carbon dioxide mixture, used for overall system performance check (calibration transfer standard) (acceptance limits are ±6 percent of the certified concentration); and

- Hydrogen chloride standard, analyzed to verify the instrumental response of HCl, a key target analyte (acceptance limits are ±10 percent of certified concentration).

The sampling and measurement system spike test was done to perform validation and directly challenge the complete system and provide information on system accuracy and bias. This test is conducted to satisfy the requirements set in EPA Draft Method 320 entitled "Measurement of Vapor Phase Organic and Inorganic Emissions By Extractive Fourier Transform Infrared Spectroscopy." Section B.1.C of Draft Method 320 gives a description of the dynamic spiking apparatus.

The following FTIR spiking procedure was used:

- Measured native stack gas until system equilibrates - took two measurements (i.e., two, 1 minute samples);

- Started spike gas flow into sample stream, upstream of the heated filter;

- Let system equilibrate;

- Measured spiked sample stream for 2 minutes (i.e., two, 1 minute samples);

- Turned off spike gas flow;

- Let system equilibrate with native stack gas; and

- Repeated cycle, two more times.

The above procedure produced six spiked/unspiked sample pairs. Spike recovery for six spiked/unspiked sample pairs were computed from the procedure given in Section 8.6.2 of EPA Draft Method 320. The recovery was between 70-130 percent and allowed the system to be considered acceptable for testing.

3.1.3 Sampling and Analysis

FTIR unconditioned sampling was performed simultaneously with the manual testing. The start and stop times of the manual methods were coordinated with the FTIR operator, so that FTIR data files can be coordinated with manual method start and stop times. FTIR inlet/outlet sampling was accomplished using two heated transfer lines, and a valving system to switch from inlet to outlet and vice versa.

Table 3-1 gives typical FTIR operating conditions. These parameters provide detection limits of 0.1-1 ppm for typical FTIR analytes, while providing adequate dynamic range (nominally 1-1,000 ppm). Some of these parameters are sample matrix dependent.

Table 3-1. Typical FTIR Operating Parameters

Parameter	Value
Spectral Range (cm^{-1})	400 - 4,000
Spectral Resolution (cm^{-1})	0.5
Optical Cell Pathlength (m)	3.4
Optical Cell Temperature (° C)	185
Sample Flow Rate (liters/minute)	9 (3.0 optical cell volumes/minute)
Integration Time (minutes)	1 (Average of 43 spectra)

Sample flow rate was determined by the data averaging interval and FTIR spectrometer sample cell volume. A minimum of three sample cell volumes of gas must flow through the

system to provide a representative sample during a single integration period. Typically, a 1 minute averaging period with a 3 liter volume sample cell gives a minimum flow rate of 9 LPM. Typically a flow rate of 20 standard LPM is used to accommodate the FTIR and other instrumentation on-site, and to minimize sample residence time in the sampling system.

The temperature of all sampling system components were at a minimum of 177°C (350 °F) to prevent condensation of water vapor or other analytes in the sampling system. Actual sampling system operating temperatures were determined before the start of testing. The FTIR sample cell temperature was maintained at 365° F (185° C) to minimize condensation of high-boiling point analytes on the cell optics.

FTIR sample cell pressure was monitored in real-time to calculate analyte concentration in parts-per-million. The cell was normally operated near atmospheric pressure with the cell pressure continuously monitored.

Sampling probe location was determined by the requirements set in EPA Method 1 in terms of duct diameters upstream and downstream of disturbances. Concurrent EPA Method 2 velocity measurements were not carried out at the same process stream location as the FTIR sampling point to provide mass emission rate determination. The stack gas velocity and flow rate were determined by the applicable manual test methods performed by PES. Velocity information can be found from the report prepared by PES.

Sampling and analysis procedures are straightforward for a single-source measurement. Once QA/QC procedures were completed at the beginning of the test day, the sample was allowed to flow continuously through the FTIR spectrometer cell and the software was instructed to start spectral data collection. The spectrometer collected one interferogram per second and averaged a number of interferograms to form a time-integrated interferogram. The typical averaging times range was approximately 1 minute. The interferogram was converted into a spectrum and analyzed for the target analytes. After spectral analysis, the spectrum was stored on the computer and later permanently archived. Spectral data collection was stopped after a

predetermined time, corresponding to a "run." Typical runs were approximately 3 hours long, giving approximately 180 1-minute average data points for each target analyte. The figure of 180 points were reduced by approximately 120 points due to elimination of data points per switch between inlet/outlet samples and vice versa. At the end of the test day, the end-of-day QA/QC procedures were conducted.

Before any testing was started at a given site, an initial "snapshot" of the stack gas was taken with the FTIR measurement and analysis system to determine the true sample matrix. Because sample conditioning was required for certain analytes, the FTIR spectrometer analyzed these compounds after the unconditioned analysis. The order used during this program is shown in the table below.

Sampling Conditions	Sampling Time	Inlet	Outlet
Unconditioned	Synchronized with dioxin sampling	5 minute cell purge and 25 minute sample collection	5 minute cell purge and 15 or 25 minute sample collection
Conditioned	1 hour (after completion of dioxin run)	2 minute cell purge and 28 minute sample collection	2 minute cell purge and 28 minute sample collection

The sample being delivered to the FTIR cell alternated between the inlet and the outlet. The switching valve, located just upstream of the common manifold, was manually activated periodically to provide alternating inlet and outlet sample collections during each three-hour period (the estimated dioxin run duration). This procedure resulted in a set of data points collected for the inlet and outlet, respectively. Five data points per set are discarded to eliminate analysis results with combined inlet and outlet samples.

FTIR method performance was gauged from the results of the QA/QC procedures given in Section B5 of EPA Draft Method 320. Acceptable spiking tests met acceptance for accuracy within ± 30 percent. The acceptable instrument diagnostic and system response checked

accuracy to be within ± 6 percent of target for all gas standards, and ± 10 percent for the HCl standards. Acceptable system response check precision was 6 percent RSD.

Quantitative analysis was performed by a mathematical method called multi-variate least squares (commonly known as Classical Least Squares or CLS). CLS constructs an optimized linear combination (or 'fit') of the reference spectra to duplicate the sample spectrum, utilizing the Beer-Lambert Law. The Beer-Lambert Law states that the absorbance of a particular spectral feature due to a single analyte is proportional to its concentration. This relationship is the basis of FTIR quantitative analysis. The coefficients of each compound in the linear fit yield the concentration of that compound. If it is found that the quantitative analysis of a given compound responds non-linearly to concentration, a calibration curve is developed by measuring a series of reference spectra with differing optical depths (concentration times pathlength) and using them in the linear fit. Low molecular weight species such as water vapor and carbon monoxide require nonlinear correction, possibly even at levels as low as 100 ppm-meters (concentration times pathlength). Analytes greater than 50-60 amu molecular weight usually does not require nonlinear corrections. An experienced spectroscopist can determine whether nonlinear corrections are necessary for an analyte in a given source testing scenario.

The ERG validated spectral database includes the compounds shown in Table 3-2. These spectra were validated in the laboratory at a cell temperature of 185° C against certified gaseous standards. Any compounds identified in the stack gas and not included in the ERG database can be quantified if necessary after subsequent laboratory reference spectrum generation.

3.1.4 FTIR Method Data Review Procedures

The following procedure was conducted to review and validate the FTIR data.

Table 3-2. Compounds for Which Reference FTIR Spectra Are Available in the ERG Spectral Library[a]

1-butene	chlorobenzene	*n*-butanol
1,3-butadiene	*cis*-2-butene	*n*-butane
2-methylpropane	cyclohexane	*n*-pentane
2-propanol	cyclopentane	nitric oxide
2-methoxyethanol	cyclopropane	nitrogen dioxide
2-methyl-2-propanol	ethane	nitrous oxide
2-methylbutane	ethylbenzene	*o*-cresol
4-vinylcyclohexane	ethylene	*o*-xylene
acetaldehyde	formaldehyde	*p*-cresol
acetic acid	hydrogen fluoride	*p*-xylene
acetone	hydrogen chloride	phenol
acetylene	isobutylene	propane
acrolein	*m*-xylene	propylene
ammonia	*m*-cresol	styrene
benzene	methane	sulfur dioxide
carbon monoxide	methanol	toluene
carbon dioxide	methyl ethyl ketone	*trans*-2-butene
carbonyl sulfide	methylene chloride	water vapor

[a] Spectra were collected at a cell temperature of 185° C.

A. Post-test Data Review procedure (on-site)

1. Examine the concentration vs. time series plot for each compound of interest, and identify regions with the following characteristics:

   - sudden change in concentration;
   - unrealistic concentration values;
   - significant changes in 95 percent confidence intervals reported by software; and
   - sudden increase of noise in data.

2. Select representative spectra from the time periods indicated from Step 1.

3. Subtract from each representative spectrum chosen in Step 2 a spectrum taken immediately prior in time to the indicated time region.

4. Manually quantitate (including any nonlinear corrections) for the species in question and compare the result with the difference in software-computed concentrations for respective spectra.

5. If concentration values in Step 4 do not agree to within 5 percent, determine whether the difference is due to a recoverable or non-recoverable error.

6 (i). If the error is non-recoverable, the spectra in the indicated time region are declared invalid.

7 (ii). If the error is recoverable, and time permits, determine possible source(s) of error and attempt to correct. If time is critical, proceed with measurement. If correction is achieved, conduct QA/QC checks before continuing.

8. Determine the peak-to-peak scatter or the root mean square (RMS) noise-equivalent-absorbance (NEA) for the representative spectra.

9. If the NEA exceeds the limits required for acceptable detection limits, the spectra in the time region are declared invalid (due to non-recoverable error).

10. Data found invalid are subject to re-measurement.

B. Final Data Review (off-site)

The procedures for final data review include those given above; however, if a non-recoverable error was found during this phase, the data are considered invalid. In addition, the following procedures are carried out by the spectroscopist to perform a final data validation:

1. If any recoverable data errors are detected from the procedure, determine the cause and perform any necessary corrections.

2. For analytes that were not detected or detected at low levels:
   - estimate detection limits from validated data;
   - check for measurement bias.

3. Verify spreadsheet calculations by independent calculation (results in Appendix A).

3.1.5 FTIR QA/QC Procedures

The FTIR QA/QC apparatus will be used to perform two functions:

- Dynamic analyte spiking; and
- Instrumental performance checks.

Dynamic analyte spiking was used for quality control/quality assurance of the complete sampling and analysis system. Dynamic spiking is continuous spiking of the sample gas to provide information on system response, sample matrix effects, and potential sampling system biases. Spiking is accomplished by either:

- Direct introduction of a certified gas standard; or
- Volatilization of a spiking solution.

Certified gas standards are preferred due to simplicity of use, but many target analytes cannot be obtained as certified gas standards, and must be spiked using standards generated by volatilized solutions.

Gaseous spiking is carried out by metering the spike gas into the sample stream at a known rate. Spike levels are calculated from mass balance principles. When certified gas standards are used, a dilution tracer, such as sulfur hexafluoride, is used to directly measure the fraction of spike gas spiked into the sample. This technique can be used instead of mass balance calculations.

FTIR method performance is gauged from the results of the QA/QC. Acceptable spiking tests will meet Draft Method 320 criteria (i.e., accuracy of within ± 30 percent) or a statistical equivalent when less than 12 spiked/unspiked pairs are collected. The EPA Draft Method 320 instructs the user to determine the percent spike recovery of three pairs of spiked/unspiked samples. The EPA Draft Method 320 acceptance criterion is 70 to 130 percent recovery for the three pairs of samples. The acceptable instrument diagnostic and system response check accuracy were within ± 6 percent of target (±10 percent for HCl standards). Acceptable system response check precision was 6 percent RSD.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

Specific QA/QC procedures were strictly followed during this test program to ensure the production of useful and valid data throughout the course of the project. A detailed presentation of QC procedures for all sampling and analysis activities can be found in the Site Specific Test Plan and Quality Assurance Project Plan for this project. This section reports all QC results so that the data quality can be ascertained.

In summary, a high degree of data quality was maintained throughout the project. All sampling system leak checks met the QC criteria as specified in Draft Method 320. Acceptable spike recoveries and close agreement between duplicate analyses were shown for the sample analyses. The data completeness was 100 percent, based on changes authorized by the Work Assignment Manager.

4.1 FTIR Analytical Quality Control

Dynamic analyte spiking was used for quality control/quality assurance of the complete sampling and analysis system. Dynamic spiking is continuous spiking of the sample gas to provide information on system response, sample matrix effects, and potential sampling system biases. Spiking was accomplished by direct introduction of a certified gas standard.

Gaseous spiking was carried out by metering the spike gas into the sample stream at a known rate. A sulfur hexafluoride dilution tracer was used to directly measure the fraction of spike gas spiked into the sample. The EPA Draft Method 320 limits the dilution of the sample gas to 10 percent.

Before any testing was started at a given site, an initial "snapshot" of the stack gas is taken with the FTIR measurement and analysis system to determine the true sample matrix. If any target analytes are present at significantly higher levels than expected, adjustments were

made to the cell pathlength and/or the spectral analysis regions used for quantitative analysis. These adjustments minimized interferences due to unexpectedly high levels of detected analytes.

FTIR method performance is gauged from the results of the QA/QC. All spiking tests met Draft Method 320 criteria. The acceptable instrument diagnostic and system response check accuracy should be within ± 6 percent of target for all gas standards except HCl. The accuracy for the HCl standard should be within ±10 percent.

Analytical QC checks for the FTIR system consisted of the following:

- Dynamic spiking of HCl;
- Direct measurement of a HCl gas standard;
- Direct measurement of a CO gas standard;
- Direct measurement of a methane (CH_4), nitrous oxide (NO_2), and carbon dioxides (CO_2) standard; and
- Pathlength calibration using halocarbon 22 (H22).

Dynamic spiking runs were conducted twice daily: before and after testing. Six spiked/unspiked data points were collected. Statistical calculations consistent with EPA Method 301 were performed on the data. Recovery of 70-130 percent was the acceptance criteria. Table 4-1 through 4-4 summarize the dynamic spiking results. All dynamic spiking tests met the above acceptance criteria. In all runs, sample gas was diluted 10 percent or less.

Direct instrumental measurement of HCl, CO, H22, and a CH_4, NO_2 and CO_2 mixture was conducted before and after daily testing activities. Acceptance criteria are normally ±6 percent of target, using EPA protocol gases. However, since the HCl standard was obtained at a ±5 percent analytical tolerance, the acceptance criteria was set at ±10 percent. FTIR NO_x is measured as NO + NO_2. Examination of Table 4-5 shows that all QC checks met the above criteria.

Table 4-1. HCl QA Spike Run 1 Results - Wet Scrubber
Austin White Lime Company

Outlet							
Spike Run Number	Lowest Unspiked Value (ppmv)	Spiked (ppmv)	Corrected Difference (ppmv)	Spike Level (ppmv)	% Recovery	SF6 Conc. (ppmv)	Dilution Ratio
1	6.54	153.63	147.74	149.00		0.048	0.100
2	6.41	164.74	158.97	149.00		0.048	0.100
3	6.37	167.84	162.11	149.00		0.048	0.100
4	6.40	176.16	170.40	149.00		0.048	0.100
5	6.60	214.76	208.82	149.00		0.048	0.100
6	6.94	172.64	166.39	149.00		0.048	0.100
Average	**6.54**	**174.96**	**169.07**	**149.00**	**113.47**	**0.048**	**0.100**
Inlet							
Spike Run Number	**Lowest Unspiked Value (ppmv)**	**Spiked (ppmv)**	**Corrected Difference (ppmv)**	**Spike Level (ppmv)**	**% Recovery**	**SF6 Conc. (ppmv)**	**Dilution Ratio**
1	64.44	180.38	121.42	126.65		0.041	0.085
2	58.23	183.70	130.42	126.65		0.041	0.085
3	53.16	185.71	137.07	126.65		0.041	0.085
4	48.44	188.18	143.86	126.65		0.041	0.085
5	54.97	229.33	179.03	126.65		0.041	0.085
6	71.11	164.38	99.31	126.65		0.041	0.085
Average	**58.39**	**188.61**	**135.18**	**126.65**	**106.74**	**0.041**	**0.085**

NOTE: The spike runs were conducted before and after the test runs, therefore the minimum and maximum values listed here may be different than those listed in the test runs, Section 2. Sample gas dilution was held to 10 percent or less in all runs. Percent recovery is defined in Draft Method 320.

(Stock spike gas values for HCl and SF6 values are 253 ppmv and 5.08 ppmv, respectively).

$$\% \text{ Recovery} = 100 \times \frac{\text{Corrected Difference}}{\text{Spike level}}$$

Corrected Difference = Spiked - (1 - Dilution Ratio) X Unspiked

Table 4-2. HCl QA Spike Run 2 Results - Wet Scrubber
Austin White Lime Company

Outlet

Spike Run Number	Lowest Unspiked Value (ppmv)	Spiked (ppmv)	Corrected Difference (ppmv)	Spike Level (ppmv)	% Recovery	SF6 Conc. (ppmv)	Dilution Ratio
1	3.15	140.24	137.41	148.00		0.209	0.100
2	3.00	150.37	147.67	148.00		0.209	0.100
3	3.03	154.83	152.10	148.00		0.209	0.100
4	3.04	159.17	156.43	148.00		0.209	0.100
5	2.87	164.67	162.09	148.00		0.209	0.100
6	3.38	165.42	162.38	148.00		0.209	0.100
Average	**3.08**	**155.78**	**153.01**	**148.00**	**103.39**	**0.209**	**0.100**

Inlet

Spike Run Number	**Lowest Unspiked Value (ppmv)**	**Spiked (ppmv)**	**Corrected Difference (ppmv)**	**Spike Level (ppmv)**	**% Recovery**	**SF6 Conc. (ppmv)**	**Dilution Ratio**
1	163.62	203.47	46.11	59.20		0.084	0.040
2	164.47	207.26	49.37	59.20		0.084	0.040
3	144.88	223.18	84.10	59.20		0.084	0.040
4	145.78	223.95	84.00	59.20		0.084	0.040
5	140.24	170.32	35.69	59.20		0.084	0.040
6	150.37	169.33	24.97	59.20		0.084	0.040
Average	**151.61**	**199.59**	**54.04**	**59.20**	**91.28**	**0.084**	**0.040**

NOTE: The spike runs were conducted before and after the test runs, therefore the minimum and maximum values listed here may be different than those listed in the test runs. Section 2. Sample gas dilution was held to 10 percent or less in all runs. Percent recovery is defined in Draft Method 320.

(Stock spike gas values for HCl and SF6 values are 253 ppmv and 5.08 ppmv, respectively).

$$\% \text{ Recovery} = 100 \times \frac{\text{Corrected Difference}}{\text{Spike level}}$$

Corrected Difference = Spiked - (1 - Dilution Ratio) X Unspiked

Table 4-3. HCl QA Spike Run 1 Results - Baghouse
Austin White Lime Company

Outlet							
Spike Run Number	Lowest Unspiked Value (ppmv)	Spiked (ppmv)	Corrected Difference (ppmv)	Spike Level (ppmv)	% Recovery	SF6 Conc. (ppmv)	Dilution Ratio
1	6.53	35.90	29.75	30.41		0.300	0.059
2	6.56	39.89	33.72	30.41		0.340	0.059
3	6.32	42.64	36.69	30.41		0.350	0.059
4	5.88	43.45	37.92	30.41		0.360	0.059
5	5.55	45.12	39.90	30.41		0.370	0.059
6	5.27	45.70	40.74	30.41		0.370	0.059
Average	**6.02**	**42.12**	**36.45**	**30.41**	**119.86**	**0.348**	**0.059**

Inlet							
Spike Run Number	**Lowest Unspiked Value (ppmv)**	**Spiked (ppmv)**	**Corrected Difference (ppmv)**	**Spike Level (ppmv)**	**% Recovery**	**SF6 Conc. (ppmv)**	**Dilution Ratio**
1	9.56	14.46	6.96	11.69		0.450	0.215
2	9.07	15.63	8.51	11.69		0.450	0.215
3	9.29	17.93	10.64	11.69		0.440	0.215
4	8.50	19.60	12.93	11.69		0.440	0.215
5	7.88	20.95	14.77	11.69		0.430	0.215
6	7.29	21.02	15.30	11.69		0.430	0.215
Average	**8.60**	**18.27**	**11.52**	**11.69**	**98.52**	**0.440**	**0.215**

NOTE: The spike runs were conducted before and after the test runs, therefore the minimum and maximum values listed here may be different than those listed in the test runs, Section 2. Sample gas dilution was held to 10 percent or less in all runs. Percent recovery is defined in Draft Method 320.

(Stock spike gas values for HCl and SF6 values are 253 ppmv and 5.08 ppmv, respectively).

$$\% \text{ Recovery} = 100 \times \frac{\text{Corrected Difference}}{\text{Spike level}}$$

Corrected Difference = Spiked - (1 - Dilution Ratio) X Unspiked

Table 4-4. HCl QA Spike Run 2 Results - Baghouse
Austin White Lime Company

Outlet							
Spike Run Number	Lowest Unspiked Value (ppmv)	Spiked (ppmv)	Corrected Difference (ppmv)	Spike Level (ppmv)	% Recovery	SF6 Conc. (ppmv)	Dilution Ratio
1	4.24	17.34	13.37	15.94		0.320	0.063
2	4.27	17.97	13.97	15.94		0.320	0.063
3	4.23	18.06	14.10	15.94		0.320	0.063
4	4.39	18.25	14.14	15.94		0.310	0.063
5	4.03	18.31	14.53	15.94		0.310	0.063
6	4.73	18.59	14.16	15.94		0.310	0.063
Average	**4.32**	**18.09**	**14.04**	**15.94**	**88.12**	**0.315**	**0.063**

Inlet							
Spike Run Number	**Lowest Unspiked Value (ppmv)**	**Spiked (ppmv)**	**Corrected Difference (ppmv)**	**Spike Level (ppmv)**	**% Recovery**	**SF6 Conc. (ppmv)**	**Dilution Ratio**
1	17.50	40.32	24.58	25.40		0.510	0.100
2	18.79	43.54	26.64	25.40		0.510	0.100
3	19.81	45.06	27.24	25.40		0.520	0.100
4	20.59	46.50	27.98	25.40		0.520	0.100
5	21.24	46.98	27.87	25.40		0.520	0.100
6	21.12	48.13	29.13	25.40		0.520	0.100
Average	**19.84**	**45.09**	**27.24**	**25.40**	**107.24**	**0.517**	**0.100**

NOTE: The spike runs were conducted before and after the test runs, therefore the minimum and maximum values listed here may be different than those listed in the test runs, Section 2. Sample gas dilution was held to 10 percent or less in all runs. Percent recovery is defined in Draft Method 320.

