UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
ALLIED BANK TOWER AT FOUNTAIN PLACE
1445 ROSS AVENUE
DALLAS, TEXAS 75202

JUL 15 1987

Mr. Jack Ellvinger, Program Manager
Hazardous Waste Section
New Mexico Environmental Improvement
Division
P.O. Box 968
Santa Fe, New Mexico 87504-0968

Dear Mr. Ellvinger:

Enclosed are the results of a detailed review of the RCRA Trial Burn Report for the Los Alamos Controlled Air Incinerator submitted by the Los Alamos National Laboratory in March 1987. The objective of the assessment was to conduct a complete audit and technical review of the trial burn results which have been reported by Los Alamos.

These comments are provided to assist you in evaluating the technical adequacy of the incinerator unit for permit development. If you have any questions on the enclosed report, please contact Marc Sides at (214) 655-6785.

Sincerely yours,

WK Honker

William K. Honker, Chief
Permits Section

Enclosure

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HAZARDOUS WASTE SECTION

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TC

REVIEW OF

RCRA TRIAL BURN FINAL REPORT

FOR THE LOS ALAMOS CONTROLLED AIR INCINERATOR

EPA CONTRACT NO. 68-01-7374
WORK ASSIGNMENT NO. R26-02-04
LOS ALAMOS NATIONAL LABORATORY
LOS ALAMOS, NEW MEXICO

June 5, 1987

METCALF & EDDY, INC.
6480 Busch Boulevard, Suite 120
Columbus, Ohio 43229

SUMMARY OF ASSESSMENT

This document presents a detailed review of the RCRA Trial Burn Final Report submitted by Los Alamos National Laboratory in March, 1987 covering the Los Alamos Controlled Air Incinerator. The objective of this assessment was to conduct a complete audit and technical review of the trial burn results which have been reported by Los Alamos.

Procedures and methods used in the assessment of the Trial Burn Final Report were the following. Parallel reviews were undertaken. One of these was performed by carefully reviewing the body of the Final Report. Each statement or group of statements was checked to verify its accuracy and conformance with the Trial Burn Plan. Any inaccuracies or discrepancies were noted and these form the basis for a series of comments. In addition, as each section of the report body was reviewed, a trail through the appropriate Appendix material was followed to confirm and verify the validity of the statements made and results reported. As an adjunct to these steps, conformance with regulatory requirements, or the published procedures for standard sampling or analytical methods, as necessary, was verified.

The other path for verification was primarily a computational one. All numerical results were verified by tracking from original observations, data sheets, and/or laboratory analysis results through the calculational procedures to the final tabulated results. These recalculations have shown that the Applicant's answers were essentially correct. Computer printouts of the recalculation results are included in Appendix A of this report. Pages 49 and 50 of Appendix A include a summary comparision of the Applicant's results and recalculated results using feed compositions based on preferred data (analytical data for liquids and overall run averages for solids).

Most of the trial burn results and the Trial Burn Report have been found to be adequate. However, there are a number of discrepancies and deficiencies, a few of which are potentially serious, which have been noted and discussed in this review. These discrepancies and deficiencies fall into the following general categories:

- The trial burn was not performed in complete conformance with the Trial Burn Plan.

- Sampling techniques were not performed as specified in the appropriate standard methods.

- Inadequacies have been noted in the procedures and techniques used for sampling and analysis.

- Proper origination and chain-of-custody procedures were not adequately established or documented.

- QA/QC procedures were not followed, documented, or reported properly.

- The suggested permit conditions do not conform with the results of the trial burn.

A summary of the operating conditions and performance for each test run is presented in Table 1. This table has been compiled from summaries and original data which the Applicant has provided.

The body of this review consists of specific comments on reasonably narrow, specific statements or topics covered in the Trial Burn Report. Each comment is referenced to the location(s) in the Report where it occurs. Two categories of comments are provided: significant discrepancies and deficiencies, and other problem areas. The significant discrepancies and deficiencies are those judged to be critical to the acceptance of the Trial Burn results, and the issuance of a permit; those comments designated as other problem areas are considered less critical and should be capable of speedy resolution.