(Stock spike gas values for HCl and SF6 values are 253 ppmv and 5.08 ppmv, respectively).

$$\% \text{ Recovery} = 100 \times \frac{\text{Corrected Difference}}{\text{Spike level}}$$

Corrected Difference = Spiked - (1 - Dilution Ratio) X Unspiked

Table 4-5. Gas Standard Analysis Results

Date	Time	Compound	True (ppm)*	Result (ppm)*	% Recovery
6/30/98	08:35 AM	HCl	253	248.2	98.1
		CO	102.3	102.3	100
		CH_4	491	489.4	99.7
		NO	503	501.9	99.8
		CO_2	4.99 %	4.95 %	99.2
		H22		3.40 m	
6/30/98	06:36 PM	HCl	253	245.4	97.0
		CO	102.3	102.4	100.1
		CH_4	491	491.2	100
		NO	503	503.2	100
		CO_2	4.99 %	4.97 %	99.6
		H22		3.38 m	
7/01/98	08:28 AM	HCl	253	251.1	99.2
		CO	102.3	100.2	100.2
		CH_4	491	490.4	99.9
		NO	503	505.4	100.5
		CO_2	4.99 %	5.07 %	101.6
			3.40 m	3.41 m	
7/01/98	08:33 PM	HCl	253	249.1	98.4
		CO	102.3	100.4	98.1
		CH_4	491	493.3	100.5
		NO	503	493.2	98.0
		CO_2	4.99 %	4.99 %	100
		H22		3.28 m	

HCl Gas Standard Accuracy: ±5 percent; Acceptance Criteria: ±10 percent of target.
CO Gas Standard Accuracy: ±1 percent; Acceptance Criteria: ±6 percent of target.
CH_4, NO_2, and CO_2 Gas Standard Accuracy; ±1 percent; Acceptance Criteria: ±6 percent of target.
* All compounds are recorded in ppm except for CO_2 in percent (%), and H22 in meters (m).
The Halocarbon 22 (H22) is used to calibrate the pathlength.

APPENDIX A

FTIR DATA SPREADSHEET CALCULATION
QA/QC SHEETS

FTIR QA/QC REVIEW
Calculation and Methodology QA/QC Checklist

- For each facility tested, the reviewer will have:
    1. Excel QA/QC workbook
    2. Inlet and Outlet QA/QC information

Facility Name: Austin White	**DATE:** JUL-01-98
Source Location (INLET or OUTLET) OUTLET	**TIME:** 19:26:02
Run Description Combined Outlet Kiln 2 Run 01	
Reviewer: M.D. BRYANT	**Date:** DEC-4-98

Checklist	Yes	No	N/A	Not det.*	Resolution
A. QA/QC entries match references values Check the following by comparing the printout of the QA/QC run to the original run information.					
1. Pollutants matches pollutants in both the original and QA/QC data	✓				
2. Times for Inlet/Outlet samples match.	✓				
3. Number of data points match.	✓				
4. Column statistics match (i.e., Average, Standard Deviation, Maximum, Minimum)	✓				
5. Verify that the QA/QC value is zero. This indicated that both the original and the QA/QC values are identical.	✓				
B. Check that calculations are correct					
1. No mathematical errors	✓				
2. No errors in the data macro	✓				
C. Comments					
1.					
2.					

* Not able to determine

FTIR QA/QC REVIEW
Calculation and Methodology QA/QC Checklist

- For each facility tested, the reviewer will have:
    1. Excel QA/QC workbook
    2. Inlet and Outlet QA/QC information

Facility Name: Austin White	**DATE:** JUL-01-98
Source Location (INLET or OUTLET) Inlet	**TIME:** 1926:02
Run Description Conditioned Inlet Kiln 2 Run 01	
Reviewer: M. D. BRYANT	**Date:** Dec-4-98

Checklist	Yes	No	N/A	Not* det.	Resolution
A. QA/QC entries match references values. Check the following by comparing the printout of the QA/QC run to the original run information.					
1. Pollutants matches pollutants in both the original and QA/QC data	✓				
2. Times for Inlet/Outlet samples match.	✓				
3. Number of data points match.	✓				
4. Column statistics match (i.e., Average, Standard Deviation, Maximum, Minimum)	✓				
5. Verify that the QA/QC value is zero. This indicated that both the original and the QA/QC values are identical.	✓				
B. Check that calculations are correct					
1. No mathematical errors	✓				
2. No errors in the data macro	✓				
C. Comments					
1.					
2.					

* Not able to determine

FTIR QA/QC REVIEW
Calculation and Methodology QA/QC Checklist

- For each facility tested, the reviewer will have:
  1. Excel QA/QC workbook
  2. Inlet and Outlet QA/QC information

Facility Name: Austin White	**DATE:** JUNE-30-98
Source Location (INLET or OUTLET) OUTLET MB INLET	**TIME:** 19:36:11
Run Description Conditioned INLET Kiln 3 Run 01	
Reviewer: M.D. BRYANT	**Date:** DEC-4-98

Checklist	Yes	No	N/A	Not det.*	Resolution
A. QA/QC entries match references values. Check the following by comparing the printout of the QA/QC run to the original run information.					
1. Pollutants matches pollutants in both the original and QA/QC data	✓				
2. Times for Inlet/Outlet samples match.	✓				
3. Number of data points match.	✓				
4. Column statistics match (i.e., Average, Standard Deviation, Maximum, Minimum)	✓				
5. Verify that the QA/QC value is zero. This indicated that both the original and the QA/QC values are identical.	✓				
B. Check that calculations are correct					
1. No mathematical errors	✓				
2. No errors in the data macro	✓				
C. Comments					
1.					
2.					

* Not able to determine

FTIR QA/QC REVIEW
Calculation and Methodology QA/QC Checklist

- For each facility tested, the reviewer will have:
    1. Excel QA/QC workbook
    2. Inlet and Outlet QA/QC information

Facility Name: Austin White	**DATE:** June-30-98
Source Location (INLET or OUTLET) OUTLET	**TIME:** 17:31
Run Description Conditioned Outlet Kiln 3 Run 01	
Reviewer: M.D. Bryant	**Date:** Dec-4-98

Checklist	Yes	No	N/A	Not det.*	Resolution
A. QA/QC entries match references values Check the following by comparing the printout of the QA/QC run to the original run information:					
1. Pollutants matches pollutants in both the original and QA/QC data	✓				
2. Times for Inlet/Outlet samples match.	✓				
3. Number of data points match.	✓				
4. Column statistics match (i.e., Average, Standard Deviation, Maximum, Minimum)	✓				
5. Verify that the QA/QC value is zero. This indicated that both the original and the QA/QC values are identical.	✓				
B. Check that calculations are correct					
1. No mathematical errors	✓				
2. No errors in the data macro	✓				
C. Comments					
1.					
2.					

* Not able to determine

FTIR QA/QC REVIEW
Calculation and Methodology QA/QC Checklist

- For each facility tested, the reviewer will have:
  1. Excel QA/QC workbook
  2. Inlet and Outlet QA/QC information

Facility Name: Austin White	**DATE:** JULY-01-98
Source Location (INLET or OUTLET) OUTLET	**TIME:** 14:15:07
Run Description Run #2 OUTLET Unconditioned	
Reviewer: M.D. BRYANT	**Date:** Dec-4-98

Checklist	Yes	No	N/A	Not det.	Resolution
A. QA/QC entries match references values Check the following by comparing the printout of the QA/QC run to the original run information:					
1. Pollutants matches pollutants in both the original and QA/QC data	✓				
2. Times for Inlet/Outlet samples match.	✓				
3. Number of data points match. 90/90	✓				
4. Column statistics match (i.e., Average. Standard Deviation, Maximum, Minimum)	✓				
5. Verify that the QA/QC value is zero. This indicated that both the original and the QA/QC values are identical.	✓				
B. Check that calculations are correct					
1. No mathematical errors	✓				
2. No errors in the data macro	✓				
C. Comments					
1. All data is identical	✓				M.D. 12/4 KB
2. File NAME is →	✓				AUSTW02.XLS

* Not able to determine

FTIR QA/QC REVIEW
Calculation and Methodology QA/QC Checklist

- For each facility tested, the reviewer will have:
  1. Excel QA/QC workbook
  2. Inlet and Outlet QA/QC information

Facility Name: Austin White	**DATE:** JULY-9-98
Source Location (INLET or OUTLET) ~~OUTLET~~ INLET	**TIME:** 14:15:07
Run Description RUN #2 ~~OUTLET~~ INLET Undoctane!	
Reviewer: M.D. BRYANT	**Date:**

Checklist	Yes	No	N/A	Not det.*	Resolution
A. QA/QC entries match references values Check the following by comparing the printout of the QA/QC run to the original run information:					
1. Pollutants matches pollutants in both the original and QA/QC data	✓				
2. Times for Inlet/Outlet samples match.	✓				
3. Number of data points match. 95/95	✓				
4. Column statistics match (i.e., Average. Standard Deviation, Maximum, Minimum)	✓				
5. Verify that the QA/QC value is zero. This indicated that both the original and the QA/QC values are identical.	✓				
B. Check that calculations are correct					
1. No mathematical errors	✓				
2. No errors in the data macro	✓				
C. Comments					
1. All data is identical	✓				M.D. 12/4/98
2. File Name is	✓				AUSTIN02.XLS

* Not able to determine

APPENDIX B

GAS CYLINDER CERTIFICATION SHEETS

REC'D AUG 14 1998

SPECTRA GASES
3434 Route 22 West • Branchburg, NJ 08876 USA Tel: (908) 252-9300 • (800) 932-0624 • Fax: (908) 252-0811

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO: Eastern Research Group Inc.
900 Perimeter Park
Morrisville , NC 27560

CERTIFICATE OF ANALYSIS

SGI ORDER # :	134942		
ITEM# :	1	**CYLINDER # :**	1689487Y
CERTIFICATION DATE:	8/10/98	**CYLINDER PRES:**	2000 psig
P.O.# :	9101008011-R132	**CYLINDER VALVE:**	CGA 330
BLEND TYPE:	CERTIFIED		

ANALYTICAL ACCURACY: + / - 5%

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Hydrogen Chloride	50 0 ppm	54.3 ppm
Sulfur Hexafluoride	2.00 ppm	2.01 ppm
Nitrogen	Balance	Balance

Sulfur Hexafluoride is +/- 2%

ANALYST: Ted Neeme

DATE: 8/10/98

SPECTRA GASES
277 Coit Street • Irvington, NJ 07111 USA Tel: (973) 372-2060 • (800) 929-2427 • Fax: (973) 372-8551

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO: Eastern Research Group Inc.
900 Perimeter Park
Morrisville , NC 27560

CERTIFICATE OF ANALYSIS

SGI ORDER # :	126876		
ITEM# :	1	**CYLINDER # :**	1852209Y
CERTIFICATION DATE:	8/29/97	**CYLINDER PRES:**	2000 PSIG
BLEND TYPE:	CERTIFIED	**P.O.# :**	7904004005-R562

ANALYTICAL ACCURACY: **+/- 5 %**

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Hydrogen Chloride	200 ppm	210 ppm
Sulfur Hexafluoride	20.0 ppm	20.2 ppm
Nitrogen	Balance	Balance

ANALYST: Ted Neeme **DATE:** 8/29/97

SPECTRA GASES
277 Colt Street • Irvington, NJ 07111 USA Tel: (973) 372-2060 • (800) 929-2427 • Fax: (973) 372-8551

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO: Eastern Research Group Inc.
900 Perimeter Park
Morrisville , NC 27560

CERTIFICATE OF ANALYSIS

SGI ORDER # :	128118		
ITEM# :	1	**CYLINDER # :**	1757972Y
CERTIFICATION DATE:	10/16/97	**CYLINDER PRES:**	2000 psig
BLEND TYPE:	CERTIFIED	**P.O.# :**	7904004005-R690

ANALYTICAL ACCURACY: **+/- 2%**

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Hydrogen Chloride**	200 ppm	220 ppm
Sulfur Hexafluoride	20.0 ppm	20.0 ppm
Nitrogen	Balance	Balance

** **Analytical Accuracy of Hydrogen Chloride is +/- 5%**

ANALYST: Ted Neeme **DATE:** 10/16/97

SPECTRA GASES

277 Coit Street • Irvington, NJ 07111 USA Tel: (973) 372-2060 • (800) 929-2427 • Fax: (973) 372-8531

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO: Eastern Research Group Inc.
900 Perimeter Park
Morrisville , NC 27560

CERTIFICATE OF ANALYSIS

SGI ORDER # :	132874		
ITEM# :	2	**CYLINDER # :**	1370597Y
CERTIFICATION DATE:	5/11/98	**CYLINDER PRES:**	2000 psig
BLEND TYPE:	CERTIFIED	**P.O.# :**	9101008004-R986

ANALYTICAL ACCURACY: **+/- 2%***

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Hydrogen Chloride	250 ppm	253 ppm
Sulfur Hexafluoride	5.00 ppm	5.08 ppm
Nitrogen	Balance	Balance

*** Analytical Accuracy of Hydrogen Chloride is +/- 5%**

ANALYST: Michael R. Doyle
Mike Doyle

DATE: 5/11/98

SPECTRA GASES

3434 Route 22 West • Branchburg, NJ 08876 USA Tel: (908) 252-9300 • (800) 932-0624 • Fax: (908) 252-0811

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO: Eastern Research Group Inc.
900 Perimeter Park
Morrisville , NC 27560

CERTIFICATE OF ANALYSIS

SGI ORDER # :	134942		
ITEM# :	2	**CYLINDER # :**	1015632Y
CERTIFICATION DATE:	8/10/98	**CYLINDER PRES:**	2000 psig
P.O.# :	9101008011-R132	**CYLINDER VALVE:**	CGA 330
BLEND TYPE:	CERTIFIED		

ANALYTICAL ACCURACY: + / - 5%

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Hydrogen Chloride	250 ppm	260 ppm
Sulfur Hexafluoride	2.00 ppm	2.00 ppm
Nitrogen	Balance	Balance

Sulfur Hexafluoride is +/- 2%

ANALYST: Ted Neeme

DATE: 8/10/98

SPECTRA GASES

277 Coit Street • Irvington, NJ 07111 USA Tel: (973) 372-2060 • (800) 929-2427 • Fax: (973) 372-8551

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO: Eastern Research Group Inc.
900 Perimeter Park
Morrisville , NC 27560

CERTIFICATE OF ANALYSIS

SGI ORDER # :	132874		
ITEM# :	1	**CYLINDER # :**	1757934Y
CERTIFICATION DATE:	5/11/98	**CYLINDER PRES:**	2000 psig
BLEND TYPE:	CERTIFIED	**P.O.# :**	9101008004-R986

ANALYTICAL ACCURACY: **+/- 2%***

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Hydrogen Chloride	500 ppm	516 ppm
Sulfur Hexafluoride	5.00 ppm	5.09 ppm
Nitrogen	Balance	Balance

*** Analytical Accuracy of Hydrogen Chloride is +/- 5%**

ANALYST: Mike Doyle **DATE:** 5/11/98

SPECTRA GASES
3434 Route 22 West • Branchburg, NJ 08876 USA Tel: (908) 252-9300 • (800) 932-0624 • Fax: (908) 252-0811

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO: Eastern Research Group Inc.
900 Perimeter Park
Morrisville , NC 27560

CERTIFICATE OF ANALYSIS

SGI ORDER # :	134942		
ITEM# :	3	**CYLINDER # :**	982153Y
CERTIFICATION DATE:	8/10/98	**CYLINDER PRES:**	2000 psig
P.O.# :	9101008011-R132	**CYLINDER VALVE:**	CGA 330
BLEND TYPE:	CERTIFIED		

ANALYTICAL ACCURACY: + / - 5%

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Hydrogen Chloride	1,000 ppm	1,030 ppm
Sulfur Hexafluoride	2.00 ppm	2.02 ppm
Nitrogen	Balance	Balance

Sulfur Hexafluoride is +/- 2%

ANALYST: _____
Ted Neeme

DATE: 8/10/98

SPECTRA GASES
277 Coit St. • Irvington, NJ 07111 USA Tel.: (201) 372-2060 • (800) 932-0624 • Fax: (201) 372-8551
Shipped From: 80 Industrial Drive • Alpha, N.J. 08865

CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE
PROCEDURE # : G1

CUSTOMER: Eastern Research Group Inc.
SGI ORDER # : 126876
ITEM# : 3
P.O.# : 7904004005-R562

CYLINDER # : CC80890
CYLINDER PRES: 2000 PSIG
CGA OUTLET: 350

CERTIFICATION DATE: 8/26/97
EXPIRATION DATE: 8/26/2000

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Monoxide	8/19/97 8/26/97	102.1 ppm 102.6 ppm	102.3 ppm	+/- 1%

BALANCE Nitrogen

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Monoxide	SRM-1680b	CLM010013	490.4 ppm

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Monoxide	Horiba-VIA-510	570423011	NDIR	8/26/97

THIS STANDARD WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES.
DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST: _____
TED NEEME

DATE: 8/26/97

SPECTRA GASES
277 Coit Street • Irvington, NJ 07111 USA Tel: (973) 372-2060 • (800) 929-2427 • Fax: (973) 372-8551

SHIPPED FROM: 80 INDUSTRIAL DRIVE ALPHA, NJ. 08865 TEL: (908) 454-7455

SHIPPED TO: Eastern Research Group Inc.
900 Perimeter Park
Morrisville , NC 27560

CERTIFICATE OF ANALYSIS

SGI ORDER # :	128118		
ITEM# :	2	**CYLINDER # :**	CC82244
CERTIFICATION DATE:	10/16/97	**CYLINDER PRES:**	2000 psig
BLEND TYPE:	CERTIFIED	**P.O.# :**	7904004005-R690

ANALYTICAL ACCURACY: **+/- 2%**

COMPONENT	REQUESTED GAS CONC	ANALYSIS
Chlorodifluoromethane	40.0 ppm	40.3 ppm
Nitrogen	Balance	Balance

ANALYST: Ted Neeme **DATE:** 10/16/97

SPECTRA GASES
277 Coit St. • Irvington, NJ 07111 USA Tel.: (201) 372-2060 • (800) 932-0624 • Fax: (201) 372-8551
Shipped From: 80 Industrial Drive • Alpha, N.J. 08865

CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE # : G1

CUSTOMER: Eastern Research Group Inc.
SGI ORDER # : 126876
ITEM# : 5
P.O.# : 7904004005-R562

CYLINDER # : CC79878
CYLINDER PRES: 2000 PSIG
CGA OUTLET: 660

CERTIFICATION DATE: 8/27/97
EXPIRATION DATE: 8/19/99

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Methane	8/21/97	491 ppm	491 ppm	+/- 1%
Nitric Oxide	8/20/97 8/27/97	502.1 ppm 504.6 ppm	503 ppm	+/- 1%
NOx			503 ppm	Reference Value Only
Carbon Dioxide	8/19/97	4.99 %	4.99 %	+/- 1%

BALANCE Nitrogen

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Methane	SRM-2751	CAL013479	98.6 ppm
Nitric Oxide	NTRM-81687	CC57165	1009 ppm
Carbon Dioxide	SRM-1674b	CLM007273	6.98 %

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Methane	H. Packard-6890	US00001434	GC - FID	8/21/97
Nitric Oxide	Nicolet-760	ADM9600121	FTIR	8/27/97
Carbon Dioxide	Horiba-VIA-510	571417045	NDIR	7/25/97

THIS STANDARD WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES.
DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST: _____
TED NEEME

DATE: 8/27/97

APPENDIX C

RAW FTIR DATA

Description Austin White
Method title Lime Uncond
Starting Date/Time Tue Jun 30 12 47 45 1998

Time	H2O	(±)H2O	CO2	(±)CO2	CO	(±)CO	NO	(±)NO	NO2
13:28:40	159535.69	1587.42	157021.03	691.38	263.31	2.92	120.19	9.31	0.00
13:29:40	158875.22	1557.89	154580.81	678.94	235.70	2.28	118.82	9.07	0.00
13:30:40	157989.94	1554.67	153957.34	678.09	350.55	5.59	100.94	9.04	0.00
13:31:40	156393.81	1536.08	152740.66	670.98	220.33	1.99	118.78	8.89	0.00
13:32:39	155989.42	1533.96	153266.91	670.31	250.58	2.67	117.23	8.92	0.00
13:33:40	153609.31	1517.29	152403.80	664.50	209.15	1.68	121.35	8.75	0.00
13:34:40	153260.20	1541.55	152887.13	675.34	228.71	2.02	118.02	8.79	0.00
13:35:40	153443.38	1535.17	153183.14	672.43	243.64	2.49	114.44	8.82	0.00
13:36:40	153643.89	1542.70	154306.61	675.60	320.07	4.52	102.69	9.00	0.00
13:37:40	152381.44	1515.20	153158.31	664.35	209.31	1.82	123.28	8.95	0.00
13:38:40	152095.88	1481.41	153452.66	648.71	185.31	1.34	128.82	8.85	0.00
13:39:39	148547.11	1429.67	149836.86	629.11	153.10	0.95	137.88	8.72	0.00
13:40:40	147387.05	1423.57	148993.33	627.12	168.55	1.11	127.97	8.54	0.00
13:41:40	148243.75	1404.27	148618.39	618.11	165.32	1.12	128.72	8.65	0.00
13:42:39	147649.06	1409.24	149730.84	620.65	245.34	2.52	117.40	8.70	0.00
13:43:40	147767.98	1426.86	149571.47	628.34	221.58	2.00	122.28	8.66	0.00
13:44:41	148724.83	1452.78	150406.84	639.18	317.18	4.70	109.98	8.81	0.00
13:45:40	148474.92	1402.52	149077.23	617.21	239.17	2.53	118.38	8.66	0.00
13:46:40	148630.38	1454.52	149220.38	640.00	233.06	2.17	121.44	8.54	0.00
13:47:40	147713.94	1421.76	148858.03	626.12	232.84	2.16	116.92	8.63	0.00
13:48:40	148786.16	1435.81	148193.19	632.87	231.06	2.09	119.96	8.51	0.00
13:49:40	80705.84	580.06	64351.43	273.38	117.37	0.54	46.51	5.93	0.00
13:50:40	111076.13	897.60	107381.16	409.76	180.70	1.25	87.64	6.83	0.00
13:51:39	145975.52	1424.85	149322.92	628.52	225.55	2.19	125.56	8.71	0.00
13:52:40	148551.45	1483.84	150189.59	652.95	307.74	4.12	112.94	8.71	0.00
13:53:40	148675.44	1434.84	149851.81	631.31	308.14	4.08	114.77	8.72	0.00
13:54:40	148340.70	1448.51	149697.30	637.53	281.41	3.37	115.94	8.68	0.00
13:55:40	148399.11	1458.61	149747.31	641.94	232.26	2.12	121.68	8.61	0.00
13:56:41	148136.75	1433.48	149883.70	631.03	234.93	2.25	121.51	8.75	0.00
13:57:40	147644.16	1444.63	150824.67	638.24	350.98	6.03	106.16	8.85	0.00
13:58:40	148617.81	1444.59	150239.89	635.64	399.62	7.43	98.92	8.85	0.00
13:59:40	148307.63	1464.80	150691.42	644.11	394.53	7.20	99.47	8.74	0.00
14:00:40	149121.78	1481.72	150867.20	651.66	320.43	5.06	105.77	8.84	0.00
14:01:40	149189.52	1460.24	148397.88	637.78	256.27	2.88	115.59	8.67	0.00
14:02:40	149740.22	1423.63	149215.44	625.75	305.44	4.01	109.34	8.64	0.00
14:03:41	149658.56	1457.92	149190.92	640.87	356.61	5.89	105.16	8.64	0.00
14:04:40	109973.70	872.84	99584.41	398.91	281.79	4.02	60.23	6.47	0.00
14:05:40	91185.41	680.48	77600.73	317.13	244.50	2.44	45.12	6.26	0.00
14:06:40	144158.86	1356.89	144158.86	599.58	353.69	5.60	93.96	8.39	0.00
14:07:40	150262.50	1484.65	149828.19	652.25	374.03	6.36	95.66	8.74	0.00
14:58:40	149119.45	1443.93	146732.61	635.05	164.22	0.98	138.31	8.45	0.02
14:59:41	149268.41	1452.99	147857.13	638.94	179.17	1.17	131.09	8.37	0.02
15:00:40	149527.05	1473.17	147414.42	647.66	158.14	0.91	138.82	8.39	0.00
15:01:41	149787.86	1505.26	148886.56	661.60	236.11	2.21	124.06	8.51	0.05
15:02:41	148880.50	1498.63	149567.94	659.25	190.32	1.34	132.86	8.50	0.02
15:03:42	147073.61	1440.92	148325.20	634.95	231.45	2.16	130.32	8.53	0.00
15:04:41	148907.45	1485.27	150289.89	653.36	194.64	1.42	135.63	8.50	0.00
15:05:42	145662.14	1401.57	145655.66	618.44	221.11	1.98	122.15	8.39	0.00
15:06:42	76401.63	563.16	58584.72	266.67	113.70	0.42	42.79	5.92	0.00
15:07:42	125943.09	1080.29	123054.41	485.87	152.03	0.82	105.37	7.29	0.00
15:08:42	149515.08	1483.40	149678.59	652.16	243.32	3.24	120.04	8.45	0.00
15:09:41	155432.09	1622.65	155793.58	709.43	284.44	3.48	119.45	8.79	0.00
15:10:42	156564.72	1673.61	157506.16	730.94	287.47	3.50	110.97	8.95	0.00
15:11:42	156741.52	1596.23	156930.42	697.03	230.58	2.25	133.05	9.04	0.07
15:12:42	156716.02	1615.68	157751.53	705.54	315.02	4.34	120.10	8.94	0.05
15:13:42	157409.86	1583.86	157419.20	691.20	279.19	3.52	124.43	9.19	0.02
15:14:41	158771.94	1604.94	157967.52	699.51	400.42	8.12	101.60	9.16	0.00
15:15:42	158431.14	1590.51	155712.91	693.44	260.06	3.45	122.99	9.01	0.00
15:16:42	159031.94	1626.23	157347.14	708.62	319.13	4.81	110.26	9.02	0.00
15:17:42	158636.98	1590.03	156011.36	693.10	249.45	2.65	123.44	9.03	0.11
15:18:42	158334.69	1581.58	155636.73	689.61	201.83	1.59	134.65	8.86	0.00
15:19:42	159113.75	1583.97	155746.02	690.15	204.83	1.71	139.24	8.85	0.04
15:20:42	160539.50	1570.20	157100.83	683.25	358.65	6.04	109.82	9.13	0.00
15:21:41	159920.23	1593.70	156809.52	693.87	295.78	3.82	111.55	9.21	0.00
15:22:42	160098.03	1604.93	156144.59	698.65	198.99	1.52	133.46	8.90	0.05
15:23:42	160213.73	1616.40	155891.82	703.56	230.51	2.39	138.26	9.05	0.02
15:24:42	160745.56	1617.80	156642.34	703.70	221.59	1.91	124.81	9.03	0.00
15:25:42	160689.09	1635.01	155419.17	711.36	208.13	1.70	126.68	8.97	0.00
15:26:41	160894.25	1598.57	155193.23	695.37	163.02	1.00	139.16	8.93	0.00
15:27:42	160749.34	1613.89	154690.20	702.12	161.99	0.97	137.14	8.86	0.00
15:28:42	160867.64	1599.54	154771.88	695.80	164.09	1.01	140.69	8.86	0.01
15:29:42	161410.59	1606.10	155683.08	698.31	194.57	1.43	142.41	8.96	0.08
15:30:42	161502.63	1612.92	154443.50	701.22	135.95	0.76	148.14	8.92	0.00
15:31:42	163262.95	1654.42	157233.92	718.09	288.97	4.47	120.24	9.12	0.00
15:32:42	162509.66	1661.87	156379.30	721.83	213.63	1.98	141.01	9.18	0.11
15:33:42	162565.44	1666.41	156354.88	723.76	184.74	1.33	141.64	9.07	0.09
15:34:43	162638.13	1636.74	156740.47	710.83	234.55	2.17	130.93	9.08	0.04
15:35:42	161764.78	1641.53	156949.08	713.48	206.41	1.73	131.03	9.01	0.01
15:36:43	162071.50	1644.41	156159.09	713.94	194.09	1.58	136.86	9.06	0.00
15:37:43	163836.03	1684.25	157570.96	730.65	245.28	2.60	122.28	9.14	0.07
Average	149853.95	1470.56	147800.46	644.99	243.39	2.77	117.81	8.64	0.01
Standard deviation	16293.34	220.63	18512.09	91.01	66.60	1.73	20.46	0.68	0.03
Maximum value	163836.03	1684.25	157967.52	730.94	400.42	8.12	148.14	9.31	0.11
Minimum value	76401.63	563.16	58584.72	266.67	113.70	0.42	42.79	5.92	0.00

Time	(±)NO2	N2O	(±)N2O	NH3	(±)NH3	CH4	(±)CH4	C2H6	(±)C2H6	C2H4	(±)C2H4	H2CO	(±)H2CO	ACTLD	(±)ACTLD
13:28:40	2.26	0.00	1.34	0.00	0.39	4.68	8.55	4.73	2.34	1.13	0.63	0.38	0.11	0.00	0.57
13:29:40	2.21	0.00	1.28	0.00	0.38	4.49	8.36	4.43	2.29	1.32	0.62	0.42	0.11	0.00	0.58
13:30:40	2.11	0.00	1.57	0.00	0.38	4.70	8.31	4.49	2.27	1.21	0.62	0.42	0.12	0.00	0.61
13:31:40	2.19	0.00	1.25	0.00	0.38	4.58	8.06	4.28	2.20	1.13	0.61	0.46	0.13	0.00	0.68
13:32:39	2.10	0.00	1.20	0.00	0.38	5.07	8.15	4.24	2.23	1.07	0.61	0.37	0.14	0.00	0.71
13:33:40	2.12	0.00	1.25	0.00	0.37	4.99	7.78	4.27	2.13	1.05	0.60	0.40	0.13	0.00	0.70
13:34:40	2.05	0.00	1.19	0.00	0.38	4.91	7.75	4.08	2.12	1.11	0.61	0.36	0.13	0.00	0.68
13:35:40	2.09	0.00	1.16	0.00	0.38	4.87	7.84	4.28	2.14	1.18	0.61	0.49	0.13	0.06	0.66
13:36:40	2.05	0.00	1.34	0.00	0.38	4.72	8.07	4.37	2.21	1.13	0.62	0.40	0.12	0.00	0.65
13:37:40	2.05	0.00	1.28	0.00	0.37	5.14	8.05	4.41	2.20	1.16	0.60	0.47	0.12	0.00	0.61
13:38:40	2.09	0.00	1.28	0.00	0.36	5.69	7.92	4.15	2.16	1.17	0.59	0.49	0.12	0.06	0.63
13:39:39	2.22	0.00	1.38	0.00	0.35	4.36	7.86	4.11	2.15	1.23	0.57	0.47	0.12	0.80	0.61
13:40:40	2.18	0.00	1.31	0.00	0.35	5.07	7.75	4.35	2.12	1.08	0.57	0.38	0.11	0.58	0.59
13:41:40	2.06	0.00	1.39	0.00	0.35	4.43	7.91	4.45	2.16	1.13	0.56	0.45	0.10	0.24	0.54
13:42:39	2.13	0.00	1.25	0.00	0.35	5.27	7.96	4.34	2.18	1.17	0.57	0.43	0.11	0.20	0.55
13:43:40	2.22	0.00	1.26	0.00	0.35	5.21	7.85	4.17	2.15	1.10	0.57	0.35	0.11	0.11	0.55
13:44:41	2.21	0.00	1.38	0.00	0.36	5.52	8.01	4.37	2.19	1.00	0.58	0.38	0.11	0.00	0.56
13:45:40	2.11	0.00	1.22	0.00	0.35	5.21	7.81	4.19	2.13	1.16	0.56	0.45	0.10	0.02	0.54
13:46:40	2.12	0.00	1.19	0.00	0.36	5.14	7.71	4.15	2.11	1.11	0.58	0.47	0.10	0.00	0.54
13:47:40	2.12	0.00	1.18	0.00	0.35	5.30	7.69	4.31	2.10	0.86	0.57	0.42	0.11	0.00	0.58
13:48:40	2.08	0.00	1.13	0.50	0.35	5.77	7.44	4.25	2.03	0.87	0.58	0.56	0.11	0.17	0.58
13:49:40	1.70	0.00	0.95	0.98	0.15	4.35	4.48	1.76	1.22	0.13	0.25	0.08	0.10	0.00	0.54
13:50:40	1.93	0.00	0.99	1.32	0.23	4.99	6.01	3.08	1.64	0.66	0.37	0.25	0.09	0.00	0.49
13:51:39	2.13	0.00	1.23	1.47	0.35	5.30	7.66	4.33	2.09	1.18	0.57	0.58	0.11	0.00	0.56
13:52:40	2.13	0.00	1.27	1.94	0.37	5.05	7.62	4.54	2.08	0.98	0.59	0.48	0.11	0.21	0.55
13:53:40	2.15	0.00	1.25	2.78	0.35	5.45	7.59	4.47	2.07	1.16	0.57	0.41	0.10	0.10	0.52
13:54:40	2.22	0.00	1.18	3.67	0.36	5.92	7.44	4.46	2.03	1.02	0.58	0.39	0.11	0.00	0.55
13:55:40	2.10	0.00	1.21	4.46	0.36	4.64	7.60	4.20	2.08	1.02	0.58	0.38	0.10	0.21	0.53
13:56:41	2.10	0.00	1.22	5.26	0.35	5.57	7.75	4.37	2.12	0.90	0.57	0.43	0.11	0.58	0.55
13:57:40	2.09	0.00	1.67	5.80	0.36	5.56	7.80	4.71	2.13	0.91	0.58	0.47	0.11	0.18	0.56
13:58:40	2.10	0.00	2.04	6.60	0.36	5.67	7.82	4.68	2.14	1.03	0.58	0.39	0.10	0.04	0.54
13:59:40	1.93	0.00	2.00	7.60	0.36	5.45	7.48	4.38	2.04	1.01	0.59	0.39	0.10	0.00	0.54
14:00:40	1.87	0.00	1.42	8.88	0.38	4.88	7.35	4.44	2.01	1.04	0.59	0.38	0.11	0.28	0.56
14:01:40	1.97	0.00	1.11	9.86	0.38	5.88	7.32	4.15	2.00	0.98	0.58	0.42	0.10	0.43	0.63
14:02:40	2.03	0.00	1.27	10.51	0.35	5.24	7.59	4.31	2.08	1.07	0.57	0.43	0.11	0.09	0.55
14:03:41	1.93	0.00	1.65	11.00	0.36	5.89	7.29	4.14	1.99	1.22	0.58	0.53	0.10	0.00	0.54
14:04:40	1.74	0.00	1.07	9.22	0.22	5.16	5.60	2.94	1.53	0.43	0.36	0.37	0.10	0.15	0.53
14:05:40	1.77	0.00	0.84	8.14	0.18	4.82	5.00	2.32	1.37	0.19	0.29	0.24	0.10	0.69	0.52
14:06:40	2.15	0.00	1.53	10.47	0.34	5.92	7.32	3.92	2.00	0.86	0.55	0.41	0.10	0.00	0.53
14:07:40	2.06	0.00	1.76	11.66	0.36	5.15	7.51	4.46	2.05	1.09	0.59	0.51	0.11	0.00	0.56
14:58:40	2.04	0.00	1.20	13.35	0.36	4.97	7.33	3.92	2.00	0.95	0.58	0.60	0.11	0.25	0.56
14:59:41	2.21	0.00	1.25	13.17	0.36	5.80	7.53	4.46	2.06	0.99	0.58	0.47	0.11	0.56	0.55
15:00:40	2.15	0.00	1.27	13.07	0.36	4.88	7.27	3.86	1.99	0.91	0.59	0.58	0.10	0.39	0.53
15:01:41	2.02	0.00	1.14	12.76	0.37	5.01	7.45	4.36	2.04	1.01	0.60	0.47	0.11	0.20	0.58
15:02:41	2.12	0.00	1.17	12.60	0.37	5.35	7.28	3.94	1.99	1.07	0.60	0.48	0.10	0.11	0.55
15:03:42	2.21	0.00	1.21	12.26	0.36	5.56	7.71	4.34	2.11	0.87	0.58	0.55	0.10	0.32	0.55
15:04:41	2.26	0.00	1.23	12.41	0.37	5.71	7.43	4.26	2.03	1.05	0.59	0.34	0.11	0.00	0.55
15:05:42	2.29	0.00	1.21	12.08	0.35	5.31	7.39	4.24	2.02	0.80	0.56	0.43	0.11	0.42	0.58
15:06:42	1.75	0.00	1.00	7.79	0.15	4.28	4.26	1.90	1.17	0.00	0.24	0.00	0.10	0.00	0.53
15:07:42	2.03	0.00	1.21	10.47	0.27	4.82	6.39	3.46	1.75	0.52	0.44	0.42	0.11	0.77	0.57
15:08:42	2.02	0.00	1.03	11.40	0.36	5.40	7.08	3.91	1.94	1.03	0.59	0.62	0.10	0.45	0.54
15:09:41	1.94	0.00	1.10	11.94	0.40	5.91	7.37	4.32	2.01	1.12	0.65	0.44	0.10	0.00	0.54
15:10:42	1.99	0.00	1.11	12.01	0.41	5.61	7.37	4.34	2.02	1.13	0.67	0.36	0.11	0.00	0.56
15:11:42	2.12	0.00	1.16	11.75	0.39	5.04	7.61	4.63	2.08	1.18	0.63	0.45	0.11	0.00	0.57
15:12:42	2.21	0.00	1.27	11.65	0.39	4.96	7.64	4.49	2.09	1.06	0.64	0.34	0.10	0.00	0.55
15:13:42	2.17	0.00	1.19	11.37	0.39	5.43	7.84	4.53	2.14	1.19	0.63	0.32	0.10	0.00	0.54
15:14:41	2.13	0.00	2.18	11.48	0.39	5.25	7.76	4.61	2.12	1.09	0.64	0.36	0.10	0.00	0.55
15:15:42	2.13	0.00	1.15	12.36	0.39	4.88	7.78	4.54	2.13	1.12	0.63	0.40	0.10	0.00	0.52
15:16:42	2.25	0.00	1.39	12.41	0.40	6.04	7.87	4.47	2.15	1.20	0.65	0.43	0.11	0.00	0.56
15:17:42	2.08	0.00	1.14	12.71	0.39	5.69	7.74	4.28	2.12	0.97	0.63	0.38	0.11	0.00	0.56
15:18:42	2.09	0.00	1.17	12.76	0.39	5.16	7.57	4.36	2.07	1.09	0.63	0.49	0.10	0.00	0.54
15:19:42	2.14	0.00	1.19	12.61	0.39	5.51	7.69	4.28	2.10	1.00	0.63	0.33	0.11	0.00	0.59
15:20:42	2.16	0.00	1.67	12.35	0.38	6.26	7.93	4.50	2.17	1.15	0.62	0.43	0.11	0.00	0.59
15:21:41	2.28	0.00	1.28	12.49	0.39	5.88	8.07	4.51	2.21	0.91	0.63	0.46	0.11	0.00	0.57
15:22:42	2.08	0.00	1.25	12.86	0.39	6.23	7.72	4.37	2.11	1.11	0.64	0.44	0.11	0.00	0.57
15:23:42	2.14	0.00	1.19	12.77	0.39	5.71	7.86	4.45	2.15	1.12	0.64	0.42	0.10	0.00	0.53
15:24:42	2.03	0.00	1.19	12.60	0.39	6.13	7.70	4.49	2.10	0.91	0.64	0.42	0.11	0.07	0.57
15:25:42	2.11	0.00	1.17	12.28	0.40	5.77	7.52	4.22	2.06	1.08	0.65	0.47	0.11	0.36	0.57
15:26:41	1.98	0.00	1.17	12.03	0.39	5.73	7.49	4.32	2.05	1.18	0.63	0.50	0.11	0.21	0.56
15:27:42	2.17	0.00	1.25	11.66	0.39	5.80	7.45	4.51	2.04	1.10	0.64	0.45	0.11	0.28	0.56
15:28:42	2.18	0.00	1.30	11.43	0.39	5.18	7.64	4.47	2.09	1.00	0.63	0.54	0.11	0.10	0.56
15:29:42	2.14	0.00	1.24	11.04	0.39	4.69	7.68	4.55	2.10	1.06	0.64	0.49	0.11	0.00	0.57
15:30:42	2.22	0.00	1.36	10.78	0.39	5.35	7.79	4.74	2.13	1.03	0.64	0.46	0.11	0.00	0.57
15:31:42	2.09	0.00	1.28	10.61	0.40	6.00	7.73	4.59	2.11	1.13	0.65	0.43	0.11	0.00	0.55
15:32:42	2.06	0.00	1.24	10.56	0.40	5.39	7.97	4.66	2.18	0.93	0.66	0.35	0.10	0.00	0.55
15:33:42	1.98	0.00	1.24	10.73	0.40	5.58	7.70	4.43	2.11	1.06	0.66	0.42	0.11	0.00	0.57
15:34:43	2.04	0.00	1.18	10.59	0.40	6.12	7.85	4.50	2.14	1.03	0.65	0.46	0.11	0.00	0.56
15:35:42	1.97	0.00	1.19	10.39	0.40	5.39	7.71	4.61	2.11	1.08	0.65	0.46	0.10	0.39	0.55
15:36:43	2.09	0.00	1.22	10.33	0.40	6.25	7.80	4.88	2.13	1.08	0.65	0.53	0.11	0.00	0.57
15:37:43	2.25	0.00	1.16	10.13	0.41	6.19	7.85	4.39	2.16	1.14	0.67	0.44	0.11	0.00	0.67
Average	2.09	0.00	1.28	7.40	0.36	5.32	7.52	4.23	2.06	1.01	0.59	0.42	0.11	0.13	0.57
Standard deviation	0.12	0.00	0.22	5.28	0.05	0.49	0.72	0.54	0.20	0.23	0.08	0.09	0.01	0.20	0.04
Maximum value	2.29	0.00	2.18	13.35	0.41	6.26	8.55	4.88	2.34	1.32	0.67	0.62	0.14	0.80	0.71
Minimum value	1.70	0.00	0.84	0.00	0.15	4.28	4.26	1.76	1.17	0.00	0.24	0.00	0.09	0.00	0.49