TABLE 1 - SUMMARY OF OPERATING CONDITIONS AND PERFORMANCE FOR EACH OPERATING CONDITION

Test No.	1-1	1-2	1-3	1-4	1-5	1-6		1 Avg.
Time	1310	1400	1443	1525	1854	1938	2125	
Sec. Temp F	2200	2200	2200	2200	2200	2200		2200
Pri. Temp F	1850	1900	1925	1950	1850	1925		1900
Pri MM Btu/hr	1.27	1.43	1.43	1.46	1.5	1.5		1.43
Feed Rate lb/hr	147	167	167	170	172	172		166
Feed CCl4 lb/hr	65.9	74.8	74.8	76.4	76.9	76.9		74
Feed TCE lb/hr	28.5	32.3	32.3	33	33.3	33.3		32
Feed TOCl lb/hr	83.9	95.1	95.1	97.2	97.8	97.8		94.5
Feed Btu/lb	8418	8418	8418	8418	8569	8569		8468.3
Stk Flow acfm	1475	1475	1475	1475	1521	1521		1490
Scr. pH	4.8	4.4	4.6	5.1	8.8	3.8		5.3
Venturi DP	45	45	45	45	42	38		43
O2 chart %	6	6.2	6.2	6.2	6	6.8		6.2
CO @12%CO2 ppm	7	7	7	7	8	8		7
CCl4 DRE	Q	99.99878	99.99895	Q	Q	99.99904		99.99892
TCE DRE	Q	99.99993	99.99999	Q	Q	99.99994		99.99995
VOST runs	1V1	1V2	1V3	1V4	1V5*	1V6		
CCl4 lb/hr E-6	>26.4	913	788	>830	>747	735		
TCE lb/hr E-6	Q	21.7	1.54	Q	Q	19		
Cl Rem Eff %	99.998				99.998		99.998	99.998
Partic gr/dscf @ 7% O2	0.011				0.0066		0.0103	0.0085
M5 Sampling Period	----------1-M5-1--------				--1-M5- 2------		-1-M5-3-	

Q = Quenched detector during analysis of VOST cartridges.

TABLE 1. (Continued)

Test No.	2-1	2-2	2-3	2-4	2-5	2-6	2 Avg.
Time	950	1044	1216	1302	1448	1527	
Sec. Temp F	2000	2000	2000	2000	2000	2000	2000
Pri. Temp F	1875	1910	1950	1975	2000	2000	1952
Pri MM Btu/hr	1.51	1.51	1.5	1.5	1.5	1.5	1.50
Feed Rate lb/hr	173	173	172	172	173	173	173
Feed CCl4 lb/hr	78.6	78.6	77.8	77.8	78.4	78.4	78
Feed TCE lb/hr	33.2	33.2	32.8	32.8	33	33	33
Feed TOCl lb/hr	99.3	99.3	98.3	98.3	99	99	98.9
Feed Btu/lb	8512	8512	8586	8586	8522	8522	8540.0
Stk Flow acfm	1351	1351	1356	1356	1345	1345	1351
Scr. pH	4.7	5.7	6.2	6.4	6.4	6.5	6.0
Venturi DP	38	38	38	38	39	39	38
O2 chart %	8	8	8	8	8.2	8.2	8.1
CO @12%CO2 ppm	8	8	9	9	11	11	9
CCl4 DRE	99.99999	Q	B	99.99979	99.99925	99.99896	99.99950
TCE DRE	99.99999	Q	B	99.99993	99.99996	99.99996	99.99996
VOST runs	2V1	2V2	2V3	2V4	2V5	2V6	
CCl4 lb/hr E-6	8.16	Q	B	157	583	815	
TCE lb/hr E-6	1.3	Q	>1.3	21.7	14.6	15.799999	
Cl Rem Eff %	99.998		99.939		99.585		99.841
Partic gr/dscf @ 7% O2	0.0137		0.0114		0.0153		0.0135
M5 Sampling Period	-----2- M5-1----		------- 2-M5-2--		-----2- M5-3-----		

Q = Quenched detector during analysis of VOST cartridges.

TABLE 1. (Continued)

Test No.	3-1	3-2	3-3	3-4	3-5	3-6	3 Avg.
Time	1036	1117	1709	1756	1924	1957	
Sec. Temp F	2200	2200	2200	2200	2200	2200	2200
Pri. Temp F	1690	1720	1640	1675	1675	1650	1675
Pri MM Btu/hr	0.865	0.865	0.967	0.967	0.923	0.923	0.918
Feed Rate lb/hr	166	166	187	187	178	178	177
Feed CCl4 lb/hr	49.3	49.3	55.8	55.8	54.1	54.1	53
Feed TCE lb/hr	24.2	24.2	27.2	27.2	26.2	26.2	26
Feed TOCl lb/hr	65.2	65.2	73.5	73.5	70.9	70.9	69.9
Feed Btu/lb	4874	4874	4874	4874	4874	4874	4874.0
Stk Flow acfm	1544	1544	1655	1655	1567	1567	1589
Scr. pH	6.4	6.5	6	6.1	6.4	6.4	6.3
Venturi DP							ERR
O2 chart %	7	7	6.5	6	7.5	8	7.0
CO @12%CO2 ppm			8	8	8	8	8
CCl4 DRE	99.99937	99.99935	99.99851	99.99881	99.99992	99.9991	99.99918
TCE DRE	99.99986	99.99986	99.99933	99.99969	99.99999	99.99999	99.99979
VOST runs	3V1	3V2	3V3	3V4	3V5	3V6	
CCl4 lb/hr E-6	315	320	834	665	40	483	
TCE lb/hr E-6	33.5	33.8	183	81.4	0.93	1.29	
Cl Rem Eff %	99.623		99.85		99.728		99.734
Partic gr/dscf @ 7% O2	0.0154		0.021		0.0237		0.0200
M5 Sampling Period	-----3-M 5-1----		----3-M5 -2------		-----3-M 5-3-----		

TABLE 1. (Continued)

Test No.	4-1	4-2	4-3	4-4	4-5	4-6	4 Avg.
Time	1349	1430	1553	1638	1809	1846	
Sec. Temp F	2000	2000	2000	2000	2000	2000	2000
Pri. Temp F	1350	1325	1425	1525	1575	1575	1463
Pri MM Btu/hr	0.985	0.985	1.002	1.002	1.049	1.049	1.012
Feed Rate lb/hr	190	190	194	194	203	203	196
Feed CCl4 lb/hr	57.4	57.4	58.7	58.7	61.6	61.6	59
Feed TCE lb/hr	28.3	28.3	28.4	28.4	30.1	30.1	29
Feed TOCl lb/hr	75.8	75.8	77.1	77.1	81.1	81.1	78.0
Feed Btu/lb	4874	4874	4874	4874	4874	4874	4874.0
Stk Flow acfm	1469	1369	1540	1540	1537	1537	1499
Scr. pH	5.5	5.8	6.2	6.3	6.4	6.5	6.1
Venturi DP	39	39	39	39	39	39	39
O2 chart %	11	10.5	10	10	9.5	10	10.2
CO @12%CO2 ppm	10	10	9	9	11	11	10
CCl4 DRE	99.99848	99.99983	99.99922	99.99824	99.99839	99.99865	99.99880
TCE DRE	99.99997	99.99999	99.99998	99.99985	99.99991	99.99993	99.99994
VOST runs	4V1	4V2	4V3	4V4	4V5	4V6	
CCl4 lb/hr E-6	873	95	455	1030	993	829	
TCE lb/hr E-6	8.1	1.61	6.31	41.6	25.9	19.6	
Cl Rem Eff %	99.937		99.644			99.609	99.73000
Partic gr/dscf @ 7% O2	0.0089		0.0001			0.0244	0.01113
M5 Sampling Period	----4-M 5-1-----		-----4-M 5-2-----			4-M5-3->	