Time	C4+	(±)C4+	CH3OH	(±)CH3OH	HCL	(±)HCL	SF6	(±)SF6	SO2	(±)SO2	NOX	(±)NOX
13:28:40	1.25	0.57	1.70	1.05	4.78	0.15	0.00	0.01	0.00	9.98	120.19	11.57
13:29:40	1.21	0.56	1.60	1.01	6.38	0.16	0.00	0.01	0.00	9.85	118.82	11.27
13:30:40	1.29	0.56	1.44	1.01	8.51	0.17	0.00	0.01	0.00	9.63	100.94	11.14
13:31:40	1.29	0.54	1.69	1.01	12.28	0.18	0.00	0.01	0.00	9.76	118.78	11.08
13:32:39	1.33	0.55	1.58	1.00	15.08	0.19	0.00	0.01	0.00	9.58	117.23	11.01
13:33:40	1.23	0.52	1.54	1.00	15.06	0.19	0.00	0.01	0.00	9.62	121.35	10.86
13:34:40	1.27	0.52	1.63	1.01	13.75	0.18	0.00	0.01	0.00	9.82	118.02	10.83
13:35:40	1.19	0.53	1.52	1.01	11.68	0.18	0.00	0.01	0.00	9.75	114.44	10.91
13:36:40	1.26	0.54	1.58	1.01	10.84	0.18	0.00	0.01	0.00	9.78	102.69	11.05
13:37:40	1.22	0.54	1.70	0.98	9.87	0.16	0.00	0.01	0.00	9.78	123.28	11.01
13:38:40	1.22	0.53	1.67	1.00	9.23	0.17	0.00	0.01	0.00	9.65	128.82	10.94
13:39:39	1.18	0.53	1.49	0.94	8.24	0.17	0.00	0.01	0.00	9.34	137.88	10.94
13:40:40	1.13	0.52	1.47	0.94	5.90	0.16	0.00	0.01	0.00	9.36	127.97	10.72
13:41:40	1.10	0.53	1.71	0.92	3.85	0.15	0.00	0.01	0.00	9.32	128.72	10.71
13:42:39	1.13	0.53	1.65	0.92	2.55	0.15	0.00	0.01	0.00	9.42	117.40	10.83
13:43:40	1.18	0.53	1.64	0.93	1.66	0.15	0.00	0.01	0.00	9.50	122.28	10.88
13:44:41	1.15	0.54	1.53	0.95	0.85	0.15	0.00	0.01	0.00	9.43	109.98	11.02
13:45:40	1.18	0.52	1.61	0.92	0.20	0.15	0.00	0.01	0.00	9.43	118.38	10.78
13:46:40	1.23	0.52	1.58	0.94	0.00	0.14	0.00	0.01	0.00	9.40	121.44	10.66
13:47:40	1.22	0.52	1.55	0.92	0.00	0.16	0.00	0.01	0.00	9.54	116.92	10.75
13:48:40	1.23	0.50	1.64	0.94	0.00	0.16	0.00	0.01	0.00	9.33	119.96	10.59
13:49:40	0.49	0.30	0.29	0.33	0.00	0.15	0.00	0.00	0.00	3.96	46.51	7.64
13:50:40	0.80	0.40	0.96	0.57	0.00	0.13	0.00	0.01	0.00	6.65	87.64	8.77
13:51:39	1.23	0.51	1.57	0.94	0.00	0.15	0.00	0.01	0.00	9.34	125.56	10.83
13:52:40	1.19	0.51	1.51	0.95	0.00	0.15	0.00	0.01	0.00	9.52	112.94	10.84
13:53:40	1.27	0.51	1.61	0.93	0.00	0.14	0.00	0.01	0.00	9.62	114.77	10.86
13:54:40	1.26	0.50	1.54	0.93	0.00	0.15	0.00	0.01	0.00	9.50	115.94	10.90
13:55:40	1.30	0.51	1.42	0.95	0.00	0.14	0.00	0.01	0.00	9.27	121.68	10.71
13:56:41	1.25	0.52	1.45	0.93	0.00	0.15	0.00	0.01	0.00	9.19	121.51	10.85
13:57:40	1.26	0.52	1.52	0.94	0.00	0.15	0.00	0.01	0.00	9.42	106.16	10.94
13:58:40	1.28	0.52	1.52	0.93	0.00	0.14	0.00	0.01	0.00	9.63	98.92	10.94
13:59:40	1.27	0.50	1.36	0.97	0.00	0.14	0.00	0.01	0.00	9.60	99.47	10.68
14:00:40	1.34	0.49	1.64	0.97	0.00	0.15	0.00	0.01	0.00	9.52	105.77	10.51
14:01:40	1.32	0.49	1.46	0.96	0.00	0.14	0.00	0.01	0.00	9.61	115.59	10.64
14:02:40	1.30	0.51	1.48	0.95	0.00	0.15	0.00	0.01	0.00	9.53	109.34	10.66
14:03:41	1.38	0.49	1.54	0.96	0.00	0.15	0.00	0.01	0.00	9.38	105.16	10.56
14:04:40	0.92	0.38	0.67	0.56	0.00	0.14	0.00	0.01	0.21	6.11	60.23	8.21
14:05:40	0.55	0.33	0.40	0.39	0.00	0.14	0.00	0.01	0.00	4.86	45.12	8.03
14:06:40	1.31	0.49	1.35	0.90	0.00	0.14	0.00	0.01	0.00	8.96	93.96	10.54
14:07:40	1.38	0.50	1.50	0.96	0.00	0.15	0.00	0.01	0.00	9.26	95.66	10.79
14:58:40	1.24	0.49	1.47	0.94	0.00	0.15	0.00	0.01	0.00	9.09	138.32	10.50
14:59:41	1.25	0.50	1.69	0.94	0.00	0.15	0.00	0.01	0.00	9.30	131.12	10.59
15:00:40	1.20	0.49	1.56	0.96	0.00	0.14	0.00	0.01	0.00	9.50	138.82	10.54
15:01:41	1.16	0.50	1.60	0.96	0.00	0.16	0.00	0.01	0.00	9.61	124.11	10.53
15:02:41	1.17	0.49	1.68	0.96	0.00	0.15	0.00	0.01	0.00	9.54	132.87	10.62
15:03:42	1.23	0.52	1.46	0.94	0.00	0.15	0.00	0.01	0.00	9.40	130.32	10.74
15:04:41	1.14	0.50	1.68	0.99	0.00	0.15	0.00	0.01	0.00	9.66	135.63	10.77
15:05:42	1.17	0.50	1.48	0.92	0.00	0.16	0.00	0.01	0.00	9.15	122.15	10.68
15:06:42	0.34	0.29	0.11	0.31	0.00	0.14	0.00	0.00	0.00	3.61	42.79	7.67
15:07:42	0.96	0.43	0.97	0.70	0.00	0.15	0.00	0.01	0.00	7.85	105.37	9.33
15:08:42	1.24	0.47	1.80	0.97	0.00	0.15	0.00	0.01	0.00	9.39	120.04	10.47
15:09:41	1.30	0.49	1.49	1.06	0.00	0.15	0.00	0.01	0.00	9.99	119.45	10.73
15:10:42	1.28	0.49	1.64	1.09	0.00	0.15	0.00	0.01	0.00	10.23	110.97	10.94
15:11:42	1.25	0.51	1.70	1.06	0.00	0.15	0.00	0.01	0.00	9.93	133.12	11.16
15:12:42	1.31	0.51	1.67	1.09	0.00	0.15	0.00	0.01	0.00	10.17	120.15	11.15
15:13:42	1.27	0.53	1.77	1.07	0.00	0.15	0.00	0.01	0.00	9.88	124.44	11.36
15:14:41	1.31	0.52	1.48	1.06	0.00	0.15	0.00	0.01	0.00	10.10	101.60	11.30
15:15:42	1.27	0.52	1.79	1.06	0.00	0.14	0.00	0.01	0.00	9.82	122.99	11.13
15:16:42	1.30	0.53	1.56	1.07	0.00	0.15	0.00	0.01	0.00	10.15	110.26	11.27
15:17:42	1.26	0.52	1.60	1.05	0.00	0.15	0.00	0.01	0.00	9.96	123.54	11.12
15:18:42	1.21	0.51	1.78	1.06	0.00	0.15	0.00	0.01	0.00	9.71	134.65	10.95
15:19:42	1.19	0.52	1.83	1.05	0.00	0.16	0.00	0.01	0.00	10.13	139.28	10.99
15:20:42	1.27	0.53	1.71	1.07	0.00	0.16	0.00	0.01	0.00	10.11	109.82	11.29
15:21:41	1.27	0.54	1.66	1.06	0.00	0.15	0.00	0.01	0.00	9.71	111.55	11.48
15:22:42	1.27	0.52	1.62	1.08	0.00	0.15	0.00	0.01	0.00	10.06	133.51	10.98
15:23:42	1.21	0.53	1.54	1.06	0.00	0.14	0.00	0.01	0.00	9.84	138.28	11.19
15:24:42	1.19	0.52	1.63	1.07	0.00	0.16	0.00	0.01	0.00	10.18	124.61	11.06
15:25:42	1.16	0.50	1.84	1.07	0.00	0.15	0.00	0.01	0.00	9.93	126.68	11.08
15:26:41	1.19	0.50	1.79	1.07	0.00	0.15	0.00	0.01	0.00	9.78	139.16	10.92
15:27:42	1.10	0.50	1.75	1.07	0.00	0.15	0.00	0.01	0.00	9.77	137.14	11.03
15:28:42	1.09	0.51	1.66	1.07	0.00	0.15	0.00	0.01	0.00	9.73	140.70	11.04
15:29:42	1.07	0.51	1.69	1.06	0.00	0.16	0.00	0.01	0.00	9.90	142.49	11.09
15:30:42	1.05	0.52	1.53	1.05	0.00	0.15	0.00	0.01	0.00	10.01	148.14	11.13
15:31:42	1.06	0.52	1.82	1.08	0.00	0.15	0.00	0.01	0.00	10.01	120.24	11.21
15:32:42	1.14	0.53	1.82	1.06	0.00	0.15	0.00	0.01	0.00	10.18	141.12	11.24
15:33:42	1.12	0.52	1.87	1.10	0.00	0.15	0.00	0.01	0.00	9.86	141.73	11.05
15:34:43	1.20	0.53	1.75	1.06	0.00	0.15	0.00	0.01	0.00	10.04	130.97	11.13
15:35:42	1.17	0.52	1.73	1.08	0.00	0.15	0.00	0.01	0.00	10.04	131.04	10.97
15:36:43	1.13	0.52	1.84	1.07	0.00	0.16	0.00	0.01	0.00	9.85	136.88	11.15
15:37:43	1.23	0.53	1.79	1.09	0.00	0.15	0.00	0.01	0.00	9.92	122.35	11.39
Average	1.18	0.50	1.54	0.96	1.78	0.15	0.00	0.01	0.00	9.36	117.82	10.73
Standard deviation	0.17	0.05	0.31	0.16	3.97	0.01	0.00	0.00	0.02	1.21	20.46	0.76
Maximum value	1.38	0.57	1.87	1.10	15.08	0.19	0.00	0.01	0.21	10.23	148.14	11.57
Minimum value	0.34	0.29	0.11	0.31	0.00	0.13	0.00	0.00	0.00	3.61	42.79	7.64

[illegible] Tue Jun 30 12 47 45 1998

Time	H2O	(±)H2O	CO2	(±)CO2	CO	(±)CO	NO	(±)NO	NO2	(±)NO2	N2O	(±)N2O	NH3	(±)NH3	CH4	(±)CH4	C2H6	(±)C2H6	C2H4	(±)C2H4	H2CO	(±)H2CO	ACTL	(±)ACTLD	C4+	(±)C4+	CH3OH	(±)CH3OH	HCL	(±)HCL	SF6	(±)SF6	SO2	(±)SO2	NOX	(±)NOX
12 53 41	153965.05	1410.[illegible]	148788.17	617.74	134.70	0.84	123.34	8.64	0.08	2.21	0.00	1.47	0.00	0.35	4.78	8.29	4.36	2.27	1.36	0.56	0.47	0.11	0.02	0.57	1.14	0.56	1.55	0.89	6.86	0.16	0.00	0.01	0.00	9.44	123.42	10.85
12 54 41	154030.31	1385.08	147704.22	600.36	182.01	1.76	121.82	8.66	0.00	2.11	0.00	1.31	0.00	0.34	4.95	8.10	4.21	2.21	0.88	0.55	0.44	0.11	0.13	0.58	1.10	0.54	1.44	0.82	6.93	0.16	0.00	0.01	0.00	9.44	121.62	10.78
12 56 40	154304.19	1480.28	148752.87	634.74	289.28	3.18	105.46	8.74	0.00	2.34	0.00	1.23	0.00	0.36	5.94	8.00	4.32	2.19	1.04	0.56	0.37	0.10	0.10	0.54	1.17	0.54	1.43	0.86	6.10	0.14	0.00	0.01	0.00	9.89	106.48	11.08
12 56 41	156463.58	1458.38	148822.58	637.57	248.66	2.50	109.88	8.74	0.00	2.12	0.00	1.25	0.00	0.36	5.44	7.99	4.36	2.18	1.07	0.56	0.42	0.11	0.28	0.56	1.21	0.54	1.50	0.94	4.79	0.15	0.00	0.01	0.00	9.37	109.88	10.86
12 57 40	154641.08	1488.86	148883.52	642.72	216.22	1.77	110.13	8.62	0.00	2.18	0.00	1.26	0.00	0.36	4.97	7.86	4.53	2.18	1.14	0.59	0.33	0.10	0.44	0.52	1.18	0.53	1.72	0.92	4.11	0.14	0.00	0.01	0.00	9.82	110.13	10.70
12 58 39	156362.05	1479.46	150137.86	648.56	321.47	4.53	98.17	8.82	0.00	2.22	0.00	1.34	0.00	0.36	5.33	8.08	4.82	2.21	1.04	0.58	0.36	0.11	0.00	0.57	1.24	0.54	1.48	0.96	3.63	0.18	0.00	0.01	0.00	9.48	98.17	11.04
12 59 40	156152.81	1487.98	150088.97	641.79	263.14	3.40	105.71	8.84	0.00	2.30	0.00	1.28	0.00	0.36	5.86	8.13	4.48	2.22	1.14	0.58	0.45	0.11	0.00	0.58	1.29	0.54	1.80	0.84	3.22	0.18	0.00	0.01	0.00	9.48	105.71	11.14
13 00 39	156308.84	1463.37	152107.08	648.01	275.82	3.22	105.87	8.82	0.00	2.21	0.00	1.29	0.00	0.36	4.96	8.23	4.56	2.25	1.31	0.58	0.40	0.10	0.00	0.54	1.38	0.56	1.58	0.87	2.81	0.15	0.00	0.01	0.00	9.58	105.87	11.13
13 01 39	155840.53	1803.83	152282.58	660.82	347.72	5.80	99.89	8.90	0.00	2.31	0.00	1.51	0.00	0.37	5.39	8.12	4.66	2.27	1.15	0.60	0.43	0.10	0.00	0.55	1.38	0.54	1.50	0.97	2.41	0.15	0.00	0.01	0.00	8.70	99.89	11.21

Description Austin White
Method title Lime Uncond
Starting Date/Time Wed Jul 01 14 15 07 1998

Time	H2O	(±)H2O	CO2	(±)CO2	CO	(±)CO	NO	(±)NO	NO2	(±)NO2	N2O	(±)N2O	NH3	(±)NH3	CH4	(±)CH4	C2H6	(±)C2H6	C2H4	(±)C2H4	H2CO	(±)H2CO	ACTL	(±)ACTLD	C4+	(±)C4+	CH3OH	(±)CH3OH	HCL	(±)HCL	SF6	(±)SF6	SO2	(±)SO2	NOX	(±)NOX
14:41:01	196410.94	1380.00	119413.11	581.65	139.12	0.73	143.52	7.67	0.00	2.11	0.00	1.42	0.00	0.33	0.00	8.43	4.93	2.30	1.17	0.53	1.96	0.12	2.30	0.64	1.76	0.56	1.43	0.73	9.53	0.17	0.00	0.01	0.00	7.61	143.52	9.78
14:42:01	197143.38	1412.50	120016.60	594.97	138.75	0.74	139.62	7.85	0.00	1.83	0.00	1.33	0.00	0.33	0.00	8.05	5.03	2.20	1.27	0.54	1.95	0.12	2.50	0.63	1.77	0.54	1.47	0.73	8.95	0.17	0.00	0.01	0.00	7.66	139.62	9.68
14:43:02	195748.55	1370.16	120203.39	577.83	139.43	0.70	138.57	8.00	0.00	1.77	0.00	1.36	0.00	0.32	0.00	8.40	5.33	2.30	1.31	0.53	1.87	0.12	2.59	0.61	1.76	0.56	1.33	0.72	8.25	0.17	0.00	0.01	0.00	7.85	138.57	9.77
14:44:02	199178.03	1373.42	118779.26	577.49	140.71	0.71	142.37	8.05	0.00	1.91	0.00	1.44	0.00	0.32	0.00	8.83	5.17	2.41	1.44	0.53	1.94	0.11	2.35	0.58	1.79	0.59	1.36	0.71	7.61	0.16	0.00	0.01	0.00	7.54	142.37	9.96
14:45:02	197065.78	1393.00	119111.97	586.80	140.62	0.76	145.22	7.87	0.00	1.95	0.00	1.36	0.00	0.33	0.00	8.48	4.82	2.32	1.36	0.53	1.96	0.12	2.54	0.61	1.83	0.57	1.42	0.71	7.34	0.17	0.00	0.01	0.00	7.41	145.22	9.81
14:46:01	198330.11	1391.34	118007.94	585.46	140.74	0.75	149.40	7.70	0.00	2.03	0.00	1.45	0.00	0.33	0.00	8.45	4.79	2.31	1.26	0.53	2.00	0.11	2.76	0.60	1.82	0.57	1.33	0.71	7.11	0.16	0.00	0.01	0.00	7.44	149.40	9.73
14:47:02	199355.84	1421.90	118247.22	597.79	139.27	0.77	149.60	7.83	0.00	1.88	0.00	1.35	0.00	0.33	0.00	8.17	4.72	2.23	1.23	0.54	1.85	0.12	2.02	0.61	1.80	0.55	1.48	0.73	6.75	0.16	0.00	0.01	0.00	7.60	149.60	9.71
14:48:01	199787.28	1429.42	119007.68	600.72	137.59	0.73	143.97	7.97	0.00	1.87	0.00	1.36	0.00	0.34	0.00	8.32	4.87	2.28	1.22	0.55	1.84	0.11	1.97	0.58	1.84	0.56	1.40	0.74	6.75	0.16	0.00	0.01	0.00	7.40	143.97	9.84
14:49:02	200601.81	1394.49	119094.32	585.63	136.46	0.75	145.23	7.98	0.00	1.87	0.00	1.36	0.00	0.33	0.00	8.21	4.76	2.24	1.36	0.53	2.00	0.11	3.01	0.59	1.77	0.55	1.35	0.72	6.40	0.16	0.00	0.01	0.00	7.45	145.23	9.85
14:50:02	202453.53	1439.09	119682.14	603.40	136.38	0.74	145.89	8.16	0.00	1.98	0.00	1.38	0.00	0.34	0.00	8.51	4.92	2.33	1.40	0.55	1.92	0.12	2.48	0.62	1.78	0.57	1.32	0.72	6.11	0.17	0.00	0.01	0.00	7.66	145.89	10.14
14:51:02	203120.50	1398.30	119976.31	585.96	136.58	0.77	146.18	8.13	0.00	1.87	0.00	1.33	0.00	0.33	0.00	8.56	5.11	2.34	1.44	0.53	2.09	0.12	2.26	0.62	1.83	0.57	1.37	0.74	5.90	0.17	0.00	0.01	0.00	7.61	146.18	10.00
14:52:01	202876.30	1453.04	120261.63	609.03	136.35	0.74	138.78	8.17	0.00	1.92	0.00	1.41	0.00	0.34	0.00	8.53	4.86	2.33	1.24	0.55	2.10	0.11	2.34	0.59	1.83	0.57	1.32	0.74	5.69	0.16	0.00	0.01	0.00	7.54	138.78	10.09
14:53:01	202281.03	1423.62	119480.37	597.01	137.42	0.72	130.40	8.04	0.00	1.68	0.00	1.35	0.00	0.33	0.00	8.33	4.90	2.28	1.27	0.54	2.03	0.11	2.55	0.59	1.86	0.56	1.44	0.72	5.26	0.16	0.00	0.01	0.00	7.38	130.40	9.72
14:54:01	200670.03	1391.00	117451.25	584.13	139.57	0.78	143.87	7.88	0.00	1.87	0.00	1.35	0.00	0.33	0.00	8.48	4.87	2.32	1.27	0.53	2.06	0.12	2.81	0.61	1.89	0.57	1.38	0.71	5.35	0.16	0.00	0.01	0.00	7.27	143.87	9.75
14:55:02	200970.98	1398.64	118052.24	587.19	138.51	0.74	146.61	8.00	0.00	2.06	0.00	1.44	0.00	0.33	0.00	8.57	4.99	2.34	1.43	0.53	2.11	0.11	2.48	0.57	1.85	0.57	1.28	0.71	5.08	0.15	0.00	0.01	0.00	7.37	146.61	10.05
14:56:02	201089.09	1397.29	118981.52	586.57	138.68	0.72	147.71	8.09	0.00	1.93	0.00	1.39	0.00	0.33	0.00	8.57	5.12	2.34	1.36	0.53	2.05	0.12	2.37	0.61	1.81	0.57	1.42	0.71	4.67	0.17	0.00	0.01	0.00	7.46	147.71	10.02
14:57:02	199902.14	1412.43	120043.99	593.53	136.14	0.76	140.70	7.92	0.00	1.81	0.00	1.29	0.00	0.33	0.00	8.14	5.16	2.22	1.33	0.54	2.09	0.11	2.54	0.56	1.81	0.54	1.33	0.75	4.76	0.15	0.00	0.01	0.00	7.59	140.70	9.73
14:58:02	200271.36	1411.42	120562.26	592.91	136.83	0.72	145.50	8.12	0.00	1.79	0.00	1.35	0.00	0.33	0.00	8.47	5.07	2.32	1.37	0.54	1.96	0.11	2.60	0.59	1.81	0.57	1.37	0.72	4.26	0.16	0.00	0.01	0.00	7.42	145.50	9.91
14:59:02	200092.66	1454.96	121246.70	611.30	136.81	0.78	135.83	7.89	0.00	1.80	0.00	1.25	0.37	0.34	0.00	8.09	4.84	2.21	1.33	0.56	1.97	0.11	2.56	0.59	1.88	0.54	1.34	0.74	4.26	0.16	0.00	0.01	0.00	7.34	135.83	9.69
15:00:02	199376.98	1429.92	120533.00	601.15	137.34	0.79	138.18	7.89	0.00	1.87	0.00	1.26	0.49	0.34	0.00	8.06	4.87	2.20	1.23	0.55	2.09	0.11	3.06	0.59	1.83	0.54	1.55	0.75	4.02	0.16	0.00	0.01	0.00	7.76	138.18	9.76
15:01:03	198044.36	1380.35	120020.62	580.98	138.19	0.76	139.67	7.96	0.00	1.79	0.00	1.36	0.65	0.33	0.00	8.40	4.81	2.30	1.36	0.53	1.92	0.11	2.72	0.58	1.91	0.56	1.17	0.72	4.04	0.16	0.00	0.01	0.00	7.27	139.67	9.75
15:02:03	197972.77	1422.90	118876.91	598.92	139.04	0.75	148.73	7.91	0.00	2.02	0.00	1.35	0.85	0.34	0.00	8.27	4.62	2.26	1.27	0.55	2.12	0.11	2.81	0.56	1.85	0.55	1.26	0.71	3.98	0.15	0.00	0.01	0.00	7.45	148.73	9.93
15:03:03	198966.33	1423.89	119397.83	598.83	137.11	0.75	140.77	8.01	0.00	1.84	0.00	1.35	0.99	0.34	0.00	8.32	4.62	2.27	1.23	0.55	2.04	0.11	2.33	0.56	1.85	0.58	1.36	0.73	3.76	0.15	0.00	0.01	0.00	7.32	140.77	9.85
15:04:03	197811.61	1368.15	119289.17	575.96	137.87	0.73	146.67	8.00	0.00	2.04	0.00	1.37	1.15	0.32	0.00	8.37	5.07	2.29	1.36	0.52	2.06	0.11	2.57	0.57	1.82	0.56	1.45	0.70	3.64	0.15	0.00	0.01	0.00	7.48	146.67	10.04
15:05:02	199334.17	1386.63	119258.74	582.97	137.41	0.77	146.39	8.00	0.00	1.94	0.00	1.30	1.30	0.33	0.00	8.00	4.78	2.19	1.29	0.53	1.98	0.11	2.48	0.59	1.86	0.54	1.46	0.71	3.70	0.16	0.00	0.01	0.00	7.41	146.39	9.94
15:41:05	194029.89	1440.41	123142.73	608.37	134.55	0.80	137.78	7.55	0.00	1.90	0.00	1.19	0.00	0.34	0.00	7.52	4.59	2.06	1.44	0.55	2.07	0.11	2.49	0.59	1.85	0.50	1.55	0.75	4.74	0.16	0.00	0.01	0.00	7.64	137.78	9.45
15:42:05	193729.80	1401.50	122467.75	592.09	134.04	0.76	143.58	7.65	0.00	1.87	0.00	1.28	0.00	0.33	0.00	7.83	4.80	2.14	1.30	0.54	2.05	0.12	2.54	0.61	1.83	0.52	1.24	0.73	4.48	0.16	0.00	0.01	0.00	7.68	143.58	9.52
15:43:05	193253.38	1406.98	122210.97	594.65	133.23	0.76	158.63	7.56	0.00	1.69	0.00	1.26	0.00	0.33	0.00	7.79	5.00	2.13	1.29	0.54	1.97	0.11	1.49	0.59	1.85	0.52	1.22	0.73	4.06	0.16	0.00	0.01	0.00	7.61	158.63	9.25
15:44:05	194150.86	1408.71	123720.86	594.92	131.71	0.78	140.31	7.72	0.00	1.60	0.00	1.17	0.38	0.33	0.00	7.58	4.82	2.07	1.45	0.54	2.07	0.11	2.41	0.56	1.75	0.51	1.50	0.75	3.83	0.15	0.00	0.01	0.00	7.51	140.31	9.32
15:45:05	194409.09	1446.25	123867.20	610.83	131.72	0.80	142.58	7.82	0.00	1.66	0.00	1.19	0.68	0.34	0.00	7.64	4.87	2.09	1.27	0.56	2.09	0.11	2.16	0.58	1.81	0.51	1.35	0.76	3.53	0.16	0.00	0.01	0.00	7.96	142.58	9.47
15:46:06	196032.23	1425.50	124148.23	601.02	132.00	0.78	143.82	7.69	0.00	1.68	0.00	1.19	0.89	0.34	0.00	7.55	4.64	2.06	1.43	0.55	2.12	0.11	2.06	0.58	1.79	0.51	1.42	0.75	3.34	0.16	0.00	0.01	0.00	7.75	143.82	9.37
15:47:04	196842.73	1406.24	124708.72	592.49	130.20	0.73	131.02	7.96	0.00	1.69	0.00	1.23	1.22	0.33	0.00	7.93	5.03	2.17	1.19	0.54	2.07	0.11	2.27	0.56	1.78	0.53	1.46	0.75	3.33	0.15	0.00	0.01	0.00	8.02	131.02	9.64
15:48:05	198553.73	1388.54	123776.60	584.17	131.44	0.70	130.20	8.06	0.00	1.95	0.00	1.34	1.48	0.33	0.00	8.35	5.34	2.28	1.22	0.53	2.14	0.12	1.39	0.60	1.78	0.56	1.37	0.75	3.18	0.16	0.00	0.01	0.00	7.67	130.20	10.00
15:49:06	196786.88	1395.49	123075.82	587.99	130.80	0.74	139.89	7.84	0.00	1.96	0.00	1.26	1.77	0.33	0.00	7.79	4.90	2.13	1.32	0.54	2.13	0.11	1.93	0.56	1.80	0.52	1.50	0.75	2.99	0.15	0.00	0.01	0.00	7.55	139.89	9.80
15:50:06	196255.59	1374.25	121338.51	579.30	131.62	0.68	146.49	7.91	0.00	1.97	0.00	1.31	1.96	0.32	0.00	8.16	5.24	2.23	1.26	0.53	2.18	0.10	2.37	0.54	1.75	0.55	1.21	0.72	2.75	0.15	0.00	0.01	0.00	7.46	146.49	9.88
15:51:07	196670.36	1438.68	123596.49	606.24	129.38	0.74	141.18	7.86	0.00	1.83	0.00	1.24	2.14	0.34	0.00	8.14	4.91	2.23	1.35	0.55	2.15	0.11	2.07	0.58	1.78	0.55	1.37	0.75	2.65	0.16	0.00	0.01	0.00	7.60	141.18	9.69
15:52:05	197422.48	1395.47	125171.90	587.65	128.56	0.71	138.19	7.98	0.00	1.96	0.00	1.32	2.23	0.33	0.00	8.41	5.13	2.30	1.23	0.53	2.13	0.11	2.22	0.58	1.79	0.56	1.32	0.75	2.45	0.16	0.00	0.01	0.00	7.56	138.19	9.95
15:53:06	195240.98	1401.35	125204.11	591.25	129.61	0.66	146.42	8.08	0.00	1.93	0.00	1.38	2.37	0.33	0.00	8.55	5.27	2.34	1.27	0.54	2.08	0.11	1.93	0.56	1.77	0.57	1.25	0.78	2.34	0.15	0.00	0.01	0.00	7.78	146.42	10.00
15:54:06	194857.34	1412.27	125090.26	596.05	129.43	0.68	150.95	7.92	0.00	1.86	0.00	1.33	2.71	0.33	0.00	8.28	5.08	2.26	1.35	0.54	2.09	0.11	2.28	0.56	1.73	0.55	1.11	0.75	2.15	0.15	0.00	0.01	0.00	7.75	150.95	9.78
15:55:06	194568.58	1408.13	125772.23	594.45	128.94	0.69	150.33	7.91	0.00	1.79	0.00	1.31	2.82	0.33	0.00	7.99	5.33	2.18	1.28	0.54	2.05	0.12	1.67	0.62	1.71	0.54	1.33	0.74	2.16	0.17	0.00	0.01	0.00	8.34	150.33	9.70
15:56:06	192614.77	1393.52	126445.80	589.29	128.78	0.69	145.74	7.82	0.00	1.83	0.00	1.30	2.95	0.33	0.00	8.18	5.10	2.24	1.33	0.54	2.09	0.11	1.81	0.56	1.72	0.55	1.25	0.76	1.88	0.15	0.00	0.01	0.00	7.86	145.74	9.66
15:57:06	193712.31	1420.99	127369.82	600.33	128.92	0.68	136.16	7.96	0.00	1.94	0.00	1.26	3.10	0.34	0.00	7.91	5.07	2.16	1.36	0.56	2.17	0.11	2.24	0.58	1.70	0.53	1.44	0.77	1.97	0.16	0.00	0.01	0.00	8.10	136.16	9.89
15:58:07	195760.88	1399.01	126965.93	589.99	128.95	0.70	141.49	8.05	0.00	1.85	0.00	1.33	3.32	0.33	0.00	8.17	4.88	2.23	1.25	0.54	2.04	0.11	1.90	0.58	1.81	0.56	1.41	0.77	1.77	0.16	0.00	0.01	0.00	8.03	141.49	9.90
15:59:06	197929.08	1440.90	128348.20	606.52	128.11	0.68	125.70	8.05	0.00	2.03	0.00	1.32	3.52	0.34	0.00	8.19	4.97	2.24	1.47	0.55	2.11	0.11	2.10	0.57	1.75	0.55	1.38	0.78	1.74	0.16	0.00	0.01	0.00	8.12	125.70	10.08
16:00:06	198172.97	1431.50	127188.13	602.44	131.12	0.72	136.66	8.09	0.00	1.76	0.00	1.32	3.62	0.34	0.00	8.18	5.01	2.24	1.32	0.55	2.05	0.11	2.33	0.56	1.72	0.55	1.52	0.78	1.64	0.15	0.00	0.01	0.00	7.93	136.66	9.85
16:01:07	200714.33	1441.70	126040.09	605.40	132.42	0.73	135.62	7.97	0.00	1.90	0.00	1.37	3.81	0.34	0.00	8.29	5.01	2.27	1.30	0.55	2.16	0.11	1.79	0.58	1.81	0.56	1.38	0.78	1.47	0.16	0.00	0.01	0.00	7.97	135.62	9.86
16:02:07	197816.94	1416.37	122143.50	596.25	135.64	0.73	133.10	7.72	0.00	1.90	0.00	1.32	3.80	0.33	0.00	8.14	5.01	2.22	1.27	0.54	2.23	0.11	2.02	0.57	1.72	0.55	1.21	0.72	1.57	0.15	0.00	0.01	0.00	7.82	133.10	9.62
16:03:08	196405.61	1347.99	121555.23	568.16	135.03	0.70	126.69	7.88	0.00	2.14	0.00	1.33	4.04	0.32	0.00	8.31	5.05	2.27	1.27	0.52	2.05	0.11	2.61	0.57	1.68	0.58	1.38	0.74	1.36	0.15	0.00	0.01	0.00	7.78	126.69	10.02
16:04:07	201256.73	1389.47	119904.01	583.20	132.97	0.75	123.10	7.76	0.00	1.95	0.00	1.33	5.53	0.33	0.00	8.15	4.97	2.23	1.29	0.53	2.13	0.11	2.16	0.57	1.66	0.55	1.28	0.72	3.31	0.15	0.00	0.01	0.00	7.45	123.10	9.71
16:05:07	196625.91	1407.80	120326.61	593.26	132.67	0.74	128.42	7.55	0.00	1.94	0.00	1.28	5.11	0.33	0.00	7.94	4.65	2.17	1.18	0.54	2.18	0.10	1.76	0.54	1.65	0.53	1.16	0.73	2.11	0.15	0.00	0.01	0.00	7.29	128.42	9.49
16:41:06	247715.55	5142.48	148332.34	2077.14	121.42	1.77	144.83	7.82	0.00	3.71	0.00	1.00	0.00	1.16	6.72	5.08	4.41	1.39	4.12	1.89	2.23	0.21	0.00	1.10	1.53	0.34	4.48	2.51	2.57	0.30	0.03	0.03	0.00	9.00	144.83	11.53
16:42:07	247044.91	5090.96	149206.34	2057.43	120.91	1.75	140.01	7.85	0.00	2.95	0.00	0.97	0.00	1.15	6.23	4.91	3.42	1.34	4.34	1.87	2.09	0.22	1.44	1.12	1.57	0.33	4.52	2.51	2.69	0.30	0.00	0.03	0.00	8.71	140.01	10.80
16:43:07	248924.36	5190.83	150503.61	2094.65	121.47	1.77	141.82	7.87	0.00	3.53	0.00	1.00	0.00	1.17	6.37	5.12	4.50	1.40	4.31	1.91	2.02	0.21	0.00	1.08	1.60	0.34	4.23	2.47	2.24	0.29	0.00	0.03	0.00	8.87	141.82	11.39
16:44:07	247397.94	5177.59	151484.98	2091.85	121.65	1.75	135.05	7.83	0.00	3.69	0.00	0.90	0.00	1.17	5.58	5.22	4.03	1.43	3.74	1.90	2.06	0.22	0.00	1.12	1.56	0.35	4.27	2.51	2.12	0.30	0.03	0.03	0.00	9.15	135.05	11.52
16:45:06	247719.61	5176.02	150844.19	2090.68	122.94	1.84	140.94	7.92	0.00	3.48	0.00	0.85	1.54	1.17	0.00	5.12	4.09	1.40	4.26	1.90	2.07	0.22	0.00	1.15	1.60	0.34	4.89	2.51	1.91	0.31	0.00	0.03	0.00	8.68	140.94	11.40
16:46:07	248194.31	5398.95	156612.36	2179.90	119.28	1.75	108.27	8.16	0.00	3.93	0.00	0.90	2.03	1.22	5.55	5.23	3.86	1.43	4.88	1.98	1.80	0.22	0.00	1.13	1.71	0.35	4.62	2.68	1.78	0.30	0.00	0.03	0.00	9.80	108.27	12.08
16:47:06	251518.11	5430.14	156578.58	2186.73	122.16	1.81	105.58	8.25	0.00	3.83	0.00	0.92	2.14	1.22	0.00	5.15	3.81	1.41	4.40	1.99	2.12	0.21	0.00	1.10	1.73	0.34	4.32	2.63	1.49	0.30	0.00	0.03	0.00	9.32	105.58	12.08
16:48:08	256352.98	5275.99	153312.36	2116.57	123.93	1.84	119.40	7.95	0.00	4.35	0.00	0.93	2.83	1.18	6.52	5.26	3.97	1.44	4.25	1.93	2.39	0.20	1.30	1.06	1.67	0.35	4.39	2.54	1.98	0.29	0.00	0.03	0.00	8.95	119.40	12.30
16:49:07	247630.48	5314.52	155275.89	2148.78	124.16	1.90	113.33	8.23	0.00	3.72	0.00	1.01	2.90	1.20	7.35	4.99	3.89	1.38	4.51	1.95	2.15	0.21	0.00	1.09	1.62	0.33	4.01	2.57	1.93	0.30	0.00	0.03	0.00	9.42	113.33	11.98
16:50:07	249178.23	5273.14	157229.31	2127.44	124.39	1.89	104.47	8.02	0.00	4.23	0.00	0.99	3.31	1.19	0.00	5.00	3.78	1.37	4.83	1.94	2.19	0.20	0.00	1.06	1.62	0.33	4.60	2.60	1.64	0.29	0.00	0.03	0.00	9.27	104.47	12.25
16:51:08	253525.31	5341.66	156018.64	2147.69	125.27	1.90	107.99	7.97	0.00	3.88	0.00	0.94	3.46	1.20	6.66	5.17	4.22	1.41	4.76	1.96	1.74	0.21	0.00	1.07	1.65	0.35	4.52	2.61	1.16	0.29	0.00	0.03	0.00	9.40	107.99	11.85
16:52:06	247621.09	5334.31	158014.80	2154.78	125.80	1.83	108.32	8.07	0.00	3.51	0.00	0.94	4.00	1.21	5.21	5.11	3.51	1.40	4.88	1.96	2.10	0.22	0.00	1.13	1.65	0.34	4.55	2.63	0.99	0.30	0.00	0.03	0.00	9.15	108.32	11.58
16:53:06	247032.78	5310.97	155803.36	2146.36	127.69	1.95	120.91	8.08	0.00	3.62	0.00	0.96	3.99	1.20	6.56	5.01	4.14	1.37	4.31	1.95	1.93	0.22	0.00	1.13	1.57	0.34	4.55	2.62	1.72	0.31	0.00	0.03	0.00	9.16	120.91	11.70
16:54:08	247453.19	5304.55	155816.92	2143.05	126.56	1.90	112.14	8.05	0.00	3.76	0.00	1.00	4.71	1.20	7.35	4.84	4.25	1.32	4.64	1.95	2.02	0.22	0.00	1.12	1.54	0.32	4.65	2.60	1.54	0.30	0.00	0.03	0.00	9.46	112.14	11.82
16:55:08	246643.95	5352.39	157352.47	2163.77	125.99	2.03	108.35	8.26	0.00	4.18	0.00	1.00	4.64	1.21	0.00	4.79	3.46	1.31	4.33	1.97	1.85	0.21	0.00	1.10	1.65	0.32	4.77	2.66	1.15	0.30	0.00	0.03	0.00	9.24	108.35	12.44
16:56:07	245506.64	5333.91	156674.19	2158.26	126.22	1.97	119.24	8.21	0.00	4.07	0.00	1.09	5.21	1.21	5.72	4.55	3.78	1.24	4.55	1.98	1.66	0.21	0.00	1.10	1.66	0.30	4.63	2.63	1.07	0.30	0.00	0.03	0.00	9.60	119.24	12.28
16:57:08	248884.28	5252.36	156981.41	2119.55	126.76	1.96	119.32	7.99	0.00	3.42	0.00	1.04	5.69	1.19	0.00	4.98	4.71	1.36	4.52	1.93	2.13	0.20	0.00	1.04	1.46	0.33	4.66	2.61	0.93	0.28	0.00	0.03	0.00	9.12	119.32	11.42
16:58:06	249111.05	5370.78	158393.63	2166.95	125.71	1.96	118.72	8.25	0.00	3.72	0.00	1.00	5.79	1.21	6.92	4.72	4.00	1.29	4.51	1.97	1.74	0.21	1.13	1.09	1.57	0.32	4.37	2.69	0.87	0.30	0.00	0.03	0.00	9.28	118.72	11.97
16:59:06	248658.98	5496.76	159342.34	2218.57	125.38	2.02	108.93	8.40	0.00	3.68	0.00	1.05	5.77	1.24	6.00	4.59	3.77	1.25	4.34	2.02	1.73	0.21	0.00	1.10	1.50	0.31	4.92	2.70	1.25	0.30	0.00	0.04	0.00	10.27	108.93	12.08
17:00:06	251934.30	5580.87	160348.27	2246.69	126.73	2.02	107.35	8.32	0.00	3.95	0.00	1.06	6.11	1.26	5.64	4.55	3.94	1.24	4.29	2.05	1.90	0.21	0.00	1.12	1.61	0.30	4.74	2.71	0.89	0.30	0.00	0.04	0.00	9.55	107.35	12.27
17:01:07	252823.50	5389.14	159247.92	2167.98	127.90	2.07	115.05	8.18	0.00	3.72	0.00	1.06	6.45	1.21	6.27	4.91	4.20	1.34	4.14	1.97	2.07	0.21	0.00	1.10	1.57	0.33	4.55	2.67	1.28	0.30	0.00	0.03	0.00	9.50	115.05	11.90
17:02:06	252229.09	5534.40	158548.72	2227.46	127.52	2.08	113.92	8.25	0.00	3.69	0.00	1.03	6.58	1.25	7.50	5.04	3.86	1.38	5.02	2.03	1.95	0.21	0.00	1.10	1.54	0.34	4.61	2.65	0.97	0.30	0.00	0.04	0.00	9.23	113.92	11.94
17:03:07	250769.47	5515.69	160453.00	2222.49	126.67	2.09	106.26	8.39	0.00	4.09	0.00	1.04	6.62	1.24	6.89	4.61	3.35	1.26	4.46	2.02	1.85	0.21	0.00	1.07	1.63	0.31	4.40	2.71	0.83	0.29	0.00	0.04	0.00	9.00	106.26	12.48
17:04:08	252027.45	5517.99	158495.63	2221.21	128.27	2.04	114.08	8.36	0.00	4.14	0.00	1.01	7.04	1.24	6.24	4.81	4.21	1.31	4.81	2.02	2.16	0.22	0.00	1.13	1.53	0.32	4.89	2.68	1.12	0.31	0.00	0.04	0.00	9.38	114.08	12.50
17:05:08	249681.16	5480.16	158660.67	2210.09	127.70	2.05	109.96	8.39	0.00	4.06	0.00	1.03	6.85	1.24	7.30	4.78	3.74	1.31	4.68	2.01	1.96	0.21	0.00	1.09	1.72	0.32	4.69	2.70	1.14	0.29	0.00	0.03	0.00	9.10	109.96	12.45
Average	215043.30	2719.78	133174.77	1113.58	131.40	1.13	133.30	7.98	0.00	2.52	0.00	1.21	2.17	0.62	1.71	7.11	4.62	1.94	2.36	1.01	2.03	0.15	1.58	0.76	1.73	0.48	2.42	1.36	3.30	0.20	0.00	0.02	0.00	8.17	133.30	10.50
Standard deviation	24615.57	1869.31	16526.67	742.23	5.79	0.57	14.42	0.20	0.00	0.93	0.00	0.17	2.22	0.41	2.88	1.57	0.53	0.43	1.51	0.68	0.13	0.05	1.09	0.25	0.11	0.11	1.52	0.89	2.14	0.07	0.00	0.01	0.00	0.82	14.42	1.05
Maximum value	256352.98	5580.87	160453.00	2246.69	140.74	2.09	158.63	8.40	0.00	4.35	0.00	1.45	7.04	1.26	7.50	8.83	5.34	2.41	5.02	2.05	2.39	0.22	3.06	1.15	1.91	0.59	4.92	2.71	9.53	0.31	0.03	0.04	0.00	10.27	158.63	12.50
Minimum value	192614.77	1347.99	117451.25	568.16	119.28	0.66	104.47	7.65	0.00	1.60	0.00	0.85	0.00	0.32	0.00	4.55	3.35	1.24	1.17	0.52	1.66	0.10	0.00	0.54	1.46	0.30	1.11	0.70	0.83	0.15	0.00	0.01	0.00	7.27	104.47	9.25