SIGNIFICANT DISCREPANCIES AND DEFICIENCIES

The comments presented in this section of this review are considered critical to the acceptance of the Trial Burn results and the future issuance of an operating permit. The Applicant should review these comments and respond with a concise, well-documented discussion. Additional data and evidence should be provided as the response requires.

Comment 1 - Chain of Custody

P. 6, Lines 37-40
P. 11, Lines 3-12
Appendix L, P. 4, Line 34

The Applicant has not provided complete documentation on sample origination, chain of custody, or sampling activities. The "chain of custody" forms provided in Appendix O do not show, in many cases, the sample originator or the time of origination. There is no indication if the sample was transferred to a custodian, or to a transporter, or ever received at the analytical laboratory. Also, there is no field log provided.

A complete chain-of-custody record should provide evidence of sample integrity, include a field log of sampling activities as required in Appendix L, indicate both the time of origination and the identity of the samplers for each analytical sample, and allow the tracking of each sample from the originator to the analyst.

Comment 2 - DRE Deficiencies

Pages 7-8
P. 12, Lines 26-31
P. 14, Lines 12-15
P. 15, Lines 6-34
Pages 17-24
Page 29

Significant deficiencies have been introduced by the Applicant in interpreting the DRE values obtained during the trial burn. In addition to the sample integrity problem discussed in Comment 1, uncertainties in results have been introduced by:

- not considering possible adsorption/desorption of POHCs by the HEPA filters and activated carbon bed

- lack of documentation of analytical instrument calibration including the lack of documentation on a recalibration of the GC/MS detector after apparent changes to the instrument's sensitivity.

- inadequately interpreting the QC results of the POHC analysis, particularly the results of the EPA audit samples.

Each of these potential problem areas are discussed below.

HEPA Filters and Activated Carbon Bed

The analyses of the HEPA filters and the activated carbon bed raise questions regarding the ability of the unit to maintain the DREs shown. Unfortunately, the Applicant has not provided all the information needed to resolve these questions. From the data provided, the activated charcoal bed appears to adsorb the POHCs during a test condition and desorb these POHCs during standby operation, i.e., overnight. This is particularly evidenced by comparison of the analyses of samples taken during "Precondition 3 - post condition 1 and 2" on 9/6/86 and "Precondition 4 - post condition 3" also on 9/6/86. The time-of-day relationship between the start and stop of the POHCs feed

and the taking of samples is not provided by the Applicant except as here stated. Between these two samples, the previously desorbed (during the overnight standby period) activated charcoal bed adsorbed 1099 ug/kg of CCl_4 and 23 ug/kg of C_2HCl_3. Since the samples upon which the DRE is based were taken downstream of the charcoal bed, the efficiency of the bed in adsorbing POHCs will affect the DRE. The data provided is inadequate to show how long the charcoal would maintain its adsorption efficiency, or whether the DRE that would result if the bed became saturated would still meet regulatory requirements.

The same situation could exist for the HEPA filters as could be inferred from the two analyses provided - fresh on 9/4/86 and used on 9/8/86. The filter situation is confused by the many replacements of filters which took place during this time period, by the lack of any other analyses, by the failure to identify which bank of filters was analyzed, and a lack of information on filter weights.

It appears that quantitative data on the amount of POHCs adsorbed by the carbon bed and filters and the ultimate capacity or time over which the efficiency will be maintained will be required in order to assess whether the incinerator can maintain the DREs shown over a period of time longer than the test period. The Applicant needs to provide additional information and data to resolve this question of the effect of adsorption/desorption of the POHCs on DRE and to allow the formulation of a permit condition for insuring that the POHC removal efficiency of the carbon bed is maintained.