[illegible]
Method title Lime Uncond
Starting Date/Time Wed Jul 01 14:15:07 1998

Time	H2O	(±)H2O	CO2	(±)CO2	CO	(±)CO	NO	(±)NO	NO2	(±)NO2	N2O	(±)N2O	NH3	(±)NH3	CH4	(±)CH4	C2H6	(±)C2H6
14:21:00	321259.16	2355.33	110533.02	900.16	69.05	0.87	141.64	20.98	0.00	1.57	0.00	2.31	0.00	0.50	0.00	14.86	6.61	4.06
14:22:01	322362.58	2358.58	111292.00	900.69	68.27	0.84	129.01	21.35	0.00	1.57	0.00	2.29	0.00	0.50	0.00	14.85	6.62	4.06
14:23:01	322023.06	2368.14	110213.65	904.58	68.90	0.87	144.14	21.16	0.00	1.52	0.00	2.26	0.00	0.51	0.00	14.57	6.55	3.98
14:24:01	317237.78	2323.85	111539.43	890.68	69.09	0.85	137.13	20.90	0.00	1.60	0.00	2.32	0.00	0.50	0.00	14.58	6.51	3.99
14:25:01	316878.47	2338.94	111488.35	898.70	69.51	0.88	140.91	20.83	0.00	1.56	0.00	2.32	0.00	0.50	0.00	14.97	6.83	4.09
14:26:02	316429.88	2278.91	112348.60	873.96	69.11	0.89	133.84	20.63	0.00	1.66	0.00	2.38	0.00	0.49	0.00	15.16	6.80	4.15
14:27:02	316588.22	2277.82	112358.60	873.44	70.28	0.88	139.81	20.65	0.00	1.58	0.00	2.39	0.00	0.49	0.00	15.17	7.08	4.15
14:28:01	334251.28	2512.37	110730.93	961.41	69.25	0.93	136.08	23.93	0.00	1.49	0.00	2.45	0.00	0.53	0.00	15.64	7.36	4.26
14:29:01	323170.56	2406.05	111571.47	918.29	70.51	0.88	139.12	21.78	0.00	1.58	0.00	2.30	0.00	0.51	0.00	14.72	6.42	4.02
14:30:01	319346.72	2363.52	111802.15	904.52	70.50	0.87	137.14	21.05	0.00	1.58	0.00	2.26	0.00	0.51	0.00	14.64	6.68	4.00
14:31:02	318152.44	2302.42	111824.21	881.69	70.81	0.85	145.80	20.64	0.00	1.47	0.00	2.27	0.00	0.49	0.00	14.78	7.23	4.04
14:32:02	315898.84	2304.46	111805.78	884.10	70.88	0.85	137.34	20.56	0.00	1.41	0.00	2.29	0.00	0.49	0.00	14.77	6.94	4.04
14:33:02	316378.25	2300.89	112164.80	882.42	70.72	0.89	134.19	20.58	0.00	1.70	0.00	2.33	0.00	0.49	0.00	15.00	7.01	4.10
14:34:01	314330.86	2287.54	111854.53	882.44	70.82	0.88	141.45	20.22	0.00	1.62	0.00	2.27	0.00	0.49	0.00	14.48	6.38	3.95
14:35:01	315468.87	2287.77	112087.86	877.87	70.85	0.85	145.69	20.23	0.00	1.38	0.00	2.24	0.00	0.49	0.00	14.51	6.74	3.97
15:11:02	314317.31	2284.77	111032.07	877.54	69.50	0.84	152.35	19.61	0.00	1.43	0.00	2.17	0.00	0.49	0.00	14.03	6.76	3.84
15:12:03	318867.47	2284.70	112838.34	880.49	67.77	0.86	128.33	20.30	0.00	1.24	0.00	2.18	0.00	0.49	0.00	14.28	6.87	3.90
15:13:03	318870.19	2309.07	112477.88	888.82	68.69	0.88	136.40	19.88	0.00	1.24	0.00	2.20	0.00	0.50	0.00	14.18	6.72	3.88
15:14:03	314882.08	2300.41	112423.78	883.12	68.39	0.84	135.09	19.88	0.00	1.32	0.00	2.16	0.00	0.49	0.00	13.86	6.43	3.78
15:15:03	316085.19	2343.08	112786.73	898.81	68.25	0.84	132.68	19.89	0.00	1.27	0.00	2.13	0.00	0.50	0.00	13.92	6.79	3.81
15:16:03	315183.41	2349.17	112088.44	901.71	68.15	0.84	138.67	20.11	0.00	1.15	0.00	2.10	0.00	0.50	0.00	13.51	6.71	3.69
15:17:02	317703.28	2361.08	111340.58	904.65	68.12	0.84	139.01	20.18	0.00	1.13	0.00	2.09	0.00	0.51	0.00	13.70	6.47	3.75
15:18:02	316216.13	2330.62	110084.28	893.93	68.22	0.84	144.94	20.02	0.00	1.23	0.00	2.08	0.00	0.50	0.00	13.40	6.53	3.66
15:19:04	315461.66	2308.75	110388.86	888.02	67.81	0.82	148.86	19.64	0.00	1.13	0.00	2.10	0.00	0.50	0.00	13.72	6.70	3.75
15:20:04	313610.19	2249.24	110888.88	864.33	67.32	0.80	147.05	19.30	0.00	1.17	0.00	2.10	0.00	0.48	0.00	13.58	6.49	3.71
15:21:04	313309.03	2252.68	111403.25	865.84	67.02	0.82	147.30	19.39	0.00	1.34	0.00	2.11	0.00	0.48	0.00	13.98	6.54	3.82
15:22:05	312481.09	2329.05	111484.87	895.74	68.71	0.81	145.00	19.21	0.00	1.34	0.00	2.11	0.00	0.50	0.00	13.49	6.23	3.69
15:23:05	313108.88	2255.68	112624.87	867.11	67.44	0.80	135.01	19.56	0.00	1.17	0.00	2.08	0.00	0.49	0.00	13.72	6.54	3.75
15:24:05	312589.25	2283.71	112199.59	878.22	67.71	0.82	135.75	19.45	0.00	1.39	0.00	2.16	0.00	0.49	0.00	13.86	6.70	3.82
15:25:05	312542.59	2285.98	111317.00	871.43	67.72	0.83	141.56	19.38	0.00	1.25	0.00	2.11	0.00	0.49	0.00	13.93	6.89	3.81
15:26:05	312659.09	2232.88	111704.04	858.64	67.60	0.81	136.63	19.45	0.00	1.40	0.00	2.12	0.00	0.48	0.00	14.19	7.07	3.88
15:27:04	312922.56	2319.88	111600.09	891.92	67.63	0.84	142.08	19.13	0.00	1.45	0.00	2.17	0.00	0.50	0.00	13.75	6.65	3.76
15:28:05	316225.44	2380.66	111184.83	905.45	67.19	0.80	139.12	19.86	0.00	1.28	0.00	2.10	0.00	0.51	0.00	13.53	6.19	3.70
15:29:05	312018.00	2289.14	112282.18	880.68	67.83	0.79	138.34	18.80	0.00	1.14	0.00	2.06	0.00	0.49	0.00	13.55	6.59	3.70
15:30:05	311276.91	2259.68	112482.47	869.80	68.50	0.80	137.53	18.90	0.00	1.34	0.00	2.08	0.00	0.49	0.00	13.50	6.25	3.69
15:31:05	311348.16	2280.84	113054.80	870.21	68.53	0.81	130.92	19.20	0.00	1.26	0.00	2.14	0.00	0.49	0.00	13.69	6.64	3.74
15:32:05	308202.75	2229.77	112188.68	859.68	70.18	0.82	144.57	18.69	0.00	1.36	0.00	2.15	0.00	0.48	0.00	13.72	6.42	3.75
15:33:04	309205.47	2218.98	112806.27	865.42	70.18	0.82	145.20	18.52	0.00	1.28	0.00	2.18	0.00	0.48	0.00	13.78	6.77	3.76
15:34:04	307024.61	2189.13	112242.56	846.25	70.80	0.84	152.20	18.52	0.00	1.38	0.00	2.17	0.00	0.47	0.00	14.01	6.68	3.83
15:35:04	310041.38	2207.78	112388.84	850.59	70.20	0.84	144.47	18.62	0.00	1.32	0.00	2.17	0.00	0.48	0.00	14.01	6.87	3.83
16:11:07	316700.09	2285.08	113850.82	878.15	65.39	0.86	121.94	18.83	0.00	1.39	0.00	2.18	1.22	0.49	0.00	13.94	6.63	3.81
16:12:07	314077.38	2303.79	113282.20	885.00	65.03	0.84	128.12	19.06	0.00	1.61	0.00	2.20	0.98	0.50	0.00	14.20	6.60	3.88
16:13:07	315067.88	2314.18	114317.00	888.36	64.56	0.85	122.02	18.86	0.00	1.53	0.00	2.20	0.54	0.50	0.00	14.07	6.70	3.85
16:14:08	314987.94	2271.59	115172.77	872.08	64.34	0.86	114.73	19.13	0.00	1.45	0.00	2.22	0.00	0.49	0.00	14.49	7.21	3.96
16:15:08	316245.28	2281.34	114608.89	875.01	64.35	0.85	119.51	18.92	0.00	1.47	0.00	2.21	0.00	0.49	0.00	14.23	7.08	3.89
16:16:08	317719.22	2282.14	113660.93	878.22	64.57	0.85	122.28	19.23	0.00	1.66	0.00	2.25	0.00	0.49	0.00	14.78	7.25	4.04
16:17:07	317560.00	2288.63	113447.38	878.88	63.88	0.84	128.25	19.12	0.00	1.72	0.00	2.27	0.00	0.49	0.00	14.52	7.34	3.97
16:18:07	301238.13	7804.77	133712.45	2771.56	64.15	1.09	126.93	17.29	0.00	9.67	0.00	1.69	2.69	1.55	0.00	10.36	4.78	2.83
16:19:07	302480.13	6833.82	136869.77	2525.03	63.90	1.09	121.41	16.91	0.00	9.04	0.00	1.64	1.65	1.41	0.00	9.80	5.34	2.68
16:20:07	301403.25	6782.61	136380.27	2475.29	63.69	1.15	121.49	16.38	0.00	8.91	0.00	1.61	1.70	1.39	0.00	9.62	5.20	2.63
16:21:08	302184.34	6869.20	138636.52	2501.97	63.56	1.09	120.12	16.43	0.00	8.38	0.00	1.61	1.48	1.40	0.00	9.76	4.52	2.67
16:22:08	302007.66	6787.27	138675.59	2476.02	63.29	1.12	128.10	16.52	0.00	8.35	0.00	1.71	1.44	1.39	0.00	9.50	4.52	2.60
16:23:08	301874.78	6735.80	138418.77	2453.69	62.68	1.02	118.63	16.34	0.00	8.94	0.00	1.56	0.00	1.37	0.00	9.80	4.87	2.68
16:24:07	301561.78	6822.62	138898.38	2485.88	62.84	1.14	114.88	16.57	0.00	8.95	0.00	1.50	0.00	1.39	0.00	9.55	4.51	2.61
16:25:07	303289.47	6723.82	139475.81	2447.24	63.32	1.04	118.22	16.33	0.00	8.52	0.00	1.56	0.00	1.37	0.00	9.84	4.86	2.69
16:26:07	309821.76	6882.44	138110.84	2438.70	63.19	1.07	122.67	16.24	0.00	8.04	0.00	1.60	0.00	1.38	0.00	10.03	4.91	2.74
16:27:08	301780.31	6818.11	138280.76	2411.11	63.37	1.08	124.49	15.98	0.00	8.00	0.00	1.48	0.00	1.36	0.00	10.17	5.20	2.79
16:28:08	307870.28	6517.86	135658.00	2380.47	63.21	1.07	127.28	15.89	0.00	8.38	0.00	1.56	0.00	1.33	0.00	10.11	4.91	2.76
16:29:08	308380.38	6477.15	135868.91	2365.00	62.23	1.05	125.37	16.01	0.00	9.31	0.00	1.51	0.00	1.32	0.00	9.62	5.04	2.63
16:30:07	308562.66	6532.34	138878.84	2387.95	62.34	1.04	119.48	16.00	0.00	7.50	0.00	1.58	0.00	1.34	0.00	10.16	5.16	2.78
16:31:07	307741.34	6690.68	138802.20	2443.95	62.42	1.08	118.76	16.35	0.00	8.49	0.00	1.58	0.00	1.37	0.00	9.93	5.16	2.72
16:32:07	309484.38	6689.38	138650.23	2440.70	62.20	1.11	119.79	16.15	0.00	7.97	0.00	1.61	0.00	1.37	0.00	9.71	5.14	2.66
16:33:08	306073.34	6532.73	138842.38	2365.74	62.66	1.07	123.05	16.07	0.00	8.18	0.00	1.66	0.00	1.33	0.00	10.01	5.22	2.74
16:34:08	308580.28	6501.34	135473.81	2373.52	62.86	1.07	128.76	15.72	0.00	8.15	0.00	1.67	0.00	1.33	0.00	9.59	4.95	2.62
16:35:08	308408.53	6559.31	135747.73	2384.83	62.51	1.05	123.30	15.63	0.00	8.14	0.00	1.60	0.00	1.34	0.00	9.72	4.76	2.68
17:11:08	304011.81	6804.68	141128.88	2510.43	64.69	1.14	105.14	16.90	0.00	8.97	0.00	1.61	4.72	1.40	0.00	9.47	4.69	2.59
17:12:08	307534.25	6476.94	139769.38	2389.20	64.65	1.12	101.95	16.67	0.00	8.23	0.00	1.63	3.89	1.32	0.00	9.66	4.73	2.64
17:13:08	308574.72	6762.15	140275.47	2465.07	65.18	1.06	108.79	16.43	0.00	9.32	0.00	1.62	3.47	1.38	0.00	9.76	4.32	2.67
17:14:08	308364.09	7160.97	143273.33	2601.18	64.89	1.11	99.34	16.42	0.00	9.42	0.00	1.60	3.11	1.48	0.00	9.74	5.14	2.66
17:15:07	380136.03	6365.68	138382.75	2333.23	64.57	1.14	95.30	16.64	0.00	8.24	0.00	1.65	2.40	1.31	0.00	9.85	4.39	2.72
17:16:08	303343.53	6281.46	138428.22	2304.73	65.44	1.14	100.26	16.86	0.00	8.26	0.00	1.63	2.21	1.29	0.00	9.70	4.47	2.65
17:17:08	306363.47	6402.18	138066.09	2340.67	65.28	1.13	104.49	16.70	0.00	7.71	0.00	1.59	1.84	1.31	0.00	9.81	4.51	2.68
17:18:08	307287.75	6336.80	137876.08	2314.88	65.13	1.12	106.46	16.70	0.00	7.35	0.00	1.63	2.11	1.30	0.00	9.89	5.15	2.70
17:19:08	306142.69	6712.70	137166.00	2438.70	64.38	1.10	109.75	17.49	0.00	8.04	0.00	1.67	2.66	1.38	0.00	10.30	5.03	2.62
17:20:08	301971.84	6576.64	139468.56	2386.78	64.11	1.08	104.40	16.85	0.00	7.94	0.00	1.52	2.23	1.34	0.00	10.06	4.79	2.75
17:21:07	308077.84	6481.33	138613.53	2388.23	64.44	1.07	102.81	16.05	0.00	7.63	0.00	1.55	1.77	1.33	0.00	10.14	5.41	2.77
17:22:07	300838.58	6583.80	138858.20	2382.82	63.56	1.06	98.28	16.58	0.00	8.00	0.00	1.55	1.78	1.34	0.00	9.90	5.23	2.71
17:23:08	308867.44	6576.81	138783.82	2400.60	63.89	1.09	100.31	16.52	0.00	7.58	0.00	1.46	1.47	1.34	0.00	9.97	4.98	2.73
17:24:08	308869.75	6542.58	138275.02	2389.19	64.95	1.12	113.68	16.40	0.00	8.35	0.00	1.55	1.45	1.34	0.00	9.73	4.88	2.68
17:25:08	308208.63	6585.92	139108.39	2392.44	64.08	1.08	110.56	16.12	0.00	7.68	0.00	1.53	0.00	1.34	0.00	9.94	4.87	2.72
17:26:08	308153.72	6586.08	139858.69	2408.75	63.29	1.05	104.04	16.07	0.00	8.85	0.00	1.51	1.52	1.35	0.00	10.08	5.35	2.75
17:27:08	307787.50	6567.04	139809.58	2388.72	62.99	1.01	100.91	16.47	0.00	7.75	0.00	1.59	1.34	1.34	0.00	9.71	4.32	2.65
17:28:07	308618.66	6551.16	141509.11	2391.62	62.92	1.02	95.68	16.40	0.00	7.42	0.00	1.51	1.52	1.34	0.00	10.41	5.69	2.85
17:29:08	300361.58	6572.18	139848.27	2386.60	62.77	1.01	98.51	16.67	0.00	7.64	0.00	1.66	0.00	1.34	0.00	10.00	4.85	2.73
17:30:08	300514.63	6619.25	139895.09	2413.51	63.86	1.07	104.34	16.95	0.00	8.07	0.00	1.57	1.53	1.36	0.00	10.15	5.57	2.77
17:31:08	307946.83	6626.68	137376.96	2383.38	63.69	1.06	116.97	16.04	0.00	8.04	0.00	1.66	0.00	1.33	0.00	10.35	5.41	2.63
17:32:08	308620.84	6628.78	138924.88	2419.64	62.52	1.08	108.56	16.63	0.00	8.14	0.00	1.54	0.00	1.35	0.00	9.63	5.12	2.63
17:33:08	308408.38	6662.58	138681.42	2432.66	63.42	1.07	108.36	16.29	0.00	7.92	0.00	1.64	0.00	1.36	0.00	9.88	5.08	2.70
17:34:07	307081.88	6610.60	138650.69	2379.02	64.03	1.10	113.26	16.14	0.00	7.29	0.00	1.64	0.00	1.33	0.00	9.67	4.97	2.70
17:35:08	308339.41	6730.82	138454.14	2484.04	64.46	1.08	109.10	16.34	0.00	7.29	0.00	1.66	0.00	1.38	0.00	10.08	5.30	2.75
Average	309881.52	4378.82	124483.69	1619.62	66.08	0.96	125.32	18.23	0.00	4.67	0.00	1.91	0.69	0.91	0.00	12.15	5.88	3.32
Standard deviation	37269.74	2186.89	13087.89	770.08	2.78	0.12	15.74	1.91	0.00	3.46	0.00	0.32	1.06	0.43	0.00	2.21	0.84	0.69
Maximum value	[illegible]	7804.77	143273.33	2771.56	70.85	1.15	152.36	23.93	0.00	9.67	0.00	2.45	4.72	1.56	0.00	15.64	7.36	4.26
Minimum value	307024.81	2189.13	110084.28	846.25	62.20	0.79	95.30	15.63	0.00	1.13	0.00	1.46	0.00	0.47	0.00	9.47	4.32	2.59

Time	C2H4	(±)C2H4	H2CO	(±)H2CO	ACTLD	(±)ACTLD	C4+	(±)C4+	CH3OH	(±)CH3OH	HCL	(±)HCL	SF6	(±)SF6	SO2	(±)SO2	NOX	(±)NOX
14:21:00	0.00	0.82	0.18	0.16	0.00	0.84	0.00	1.00	0.00	0.96	17.07	0.23	0.00	0.01	0.00	7.33	141.64	22.58
14:22:01	0.00	0.82	0.00	0.16	0.00	0.83	0.00	0.99	0.00	0.95	16.07	0.22	0.00	0.01	0.00	7.21	129.01	22.92
14:23:01	0.00	0.82	0.21	0.16	0.00	0.84	0.00	0.98	0.00	0.94	15.31	0.23	0.00	0.01	0.00	6.97	144.14	22.67
14:24:01	0.00	0.81	0.00	0.15	0.00	0.81	0.00	0.98	0.00	0.94	14.88	0.22	0.00	0.01	0.00	7.17	137.13	22.70
14:25:01	0.00	0.82	0.23	0.15	0.00	0.81	0.00	1.00	0.00	0.94	14.42	0.22	0.00	0.01	0.00	7.21	140.91	22.39
14:26:02	0.00	0.80	0.21	0.15	0.00	0.79	0.00	1.02	0.00	0.93	13.78	0.21	0.00	0.01	0.00	7.35	133.84	22.28
14:27:02	0.00	0.80	0.27	0.15	0.00	0.78	0.00	1.02	0.00	0.94	13.31	0.21	0.00	0.01	0.00	7.33	139.81	22.24
14:28:01	0.00	0.87	0.47	0.15	0.00	0.76	0.00	1.05	0.00	0.99	12.41	0.21	0.00	0.02	0.00	6.82	136.08	25.42
14:29:01	0.00	0.84	0.21	0.14	0.00	0.75	1.03	0.99	0.00	0.95	12.21	0.20	0.00	0.01	0.00	6.88	139.12	23.36
14:30:01	0.00	0.82	0.24	0.15	0.00	0.78	0.00	0.98	0.00	0.95	12.17	0.21	0.00	0.01	0.00	6.86	137.14	22.63
14:31:02	0.00	0.80	0.22	0.14	0.00	0.74	0.00	0.99	0.00	0.94	11.92	0.20	0.00	0.01	0.00	7.28	145.80	22.11
14:32:02	0.00	0.80	0.26	0.14	0.00	0.75	1.01	0.99	0.00	0.96	11.73	0.20	0.00	0.01	0.00	7.32	137.34	21.97
14:33:02	0.00	0.80	0.28	0.15	0.00	0.78	0.00	1.00	0.00	0.96	11.47	0.21	0.00	0.01	0.00	7.09	134.19	22.28
14:34:01	0.00	0.80	0.18	0.15	0.00	0.80	1.05	0.97	0.00	0.93	11.48	0.22	0.00	0.01	0.00	7.00	141.45	21.84
14:35:01	0.00	0.80	0.20	0.14	0.00	0.73	0.00	0.97	0.00	0.95	11.40	0.20	0.00	0.01	0.00	7.22	145.69	21.61
15:11:02	0.00	0.80	0.20	0.13	0.00	0.66	1.07	0.94	0.00	0.95	5.04	0.18	0.00	0.01	0.00	6.95	152.35	21.04
15:12:03	0.00	0.80	0.25	0.13	0.00	0.68	1.01	0.95	0.00	0.98	5.31	0.18	0.00	0.01	0.00	7.31	128.33	21.54
15:13:03	0.00	0.81	0.13	0.13	0.00	0.67	1.03	0.95	0.00	0.98	5.88	0.18	0.00	0.01	0.00	7.18	136.40	21.22
15:14:03	0.00	0.80	0.18	0.14	0.00	0.73	0.98	0.93	0.00	0.98	5.88	0.20	0.00	0.01	0.00	7.60	135.09	21.20
15:15:03	0.00	0.82	0.28	0.12	0.00	0.62	1.03	0.93	0.00	0.98	6.01	0.17	0.00	0.01	0.00	7.42	132.68	21.16
15:16:03	0.00	0.82	0.18	0.12	0.00	0.65	1.08	0.90	0.00	0.95	6.14	0.18	0.00	0.01	0.00	7.08	138.67	21.26
15:17:02	0.00	0.82	0.23	0.13	0.00	0.68	1.08	0.92	0.00	0.95	6.38	0.18	0.00	0.01	0.00	7.01	139.01	21.31
15:18:02	0.00	0.81	0.24	0.13	0.00	0.66	1.03	0.90	0.00	0.98	6.32	0.18	0.00	0.01	0.00	6.88	144.94	21.25
15:19:04	0.00	0.81	0.16	0.13	0.00	0.66	1.00	0.92	0.00	0.94	6.64	0.18	0.00	0.01	0.00	6.81	148.86	20.76
15:20:04	0.00	0.79	0.18	0.13	0.00	0.69	1.03	0.91	0.00	0.95	6.63	0.18	0.00	0.01	0.00	6.94	147.05	20.47
15:21:04	0.00	0.79	0.20	0.13	0.00	0.67	1.09	0.94	0.00	0.94	6.59	0.18	0.00	0.01	0.00	6.89	147.30	20.73
15:22:05	0.00	0.82	0.19	0.13	0.00	0.66	0.99	0.90	0.00	0.94	6.75	0.18	0.00	0.01	0.00	7.31	145.00	20.56
15:23:05	0.00	0.79	0.17	0.13	0.00	0.66	1.09	0.92	0.00	0.95	6.70	0.18	0.00	0.01	0.00	7.03	135.01	20.73
15:24:05	0.00	0.80	0.00	0.13	0.00	0.66	1.05	0.94	0.00	0.92	6.73	0.18	0.00	0.01	0.00	7.06	135.75	20.83
15:25:05	0.00	0.79	0.00	0.13	0.00	0.66	1.04	0.93	0.00	0.94	6.78	0.18	0.00	0.01	0.00	7.02	141.56	20.61
15:26:05	0.00	0.78	0.25	0.12	0.00	0.63	1.07	0.95	0.00	0.94	6.70	0.17	0.00	0.01	0.00	6.98	136.63	20.84
15:27:04	0.00	0.81	0.24	0.13	0.00	0.68	1.01	0.92	0.00	0.94	6.82	0.18	0.00	0.01	0.00	6.94	142.08	20.59
15:28:05	0.00	0.82	0.22	0.14	0.00	0.71	1.04	0.91	0.00	0.95	9.38	0.19	0.00	0.01	0.00	6.80	139.12	21.14
15:29:05	0.00	0.80	0.15	0.12	0.00	0.64	1.10	0.91	0.00	0.98	6.92	0.17	0.00	0.01	0.00	6.86	138.34	19.94
15:30:05	0.00	0.79	0.00	0.13	0.00	0.67	1.13	0.90	0.00	0.94	6.82	0.18	0.00	0.01	0.00	6.91	137.53	20.24
15:31:05	0.00	0.79	0.14	0.13	0.00	0.66	1.07	0.92	0.00	0.93	6.86	0.18	0.00	0.01	0.00	7.04	130.92	20.46
15:32:05	0.00	0.78	0.19	0.13	0.00	0.69	1.13	0.92	0.00	0.93	6.72	0.19	0.00	0.01	0.00	7.09	144.57	20.04
15:33:04	0.00	0.78	0.22	0.13	0.00	0.69	1.11	0.92	0.00	0.94	6.71	0.19	0.00	0.01	0.00	7.03	145.20	19.80
15:34:04	0.00	0.77	0.19	0.13	0.00	0.69	1.14	0.94	0.00	0.93	6.56	0.19	0.00	0.01	0.00	7.04	152.20	19.80
15:35:04	0.00	0.77	0.22	0.13	0.00	0.66	1.10	0.94	0.00	0.95	6.40	0.18	0.00	0.01	0.00	7.17	144.47	20.14
16:11:07	0.00	0.80	0.27	0.13	0.00	0.66	1.00	0.93	0.00	0.96	1.84	0.18	0.00	0.01	0.00	7.22	121.94	20.22
16:12:07	0.00	0.81	0.28	0.12	0.00	0.64	0.97	0.95	0.00	0.97	1.94	0.17	0.00	0.01	0.00	7.16	128.12	20.68
16:13:07	0.00	0.81	0.25	0.12	0.00	0.64	0.98	0.94	0.00	0.98	1.87	0.17	0.00	0.01	0.00	7.28	122.02	20.39
16:14:08	0.00	0.79	0.20	0.12	0.00	0.62	0.00	0.97	0.00	0.95	1.89	0.17	0.00	0.01	0.00	7.33	114.73	20.58
16:15:08	0.00	0.80	0.18	0.13	0.00	0.67	0.00	0.95	0.00	0.97	2.09	0.18	0.00	0.01	0.00	7.31	119.51	20.39
16:16:08	0.00	0.80	0.19	0.12	0.00	0.64	0.00	0.99	0.00	0.99	2.05	0.17	0.00	0.01	0.00	7.01	122.28	20.89
16:17:07	0.00	0.80	0.19	0.13	0.00	0.68	1.02	0.97	0.00	0.97	2.16	0.18	0.00	0.01	0.00	6.99	128.25	20.83
16:18:07	0.00	2.52	0.00	0.22	0.00	1.13	0.00	0.89	3.80	2.90	3.24	0.31	0.00	0.04	0.00	8.39	126.93	28.96
16:19:07	2.78	2.30	0.00	0.20	0.00	1.05	0.00	0.88	3.71	2.77	2.61	0.28	0.00	0.04	0.00	8.50	121.41	25.95
16:20:07	2.59	2.25	0.00	0.21	0.00	1.12	0.78	0.84	3.58	2.71	2.49	0.30	0.00	0.04	0.00	8.90	121.49	25.29
16:21:08	2.95	2.28	0.27	0.22	0.00	1.15	0.82	0.85	3.24	2.67	2.44	0.31	0.00	0.04	0.00	8.27	120.12	24.80
16:22:08	3.24	2.25	0.30	0.22	0.00	1.17	0.91	0.84	3.98	2.72	2.20	0.32	0.00	0.04	0.00	8.24	128.10	24.87
16:23:08	2.51	2.23	0.00	0.23	0.00	1.20	0.81	0.86	4.19	2.85	2.53	0.32	0.00	0.04	0.00	8.02	118.63	25.27
16:24:07	2.43	2.26	0.00	0.20	0.00	1.07	0.82	0.84	4.26	2.69	2.69	0.29	0.00	0.04	0.00	8.06	114.88	26.62
16:25:07	2.62	2.23	0.00	0.22	0.00	1.14	0.77	0.86	3.78	2.88	2.21	0.31	0.00	0.04	0.00	8.31	118.22	24.85
16:26:07	2.31	2.21	0.40	0.22	0.00	1.14	0.90	0.87	3.74	2.89	2.49	0.31	0.00	0.04	0.00	9.00	122.67	24.28
16:27:08	2.60	2.19	0.46	0.21	0.00	1.09	0.90	0.88	3.90	2.91	2.68	0.29	0.00	0.04	0.00	7.79	124.49	23.99
16:28:08	2.84	2.17	0.00	0.20	0.00	1.04	0.97	0.88	3.60	2.85	2.21	0.28	0.00	0.04	0.00	8.91	127.28	24.28
16:29:08	2.24	2.15	0.00	0.21	0.00	1.10	0.80	0.84	3.55	2.60	2.80	0.30	0.00	0.04	0.00	8.31	125.37	25.32
16:30:07	2.97	2.17	0.00	0.22	0.00	1.15	0.92	0.88	3.38	2.61	2.67	0.31	0.00	0.04	0.00	8.40	119.48	23.80
16:31:07	2.88	2.22	0.00	0.22	0.00	1.13	0.84	0.87	3.46	2.62	2.67	0.31	0.00	0.04	0.00	8.10	118.76	24.84
16:32:07	2.79	2.22	0.00	0.21	0.00	1.13	0.86	0.85	3.49	2.62	2.74	0.30	0.00	0.04	0.00	8.17	119.79	24.12
16:33:08	2.98	2.17	0.25	0.21	0.00	1.11	0.80	0.87	3.30	2.67	2.30	0.30	0.00	0.04	0.00	8.04	123.05	24.25
16:34:08	2.35	2.16	0.00	0.22	0.00	1.18	0.83	0.84	3.60	2.58	2.61	0.31	0.00	0.04	0.00	8.59	128.76	23.87
16:35:08	2.26	2.18	0.00	0.21	0.00	1.08	0.97	0.85	3.78	2.85	2.61	0.29	0.00	0.04	0.00	8.18	123.30	23.77
17:11:08	2.56	2.29	0.22	0.22	0.00	1.16	0.75	0.83	3.72	2.73	0.83	0.31	0.00	0.04	0.00	8.33	105.14	25.88
17:12:08	2.78	2.15	0.00	0.21	0.00	1.11	0.95	0.85	3.71	2.64	0.80	0.30	0.00	0.04	0.00	8.69	101.95	24.90
17:13:08	3.00	2.24	0.00	0.21	0.00	1.09	0.86	0.85	3.47	2.69	1.48	0.30	0.00	0.04	0.00	8.41	108.79	25.75
17:14:08	2.82	2.37	0.00	0.21	0.00	1.09	0.81	0.85	4.09	2.81	1.27	0.29	0.00	0.04	0.00	9.40	99.34	25.84
17:15:07	2.72	2.12	0.00	0.20	0.00	1.03	0.70	0.87	3.73	2.54	1.42	0.28	0.00	0.04	0.00	8.79	95.30	24.68
17:16:08	2.49	2.10	0.00	0.20	0.00	1.05	0.80	0.85	3.59	2.59	1.61	0.28	0.00	0.04	0.00	8.88	100.26	26.14
17:17:08	2.73	2.13	0.32	0.20	0.00	1.08	0.72	0.86	3.91	2.59	1.38	0.29	0.00	0.04	0.00	8.63	104.49	24.40
17:18:08	2.56	2.11	0.32	0.21	0.00	1.09	0.70	0.88	3.74	2.55	1.43	0.29	0.00	0.04	0.00	8.80	106.46	24.06
17:19:08	2.22	2.22	0.26	0.22	0.00	1.17	0.86	0.89	3.64	2.69	2.00	0.32	0.00	0.04	0.00	8.28	109.75	26.64
17:20:08	3.03	2.18	0.27	0.22	0.00	1.14	0.89	0.87	3.74	2.66	2.22	0.31	0.00	0.04	0.00	8.89	104.40	24.79
17:21:07	2.58	2.16	0.00	0.22	0.00	1.13	0.00	0.86	3.82	2.61	2.22	0.31	0.00	0.04	0.00	9.00	102.81	23.88
17:22:07	2.75	2.18	0.28	0.22	0.00	1.16	0.70	0.86	3.47	2.60	2.28	0.31	0.00	0.04	0.00	8.01	98.28	24.58
17:23:08	2.75	2.19	0.00	0.22	0.00	1.14	0.70	0.87	3.85	2.65	1.83	0.31	0.00	0.04	0.00	8.52	100.31	24.07
17:24:08	2.38	2.17	0.00	0.22	0.00	1.16	0.00	0.85	3.67	2.62	1.87	0.31	0.00	0.04	0.00	9.08	113.68	24.75
17:25:08	2.77	2.18	0.00	0.22	0.00	1.17	0.78	0.87	3.59	2.66	1.63	0.32	0.00	0.04	0.00	8.64	110.56	23.80
17:26:08	2.55	2.18	0.32	0.21	0.00	1.12	0.74	0.87	3.63	2.64	1.84	0.30	0.00	0.04	0.00	8.93	104.04	24.92
17:27:08	2.94	2.18	0.31	0.22	0.00	1.17	0.80	0.85	3.64	2.63	1.78	0.32	0.00	0.04	0.00	8.64	100.91	24.21
17:28:07	2.52	2.18	0.36	0.22	0.00	1.13	0.00	0.70	4.20	2.63	1.61	0.31	0.00	0.04	0.00	8.38	95.68	23.82
17:29:08	3.03	2.18	0.00	0.21	0.00	1.12	0.79	0.87	4.32	2.69	2.13	0.30	0.00	0.04	0.00	9.18	98.51	24.30
17:30:08	2.62	2.20	0.00	0.23	0.00	1.19	0.89	0.86	3.64	2.66	2.16	0.32	0.00	0.04	0.00	8.44	104.34	25.02
17:31:08	2.66	2.17	0.00	0.22	0.00	1.18	0.74	0.88	4.00	2.98	1.80	0.31	0.00	0.04	0.00	8.72	116.97	24.09
17:32:08	2.70	2.20	0.00	0.22	0.00	1.17	0.78	0.85	3.83	2.85	2.08	0.32	0.00	0.04	0.00	8.01	108.56	24.77
17:33:08	2.65	2.21	0.00	0.22	0.00	1.14	0.77	0.88	3.80	2.85	2.08	0.31	0.00	0.04	0.00	8.43	108.36	24.21
17:34:07	2.42	2.17	0.38	0.21	0.00	1.12	0.83	0.88	4.04	2.64	1.72	0.30	0.00	0.04	0.00	8.70	113.26	23.42
17:35:08	3.02	2.24	0.00	0.21	0.00	1.09	0.87	0.87	3.86	2.63	2.00	0.28	0.00	0.04	0.00	8.89	109.10	23.83
Average	1.25	1.47	0.16	0.17	0.00	0.90	0.72	0.91	1.79	1.78	6.18	0.24	0.00	0.02	0.00	7.78	125.32	22.80
Standard deviation	1.35	0.71	0.13	0.04	0.00	0.20	0.40	0.16	1.89	0.86	4.23	0.06	0.00	0.01	0.00	0.77	15.74	1.84
Maximum value	3.24	2.52	0.47	0.23	0.00	1.20	1.14	1.06	4.32	2.91	17.07	0.32	0.00	0.04	0.00	9.40	152.35	28.96
Minimum value	0.00	0.77	0.00	0.12	0.00	0.62	0.00	0.83	0.00	0.92	0.80	0.17	0.00	0.01	0.00	6.81	95.30	19.80

All data in ppmv wet basis																												
Title conditioned outlet/inlet kiln 2																												
Description Austin White																												
Method title Sac Al cond																												
Starting Date/Time: Wed Jul 01 19 26.02 1998																												
Time	C6H6	(+-)C6H6	C7H8	(+-)C7H8	OXYL	(+-)OXYL	MXYL	(+-)MXYL	PXYL	(+-)PXYL	STYR	(+-)STYR	13BUT	(+-)13BUT	CO2	(+-)CO2	H2O	(+-)H2O	C2H4	(+-)C2H4	C2H2	(+-)C2H2	C3H6	(+-)C3H6	CH3OH	(+-)CH3OH		
20 01:57	0.76	0 33	0 00	1 05	0.00	0 67	0 00	1 41	1 98	1 53	0 00	1 22	0 00	0 20	0 00	0 59	0 00	126 96	2 27	0 12	0 18	0 18	1 54	0 35	0 00	0 14		
20:02 57	0 82	0 32	0.00	1 01	0 00	0 65	0 00	1 36	1 84	1 47	0 00	1 18	0 00	0 19	0 00	0 57	0 00	122 04	2 49	0 11	0 20	0.17	1 05	0 32	0 00	0 13		
20 03.56	0 84	0 41	0.00	1 28	0 00	0 82	0 00	1 72	2 11	1 87	0 00	1 50	0 00	0 19	0 00	0 72	0 00	154 98	2 53	0 11	0 00	0 22	1 73	0 32	0.00	0 13		
20 04 56	0.82	0 43	0 00	1.36	0 00	0 87	0 00	1 83	0 00	1 99	0 00	1 59	0 00	0 18	0 00	0 76	0 00	164 91	2 61	0 11	0 00	0 23	1 41	0 31	0 00	0 12		
20.05.56	0 88	0 45	0 00	1 41	0 00	0 90	0 00	1 89	0 00	2 05	0 00	1 64	0 00	0 18	0 00	0 79	0 00	170 12	2 62	0 10	0 00	0 24	1 74	0 30	0 00	0 12		
20 06.57	0 91	0 52	0 00	1 64	0 00	1.05	0 00	2 20	0 00	2 39	0 00	1 91	0 00	0 18	0 00	0 92	0 00	198 39	2 56	0 11	0 00	0 28	1 51	0 31	0 00	0 12		
20 07 57	0 93	0 53	0 00	1 67	0 00	1 07	0 00	2 25	0 00	2 44	0 00	1 95	0 00	0 18	0 00	0 94	0 00	202 44	2 72	0 11	0 00	0 29	1 31	0 31	0 00	0 12		
20 08.57	0 90	0 59	0 00	1 87	0 00	1 20	0 00	2 51	0 00	2 73	0 00	2 18	0 00	0 17	0 00	1 05	0 00	226 03	2 71	0 10	0 00	0 32	1 57	0 30	0 00	0 12		
20:09 57	0 91	0.56	0 00	1 78	0 00	1.14	0 00	2 39	0 00	2 59	0 00	2 07	0 00	0 18	0 00	1 00	0 00	214 77	2 71	0 11	0 00	0 31	1 55	0 31	0 00	0 12		
20:10 57	0 96	0 55	0.00	1 75	0 00	1 12	0 00	2 35	0 00	2 55	0 00	2 04	0 00	0 18	0 00	0 98	0 00	211 51	2 75	0 11	0 00	0 30	1 70	0.31	0 00	0 12		
20 11 58	0 96	0 55	0 00	1 74	0 00	1.11	0 00	2 34	0 00	2 54	0 00	2 03	0 00	0 17	0 00	0 97	0 00	210 27	2 71	0 10	0 00	0 30	1 53	0 30	0 00	0 12		
20:12 58	0.87	0 62	0 00	1 95	0 00	1 25	0.00	2 62	0 00	2 85	0 00	2 28	0 00	0 18	0 00	1 09	0 00	236 12	2 85	0 10	0 00	0 34	1 65	0 30	0 00	0 12		
20:13 58	0 91	0 58	0.00	1 83	0 00	1 17	0 00	2 45	0 00	2 66	0 00	2 13	0 00	0 19	0 00	1 02	0 00	220 66	2 78	0 11	0 00	0 31	1.75	0 33	0 00	0.13		
20.14.58	0 99	0.59	0 00	1 85	0 00	1.18	0 00	2 48	0 00	2 70	0 00	2 16	0 00	0 20	0 00	1 04	0 00	223 63	2 71	0 12	0 00	0 32	1.75	0 34	0 00	0 13		
20:15:59	0 90	0.59	0 00	1.87	0 00	1 20	0 00	2 51	0 00	2 73	0 00	2 18	0 00	0 18	0 00	1 05	0 00	226 21	2 74	0 10	0 00	0 32	1.78	0 30	0 00	0 12		
20:16 59	0 89	0 58	0 00	1 84	0 00	1 18	0 00	2 47	0 00	2 69	0 00	2 15	0 18	0 17	0 00	1 03	0 00	222 49	2 78	0 10	0 00	0 32	1 64	0 30	0 00	0 12		
20:17:59	0 83	0 57	0 00	1.79	0.00	1.15	0 00	2.41	0 00	2 62	0 00	2 09	0 18	0 17	0 00	1 01	0 00	216 98	2 65	0 10	0 00	0.31	1.68	0 29	0.00	0 12		
20:18:58	0 85	0 56	0 00	1.77	0.00	1 13	0 00	2 37	0 00	2 58	0 00	2 06	0 18	0 16	0 00	0 99	0 00	213 74	2 73	0 09	0 00	0 30	1.66	0 27	0.00	0.11		
20.19.58	0 85	0 61	0.00	1 94	0 00	1 24	0.00	2 60	0 00	2 82	0 00	2 26	0 00	0 15	0 00	1 08	0 00	233.95	2 72	0 09	0.00	0 33	1.29	0 26	0 00	0 10		
20 20.58	0 76	0.63	0 00	1 98	0 00	1 27	0.00	2 66	0 00	2 90	0 00	2 31	0 34	0 15	0 00	1 11	0 00	239 88	2 64	0 09	0.00	0.34	1 74	0 26	0 00	0 10		
20:21:58	0.85	0 61	0.00	1 93	0 00	1 24	0 00	2 60	0 00	2 82	0 00	2 26	0 00	0 16	0 00	1 08	0 00	233 78	2 68	0 10	0 00	0 33	1 97	0.26	0 00	0 11		
20 22:59	0 93	0.66	0 00	2 07	0 00	1 33	0 00	2 78	0 00	3 03	0 00	2 42	0 00	0 17	0 00	1 16	0 00	250 66	2.69	0 10	0 00	0 36	2.07	0 30	0 00	0.12		
20:23:59	0.93	0.68	0 00	2.15	0 00	1 37	0.00	2 88	0 00	3 13	0 00	2 50	0 28	0 18	0 00	1 20	0 00	259 63	2 82	0 10	0 00	0 37	2.02	0 30	0 00	0 12		
20.24:59	0 93	0 71	0.00	2 23	0 00	1 43	0 00	3 00	0 00	3.26	0 00	2 60	0 00	0 19	0 00	1 25	0 00	269 70	2 69	0 11	0 00	0 38	2 00	0 32	0 00	0.13		
20:25.58	1 09	0.78	0 00	2 47	0 00	1 58	0 00	3 31	0 00	3 60	0 00	2 88	0 00	0 21	0 00	1 38	0 00	298 09	2 77	0 12	0 00	0 42	1 91	0.36	0.00	0 14		
Average	0 89	0.56	0.00	1 77	0 00	1 13	0 00	2 38	0 24	2 58	0 00	2 06	0 05	0 18	0 00	0 99	0 00	213 92	2 68	0 10	0 02	0 30	1.66	0 31	0 00	0.12		
Standard deviation	0 07	0 11	0 00	0 34	0 00	0 22	0 00	0 45	0 66	0 50	0 00	0 40	0 10	0 01	0 00	0 19	0 00	40 98	0 12	0 01	0 05	0.06	0.24	0 02	0 00	0 01		
Maximum value	1 09	0.78	0 00	2 47	0 00	1 58	0 00	3 31	2 11	3 60	0 00	2 88	0 34	0 21	0 00	1 38	0 00	298 09	2 85	0 12	0 20	0 42	2 07	0 36	0.00	0.14		
Minimum value	0.76	0.32	0 00	1 01	0 00	0 65	0 00	1 36	0 00	1 47	0 00	1 18	0 00	0 15	0 00	0 57	0 00	122 04	2 27	0 09	0 00	0 17	1 05	0 26	0 00	0 10		