Instrument Calibration

No calibration data for any analytical instruments have been submitted. In addition, the Applicant has indicated that the analytical detector was quenched when a level of 188 ng was reached during the CCl_4 analysis of the VOST cartridge from Run 1-1. Other CCl_4 analyses were successful at much higher levels (i.e, 6780 ng CCl_4 were detected in the VOST cartridge from Run 1-2). It appears that some adjustment to the

detector's sensitivity was made after the sample from Run 1-1 quenched it, in order to accomodate higher levels of POHCs. If this adjustment was made, evidence should be provided which shows that the instrument calibration is valid at both sensitivity levels.

Evidence which shows the calibration of the analytical instruments should be provided. The Applicant should indicate whether or not the GC/MS sensitivity was changed after the quenching of the VOST sample from Run 1-1. If the change was made, additional evidence should be provided to show the instrument was recalibrated.

QC Results

Serious questions arise because of the poor results obtained during QC checks of analytical procedures (see also Comment 26). A major discrepancy exists among the quality assurance objectives listed in the Quality Assurance Plan (Appendix J), the stated $\pm$ 10% accuracy used in the analytical reporting (and stated elsewhere), and the results obtained in the QC checks. This is especially apparent for the EPA audit samples. Only one result fell within the $\pm$ 10% range. For TCE, recoveries were 86%, 106%, and 190% for the three samples of the presumed valid "second set". For CCl_4, the similar results were 60%, 150%, and 180%.

The Applicant should verify that the use of the analytical results presented which do not meet the criteria for acceptance of the data still produce usable results. The Applicant should be requested to address the effect of the poor QC results on the accuracy and/or precision of the test results and to calculate confidence limits for critical results (i.e., DREs) to show whether there is a significant probability that the apparently poor precision of the data may cause the results to not meet the regulatory requirements.

Comment 3 - Lack of Justification for Permit Conditions

Pp. 36-43

There are several proposed permit conditions which are not apparently justified on the basis of the results of the trial burn. Each of these will be discussed separately.

Primary Combustion Temperature

The proposal that there be no lower limit on primary chamber combustion temperature has not been demonstrated to be acceptable by the results of the trial burn. For the liquid feed runs, Conditions 1 and 2, the lowest primary chamber temperature tested was 1850 ^{o}F. In a similar fashion, when POHCs were being introduced in solid feed (as in Conditions 3 and 4), the lowest primary chamber temperature tested was 1325 ^{o}F. However, the primary chamber temperature is not normally considered to be significant and is not normally regulated.

Minimum Scrubber pH

The scrubber water pH generally ranged above 4.0 with only occasional swings below this value. This condition, coupled with the apparent operational difficulties in controlling scrubber water pH, leads to the recommendation that 4.0 be established as the minimum value for permit conditions. This is not much different than the 5.0 level which was the target value for the trial burn.

Minimum Btu/lb

The trial burn established minimum values for the heat of combustion of the wastes fed. These values are 4874 Btu/lb for solid feeds and 8512 Btu/lb for liquid feeds (operating at a secondary combustion temperature of 2000 ^{o}F).

Waste Feed Rate

The maximum waste feed rates that have been established by the conditions of the trial burn are 203.4 lb/hr for solids or 173.4 lb/hr for liquids. Combinations of liquid and solid feeds were not tested, but may be acceptable if the total quantity of organic chlorine does not exceed the level tested.

Water Injection Rate

Water injection was not demonstrated during the trial burn. There is no similarity between solid feed (containing contaminants) and an aqueous feed (containing contaminants). Also, the term "flameless oxidation" and its successful demonstration is not explained nor is it understood in this context.

OTHER PROBLEM AREAS

The following comments are considered less critical to the acceptance of the Trial Burn results. The Applicant, however, should respond to each comment with the best explanation possible and provide additional documentation and data as might be required.

Comment 4 - Designation of Trichloroethylene as a POHC

P. 1, Line 14

Trichloroethylene was not specified in the trial burn plan as a POHC. Hexachlorobenzene was mentioned in the sampling and analysis plan (Appendix L) as another POHC, but this was not used. Documentation of approvals for use of trichloroethylene instead of HCB as a supplemental POHC was not provided.

Comment 5 - Minimum Temperature in Primary Chamber

P. 3, Line 4

No specification is listed here, but the primary chamber temperature is specified in the Trial Burn Plan (Appendix I) as 1550 ^{o}F as a minimum temperature (page 7, Table 1) for waste feed shutoff and in Table 8, page 37, which gives 1600 ^{o}F as the primary chamber temperature for all Trial Burn Tests. No documentation for the change was provided.

Comment 6 - Minimum Temperature in SCC

P. 3, Line 5
Lines 28-30

Contrary to the 2000-2200 ^{o}F listed here, the Trial Burn Plan gives the minimum secondary combustion chamber temperature for waste feed cut-off as 1550 or 1750 ^{o}F (Table 1, page 7) and as 1800 and 2000 ^{o}F in Table 8, page 37. No documentation for the change was provided.

Comment 7 - Equipment Calibration

P. 4, Lines 21-23
Appendix J, Tables 8-1 and 8-2

Calibration of the sampling equipment is not documented fully. Most of the required calibrations for Method 5 sampling have been specified in Appendix J. However, no data has been submitted which shows that all calibrations for Method 5 and VOST sampling have been performed.

The Applicant should provide data to show that required Method 5 calibrations of the following items were carried out: impinger thermometer, dry gas meter thermometer(s), stack temperature sensor (before and after test), barometer (before and after test), and the analytical balance. Furthermore, three probe nozzle ID measurements should be shown which agree within 0.004 inches. In addition, data

should be provided to show that the VOST thermocouple has been calibrated.

Comment 8 - Method 5 Sampling Train Leak-Checks

P. 5, Line 7

The Applicant has not provided evidence to show that proper leak-check procedures have been carried out as specified in 40 CFR 60, Appendix A, Method 5, Section 4.1.4. The Method 5 Field Data Sheets do not indicate that post-test leak checks were done for Runs 1-1, 4-2, and 4-3. Furthermore, since the ports where Method 5 sampling occurred are in a horizontal duct, the sampling probe must have been rotated 180° between traverses. The Applicant has not detailed the manner by which this was done, but it is likely that the probe was disconnected and rotated 180°. If so, at least one additional leak-check should have been done. If only the nozzle was rotated and the pitot tube used in reverse, this should have been noted.

The Applicant should provide evidence to show that post-test leak-checks were performed with acceptable results for Runs 1-1, 4-2, and 4-3. Detail should be provided about how the Method 5 sampling train was made to sample from the two ports. If a disconnection of any joint of the samplng train between ports was required, evidence must be provided which shows that an additional leak-check was done immediately before the modification and that acceptable results were achieved.

Comment 9 - Deviations from Sampling Protocols

P. 6, Lines 18-22

The Applicant did not follow the sampling protocols described in Appendix K in many instances. For example, Paragraph K (under Section IV. SAMPLING REQUIREMENTS) specifies that "(b)efore each trial burn run two samples of (scrubber discharge liquid) blowdown will be collected 30 minutes apart and composited to provide a blank sample." Also,

"(d)uring each trial burn run, blowdown water samples shall be taken every 60 minutes and composited for that run." Evidence provided (see Origination Form for Scrubber Discharge Liquid in Appendix O), indicates that no blanks were taken and that sampling was not done at 60-minute intervals. Since time of sampling was not recorded, no reference to the VOST and M5 samples can be made.

Other sampling discrepancies exist as well.

The Applicant should explain and justify all deviations and inconsistencies among the various sampling protocols provided.