Outlet

All data in ppmv wet basis																											
Title: conditioned outlet/inlet kiln 2																											
Description. Austin White																											
Method title: Sec. Al. cond																											
Starting Date/Time Wed Jul 01 19 26:02 1998																											
Time	C6H6	(+-)C6H6	C7H8	(+-)C7H8	OXYL	(+-)OXYL	MXYL	(+-)MXYL	PXYL	(+-)PXYL	STYR	(+-)STYR	13BUT	(+-)13BUT	CO2	(+-)CO2	H2O	(+-)H2O	C2H4	(+-)C2H4	C2H2	(+-)C2H2	C3H6	(+-)C3H6	CH3OH	(+-)CH3OH	
19 31 56	0 43	0 11	0.00	0 36	0 00	0 23	0 00	0 48	1 22	0 52	0 00	0 42	0 00	0 18	0 00	0 20	0 00	43 29	1 46	0 10	0.19	0 06	1 24	0 31	0 00	0 12	
19 32 56	0 49	0 13	0 00	0 40	0 00	0 26	0 00	0 54	1 42	0 58	0 00	0 47	0 00	0 18	0 00	0 22	0 00	48 36	1 63	0 10	0 17	0 07	0 76	0 30	0 00	0 12	
19 33 57	0 46	0 12	0 00	0 38	0 00	0 24	0 00	0 51	1 50	0 56	0 00	0 45	0 00	0 19	1 42	0 21	0 00	46 17	1 54	0 11	0 17	0 07	0 82	0 32	0 00	0 13	
19 34 55	0 35	0 12	0 00	0 39	0 00	0 25	0 00	0 52	1 44	0 57	0 00	0 45	0 00	0 19	1 51	0 22	0 00	46 97	1 63	0 11	0 19	0 07	0 78	0 32	0 00	0 13	
19 35 56	0 54	0 15	0 00	0 47	0.00	0 30	0 00	0 64	1 44	0 69	0 00	0 55	0 00	0 19	3 51	0 27	0 00	57 32	1.58	0 11	0.13	0 08	1 24	0 33	0 00	0 13	
19:36:56	0.43	0 12	0 00	0 37	0 00	0 24	0 00	0 50	1 26	0 55	0 00	0 44	0 00	0 20	0 00	0 21	0 00	45 24	1 65	0 12	0 16	0 06	0 76	0 34	0 00	0 13	
19:37 56	0 52	0 13	0 00	0 41	0 00	0 26	0 00	0 55	1 58	0 59	0 00	0 47	0 00	0 18	0 00	0 23	0 00	49 16	1 55	0 11	0 17	0 07	0 56	0 31	0 00	0 12	
19 38 56	0 47	0 15	0 00	0 49	0 00	0 31	0 00	0 65	1 47	0 71	0 00	0 57	0 00	0 19	3 29	0 27	0 00	58 69	1 61	0 11	0 18	0 08	1 05	0 33	0 00	0 13	
19 39 57	0.44	0 21	0.00	0 65	0 00	0 42	0 00	0 88	1 45	0 95	0 00	0 78	0 00	0 19	5 79	0 37	0 00	78 79	1 62	0 11	0 16	0 11	0 63	0 33	0 00	0 13	
19 40 55	0 33	0 17	0.00	0 55	0 00	0 35	0 00	0 73	1 37	0.80	0 00	0 64	0 00	0 19	4 25	0 31	0 00	65 88	1 66	0 11	0.15	0 09	1.27	0 33	0 00	0.13	
19.41:56	0 41	0.17	0.00	0 55	0 00	0.35	0.00	0 74	1.22	0 81	0 00	0 64	0 00	0 19	4 81	0 31	0 00	66 73	1 73	0 11	0.16	0.10	0 69	0.32	0 00	0 13	
19:42.56	0 36	0 19	0 00	0 60	0 00	0 39	0.00	0 81	1 39	0 88	0 00	0 70	0.00	0 18	4 98	0 34	0 00	73 06	1 60	0 11	0 19	0.10	1.12	0 31	0 00	0.12	
19:43.56	0 39	0 17	0 00	0 52	0.00	0 33	0 00	0.70	1 18	0 76	0 00	0 61	0 00	0 18	5 29	0 29	0 00	62 98	1 60	0 11	0 20	0 09	1 06	0 31	0 00	0.12	
19 44.56	0 39	0.19	0.00	0 61	0 00	0 39	0 00	0 82	1 37	0 89	0 00	0 71	0 00	0 18	5 28	0 34	0 00	73 97	1 82	0 11	0 15	0 11	0 74	0 31	0 00	0 12	
19:45:56	0 36	0 18	0.00	0 56	0 00	0 36	0 00	0 76	1 10	0 82	0 00	0 66	0 00	0 18	6 25	0 32	0 00	68 22	1 61	0 11	0.18	0 10	0 86	0 31	0 00	0 12	
19:46 57	0 40	0 18	0.00	0 58	0 00	0 37	0 00	0 77	1 36	0 84	0 00	0 67	0 00	0 19	5 74	0 32	0 00	69 64	1 64	0 11	0 17	0 10	1 03	0.32	0 00	0 13	
19 47.57	0 31	0.15	0 00	0 46	0 00	0.29	0.00	0 62	1 02	0 67	0 00	0 54	0 00	0 16	3 12	0 26	0 00	55 63	1 63	0 09	0 19	0 08	1 12	0 27	0 00	0 11	
19.48 57	0 31	0 10	0.00	0 30	0 00	0.19	0 00	0.41	1 07	0 44	0 00	0 35	0 00	0 16	0 00	0 17	0 00	36 77	1 60	0.09	0 14	0 05	0 79	0 27	0 00	0 11	
19 49.57	0 40	0 11	0 00	0.35	0 00	0 22	0 00	0 47	1 28	0 51	0 00	0 41	0 00	0 17	0 00	0 20	0 00	42 39	1 74	0 10	0 18	0 06	0 82	0 30	0 00	0.12	
19 50:57	0 44	0 13	0 00	0.42	0.00	0 27	0 00	0 57	1 67	0 62	0 00	0 49	0 00	0 18	0 00	0 24	0 00	50 98	1 62	0.11	0 17	0.07	1.43	0 31	0 00	0 12	
19:51 57	0 49	0.14	0 00	0 44	0 00	0 28	0 00	0 60	1 94	0 65	0 00	0 52	0 00	0 18	0 00	0 25	0 00	53 68	1 72	0 11	0.16	0 08	0.79	0 31	0 00	0 12	
19 52.58	0 59	0.17	0 00	0 55	0 00	0 35	0 00	0 74	1 75	0 80	0 00	0 64	0 00	0 19	0 00	0 31	0 00	66 65	1 66	0.11	0 18	0 09	0 77	0 32	0 00	0 13	
19.53.58	0 59	0 21	0 00	0 65	0 00	0 42	0 00	0 87	1 88	0 95	0 00	0 76	0 00	0 19	0 00	0 36	0 00	78 69	1 71	0 11	0 20	0 11	1 03	0 33	0 00	0.13	
19 54 57	0 63	0.25	0.00	0.80	0 00	0 51	0 00	1 08	1 88	1 17	0 00	0 94	0 00	0 20	0 00	0 45	0 00	97 10	1 68	0 12	0 18	0.14	1 04	0 34	0 00	0 13	
19.55 57	0 54	0 26	0 00	0 84	0 00	0 53	0 00	1 12	2 19	1.22	0 00	0 97	0 00	0 20	0 00	0 47	0 00	100 96	1 59	0.12	0 16	0 14	1 09	0 35	0 00	0.14	
Average	0.44	0 16	0 00	0 51	0 00	0 32	0 00	0 68	1 46	0 74	0 00	0 59	0 00	0 18	2 21	0 29	0 00	61 49	1 64	0 11	0 17	0 09	0 94	0 32	0.00	0.12	
Standard deviation	0 09	0.04	0 00	0 14	0 00	0 09	0 00	0 18	0 29	0 20	0 00	0 16	0 00	0 01	2 44	0 08	0 00	16 42	0 07	0 01	0 02	0 02	0 22	0.02	0 00	0 01	
Maximum value	0 63	0 26	0 00	0 84	0 00	0 53	0.00	1 12	2 19	1 22	0 00	0 97	0 00	0 20	6 25	0 47	0 00	100 96	1 82	0 12	0 20	0.14	1 43	0.35	0 00	0.14	
Minimum value	0 31	0 10	0.00	0 30	0 00	0 19	0.00	0 41	1 02	0 44	0 00	0 35	0 00	0 16	0 00	0 17	0 00	36 77	1 46	0 09	0 13	0.05	0 56	0 27	0 00	0.11	

APPENDIX D

FTIR FIELD DATA SHEETS

FTIR Temperature Readout Sheet

Facility	Austin White
Stack ID	Kiln 2
Date	07/1/98
Run Number	1 - uncond.
Recorded By	JP/OM

		Temperature (deg. F)														
		Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time
Channel	Description	1445	1430	1445	1500	1515	1530	1545	1600	1615	1630	1645	1700	1715	1730	1745
1	Inlet Stack	349	355	346	353	352	347	352	354	354	349	351	352	352	356	
2	Outlet Stack	130	129	129	129	130	131	129	130	131	131	131	132	131	131	
3	Inlet Probe	339	336	338	342	339	339	339	339	342	339	337	337	339	335	
4	Outlet Probe	342	342	343	342	338	341	343	342	344	340	334	338	342	340	
5	Inlet Filter	344	342	342	344	341	342	344	344	345	345	341	344	341	341	
6	Outlet Filter	339	340	340	341	340	340	340	340	340	341	337	339	340	340	
7	Inlet HT	313	312	311	309	307	305	301	298	296	294	292	292	290	289	
8	Outlet HT	337	335	333	331	330	329	329	329	329	329	328	328	326	326	
9	Inlet Pump	284	263	271	264	246	266	266	245	271	270	249	275	260	258	
10	Outlet Pump	332	324	327	316	324	325	336	328	332	336	335	316	329	312	
11	FTIR Pump	309	317	280	297	308	291	306	307	297	286	273	305	278	280	
12	Pump Box	134	128	125	127	128	126	124	128	125	123	119	120	121	121	
13	Extra HT	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14	FTIR Jumper	325	322	322	323	324	323	324	324	320	318	317	320	314	313	
15	Pump Jumper	322	323	323	323	324	325	326	325	323	322	321	322	320	319	
16	Hot Box	355	358	352	352	354	351	351	351	352	353	354	354	352	351	
17	Hot Box	249	249	249	250	250	250	250	250	249	249	249	249	249	249	
18	Extra HT	325	324	323	322	321	318	314	311	309	307	306	305	303	302	
19	Electronics Box	95	96	96	96	97	98	98	98	98	98	98	91	90	90	
20																

A/C vent redirect

FTIR Temperature Readout Sheet

Facility	Austin White
Stack ID	Kiln 3 Inlet Outlet
Date	6/30/98
Run Number	1
Recorded By	JPR

		Temperature (deg. F)														
		Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time
Channel	Description	1305	1320	1335	1350	1405	1420	1435	1450	1505	1520	1535	1550	1605	1620	1635
1	Inlet Stack	410	416	423	425	427	427	429	430	433	430	425	423	421	433	
2	Outlet Stack	364	340	370	360	297	301	330	382	380	384	384	384	383	383	
3	Inlet Probe	343	340	340	339	339	338	340	342	339	340	342	338	341	356	
4	Outlet Probe	333	334	339	340	338	336	332	340	340	337	336	342	340	339	
5	Inlet Filter	340	341	339	343	343	342	343	344	341	342	343	343	343	341	
6	Outlet Filter	342	340	338	338	342	342	346	337	342	344	341	337	330	339	
7	Inlet HT	301	302	304	306	308	309	309	311	312	310	310	311	312	311	
8	Outlet HT	339	342	346	348	349	349	349	350	350	348	348	347	348	347	
9	Inlet Pump	244	277	248	277	265	253	279	272	254	281	266	254	271	274	
10	Outlet Pump	330	325	341	339	324	339	328	338	338	329	318	334	345	335	
11	FTIR Pump	273	304	287	284	282	271	294	292	301	294	284	277	298	303	
12	Pump Box	117	120	122	123	126	123	127	129	130	130	127	130	129	128	
13	Extra HT	265	267	268	270	271	271	271	272	273	273	274	275	277	277	
14	FTIR Jumper	315	314	315	317	317	317	318	319	318	318	321	320	320	320	
15	Pump Jumper	319	319	320	321	323	323	324	324	323	324	325	326	326	325	
16	Hot Box	357	356	356	357	355	355	355	357	354	355	357	357	358	356	
17	Hot Box	250	249	250	250	250	250	250	250	250	250	250	251	251	251	
18	Extra HT	294	295	301	304	307	307	307	308	309	309	308	309	310	309	
19	Electronics Box	88	88	89	90	91	92	92	93	94	95	96	97	98	96	
20																

FTIR Temperature Readout Sheet

Facility	Austin White
Stack ID	Kiln 3 cond inlet outlet
Date	6/30/99
Run Number	1 - Conditioned
Recorded By	JM

		Temperature (deg. F)															
		Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time
Channel	Description	1730	1755	1810	1825	1840											
1	Inlet Stack			415	413												
2	Outlet Stack			355	376												
3	Inlet Probe			341	335												
4	Outlet Probe			232	342												
5	Inlet Filter			343	346												
6	Outlet Filter		shut off	303	213												
7	Inlet HT			296	296												
8	Outlet HT			316	271												
9	Inlet Pump			254	212												
10	Outlet Pump			317	315												
11	FTIR Pump			306	302												
12	Pump Box			125	120												
13	Extra HT			281	282												
14	FTIR Jumper			335	336												
15	Pump Jumper			330	332												
16	Hot Box			357	358												
17	Hot Box			252	251												
18	Extra HT			316	316												
19	Electronics Box			95	95												
20																	

FTIR Temperature Readout Sheet

Facility	Austin White
Stack ID	Kiln 2
Date	6 7/1/98
Run Number	1 – Conditnd
Recorded By	JM

		Temperature (deg. F)															
		Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time
Channel	Description	1925	1940	~~1955~~	2010	2025											
1	Inlet Stack	352	348	1955 345	354												
2	Outlet Stack	132	133	133	133												
3	Inlet Probe	337	338	336	333												
4	Outlet Probe	342	337	341	337												
5	Inlet Filter	344	344	342	340												
6	Outlet Filter	342	341	340	340												
7	Inlet HT	262	275	279	285												
8	Outlet HT	179	250	268	290												
9	Inlet Pump	264	269	278	263												
10	Outlet Pump	330	316	329	317												
11	FTIR Pump	304	309	278	282												
12	Pump Box	124	125	124	122												
13	Extra HT	–	–	–	–												
14	FTIR Jumper	323	322	322	323												
15	Pump Jumper	320	316	315	315												
16	Hot Box	353	353	356	354												
17	Hot Box	246	246	246	246												
18	Extra HT	305	306	306	306												
19	Electronics Box	88	88	87	87												
20																	

HT shorted off - restart by [illegible]

APPENDIX E

PRE-TEST CALCULATIONS

Below are the results of the Draft Method 320 pre-test calculations for this test program. The calculations are organized by appendix as found in the FTIR Protocol. These calculations were originally taken from the Secondary Aluminum HCl program from late 1997.

Appendix B

Potential Interferant Calculations:

These calculations determine potential **spectral** interferants for **the** analytes of interest (i.e., HCl). The results for HCl are given in the table below. The analysis **region** for HCl is not given since it is considered proprietary information.

TABLE 1. INTERFERANT CALCULATIONS

Analyte	Concentration	Band area	IAI/AAI	Average absorbance
HCl (target)	0.1 ppmv	0.0005436	-	0.00000322
H_2O (potential interferant)	**20%**	**0.2213**	**407**	0.00131
CO_2 (potential interferant)	20%	0.000002	0.0036	[redacted]
H_2CO (potential interferant)	1 ppmv	0.0002100	0.386	[redacted]
CH_4 (potential interferant)	**20 ppmv**	**0.0105**	**19.3**	0.00006213
[redacted]	[redacted]	[redacted]	**AVT**	0.00137

Note: Compounds in bold are known interferants. AVT is computed from target and known interferants.

Known interferant criteria is IAI/AAI > 0.5

From the Table, two potential interferants are identified: H_2O and CH_4.

Appendix C

Noise Level

This calculation determines instrumental noise level in the spectral analysis region for HCl. For a 1 minute integration time, the RMS noise is found to be 0.00022 (absorbance units) in the HCl spectral analysis region by the procedure given in Appendix G.

Appendix D

Estimating Minimum Concentration Measurement Uncertainties (MAU)

The result for HCl is:

MAU (HCl) = 0.4 ppmv.

This value is computed using the formula given in Appendix D. However, this value is derived using band area calculations. The FTIR spectral data in this field study are analyzed by classical least squares (CLS), not band areas. CLS derived minimum measurement uncertainties for HCl are on the order of 0.1-0.2 ppmv for this test program.

Appendix E

Determining Fractional Reproducibility Uncertainties (FRU)

This calculation estimates the uncertainty in analysis, using band areas, of two sequentially measured CTS spectra collected immediately before and after the HCl reference spectrum. The calculation is performed in the analysis region used for HCl. The result is:

FRU (HCl region) = 0.093.

The corresponding value using CLS is somewhat lower. For most analytes of interest, FRU usually falls between 0.001 and 0.04 using CLS.

Appendix F

Determining Fractional Calibration Uncertainties (FCU)

This section determines the fractional calibration uncertainties when analyzing each reference spectrum. These results will be applied to the compounds analyzed in the HCl analysis region. The table below gives the results.

TABLE 2. FCU DETERMINATION

Analyte	ASC (ppm)	ISC (H_2O)	ISC (HCl)	ISC (CH_4)	FCU	AU
H_2O	113000	115000	0.000	0.000	-1.7%	-
HCl	253	-22.5	254	0.000	-0.4%	30%
CH_4	491	-23.0	0.000	493	-0.2%	-

Appendix G

Measuring Noise Levels

The result of this calculation is given under the Appendix C heading.

Appendix H

Determining Sample Absorption Pathlength (Ls) and Fractional Analytical Uncertainty

Since the HCl reference spectrum used in this program were measured at the same pathlength to be used during testing, these calculations are not required.

APPENDIX F

POST-TEST CALCULATIONS

Below are the results of the Method 320 post-test calculations for this test program. The calculations are organized by appendix as found in the FTIR Protocol. Since classical-least-squares (CLS) is used for analysis, the CLS-equivalent calculations are used, since in some cases, the FMU values using band-areas can differ as much as an order of magnitude compared to CLS-derived results.

Appendix I

Determining Fractional Model Uncertainties:

These calculations determine the fractional error in the analysis for the analytes of interest (i.e., HCl). The results for HCl are given in the table below for 1 spectrum selected from the inlet and outlet test. In order to achieve results that are consistent with the CLS analysis approach, the CLS equivalent of the calculation was performed. This is simply the reported analysis error divided by the HCl concentration.

TABLE 1. FMU CALCULATION FOR HCL -AUSTIN WHITE

Spectral File Name	Inlet/Outlet	Error (ppm)	Concentration (ppm)	FMU
RN010007.spa	Outlet (#3)	0.23	17.1	0.013
RN010042.spa	Inlet (#3)	0.17	9.53	0.018
RN010007.spa	Outlet (#2)	0.16	6.86	0.023
RN010042.spa	Inlet (#2)	0.15	4.78	0.031

Error is 95% confidence interval reported by CLS software.

Appendix J

Overall Concentration Uncertainty

The CLS equivalent of overall concentration uncertainty is simply the error reported by the CLS software. The results for this test program are found in Table 1, above.

TECHNICAL REPORT DATA

(Please read Instructions on reverse before completing)

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EPA- 454/R-00-008		

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16. ABSTRACT

The United States Environmental protection Agency is investigating the lime manufacturing industry source category to identify and quantify emissions of hazardous air pollutants (HAPs) from rotary kilns. The primary objective of this test program was to obtain data on controlled and uncontrolled emissions of hydrogen chloride (HCL) and gather screening data on other hazardous air pollutants from lime production plants. EPA test Method 320 was used to collect the emission data.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Hydrogen Chloride (HCL) Hazardous Air Pollutants	Air Pollution control Fabric Filter Baghouse Wet Scrubber	

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