Comment 10 - Deviation from Sampling Protocol for Used Activated Carbon

P. 6, Lines 29-36

The Applicant should justify the sampling protocol discrepancies for used activated carbon. Paragraph M (under Section IV. SAMPLING REQUIREMENTS) indicates that used activated carbon will be sampled after each trial burn run. In addition to the fresh carbon, only three other samples were taken and none was taken after either Condition 1 or Condition 2; one was taken before and one after Condition 3 and one was taken after Condition 4 (see also Comment 2).

Comment 11 - VOST Internal Standards

Page 12, Lines 14-30

The Applicant has stated that an internal surrogate standard was not used in the VOST cartridge analyses. This is in contrast to the QA/QC protocol which had previously been submitted and does not conform to the standard methods in "Protocol for the Collection and Analysis of Volatile POHC, Using VOST", EPA-600/8-84-007, which the Applicant claims to follow. By failing to correct the VOST recoveries using internal standards, the Applicant has submitted analytical results which may be lower than reality. This would result in the calculation of artificially high DREs. The reason which has been provided to explain

this deviation from standard methods does not include a reference. Furthermore, the Applicant's substituted method of inserting additional spiked QC samples into the sample batches has not provided results of sufficient quality in order to justify the deviation from standard methods.

The Applicant should detail the justification by which internal surrogate standards have not been used for VOST analyses. The explanation should include references. The Applicant should provide justification to show that the substituted method of using additional QC samples has demonstrated an adequate level of quality assurance (see Comment 20).

Comment 12 - Marginal Acceptability of Completeness for VOST Results for Condition 1

P. 14, Lines 11-15
P. 15

The VOST results for Condition 1 do not meet the standards for completeness expressed in the Quality Assurance Plan (Appendix J). Also, the completeness attained, 3/6 or 50%, is considered only marginally acceptable by normal standards. The Applicant should address the acceptability of the results for Condition 1 in view of the saturation produced in Runs 1-4 and 1-5.

Comment 13 - Particulate Emissions in Run Number 4-2

P. 28, Appendix D, Section 2, p. 8

Results for particulate emissions during Run 4-2 have not been provided. The reason for this omission is unknown since sufficient data has been presented elsewhere to perform the calculations.

The Applicant should perform the calculations showing intermediate results in order to determine particulate emissions during Run 4-2. The final result should approximate the following data:

0.0097 gr/dscf, uncorrected

0.0138 gr/dscf, corrected to 7% O_2

0.0582 lb/hr

Comment 14 - Waste Feed Cutoff System

P. 33, Lines 17-35

The correspondence of the imposed voltages/currents to the value of the tested parameter have not been documented. The Applicant should provide evidence that the imposed voltages/currents are actually representative of values being simulated.

Comment 15 - Maximum Levels for Appendix VIII Constituents

P. 39, Line 2

The significant levels for $CFCl_3$, $CHBr_3$, and CF_2Cl_2 in wastes should be 100 ppm, not 1000 ppm.

Comment 16 - Emergency Waste Feed Cutoff Testing

P. 43, Lines 18-22

Testing of the waste feed cutoff system would normally be required at least monthly while the incinerator is in operation and upon startup after any period of extended shutdown.

Comment 17 - Liquid Feed Mixture Analytical Results

Appendix A, Sections 1 and 4

Two sets of analytical results for POHCs in the liquid feed mixture have been submitted. The analytical results data in Appendix A, Section 1 do not correspond with the tabular data in Appendix A, Section 4.

The discrepancies between Appendix A data in Sections 1 and 4 should be addressed. An explanation should include reasons why one set of data is erroneous and the other valid. The Applicant should also submit chromatograms from GC and GC/MS analyses (see Comment 18).

Comment 18 - POHC Analytical Results

Appendix A, Sections 1 and 2

The Applicant has not provided the results for POHC analyses in their most original form. The data in Appendix A only includes a tabular summary of this data.

The Applicant should supply copies of the chromatograms or other output from GC and GC/MS analyses.

Comment 19 - Incomplete Quality Assurance Results

Appendix A, Section 6
Appendix J, Section 14.0

The QA Report is incomplete. The Applicant has shown calculations for detemining data accuracy, precision and completeness in the QA Plan. However, the results of these determinations for data collected during the Trial Burn are not presented. In addition, evidence that replicate analyses have been performed is not shown in the Analytical Results section in Appendix A.

The Applicant should complete the QA Report by presenting results of the calculations to determine accuracy, precision and completeness for data collected during the Trial Burn. Analytical results from replicates and standards should also be summarized as were the results from the QC samples.

Comment 20 - Analytical Accuracy Objectives

Appendix A, Section 6(i)
Appendix J, Table 5-1

The quality assurance objectives listed in the Quality Assurance Plan do not appear to have been achieved. It is assumed that the accuracy objective for all analyses is 80-120%, not 80% as shown in Table 5-1. The total number of QC samples analyzed and the number of percent recoveries found within the 80-120% range are shown for each analysis in Table 2.

The Applicant should provide additional discussion on the effects of the apparent failure to meet QA objectives (see Comment 12).

Comment 21 - Sample Preparation Procedures for Liquids and Solids

Appendix A, Section 6(i)
Appendix N, pp 8-9

In the CAI Operational Run Plan, extractions of both liquid and solid samples are specified. However, the Applicant has provided no information regarding the procedures for sample preparation prior to analysis. This detail is especially appropriate in light of some poor sample recoveries exhibited in the QC results.

The Applicant should provide all extraction procedures and methods which were used to prepare liquid and solid samples for analysis.

Comment 22 - Pitot Tube Coefficient

Appendix D, Section 3
Appendix O, Section 7-4

The baseline value of 0.84 was used by the Applicant for the pitot tube coefficient. However no data has been submitted which verifies that the EPA geometric standards were met.

TABLE 2 - QA RESULTS

Analysis		No. of Recoveries Within 80-120% Range	Total No. of QC Samples
Chloride		6	6
Inorganic (Na, Fe, Al)		1	3
POHCs in Liquid Mixture Feed		1	1
POHCs in Soil	1st Set	0	4
	2nd Set	0	4
POHCs in Water	1st Set	1	4
	2nd Set	1	4
POHCs in VOST Cartridges			
	1st Set	0	6
	2nd Set	2	6

The Applicant should submit data which shows the required measurements in order to verify alignment of the pitot tube face openings.

Comment 23 - Stack Sampling Locations

Appendix I, pp 16, 17, 19 & 22
Appendix K, pp 4-5
Appendix L, pp 4 & 8

The schematic diagrams which the Applicant has used to illustrate the stack sampling locations are lacking in detail. Dimensional drawings should be substituted.

Dimensional drawings should be provided for all stack sampling locations to prove that they meet EPA requirements found in 40 CFR 60, Appendix A, Method 1, Section 2.

Comment 24 - Equation for Determining Analytical Accuracy

Appendix J, Equation 14-1 and Table 5-1

The measure of accuracy shown in Table 5-1 is not determined using equation 14-1. In Table 5-1 accuracy appears to be based on percent recovery of a spike and 100% is the optimum value. Equation 14-1 expresses accuracy as the percent difference between the measured value and the true value, with 0% as the optimum value.

The Applicant should indicate the actual equation which is used to determine accuracy.

Comment 25 - Method 3 Sampling Train

Appendix O, Page 3-2 and Figure 3

Insufficient detail has been provided showing elements of the Method 3 sampling train or its location.

The Applicant should illustrate the Method 3 sampling train components, showing where the sample is collected for Orsat Analysis, provide the location of this measurement point on the stack, and show the position of the sampling probe in the stack.

Comment 26 - Particulate Recovery Data

Appendix O, Section 7-7

In comparing data shown on Weight Sheet #1 with the laboratory data sheet, the basis for choosing values for gross and tare weights is unclear. Multiple weights were recorded in the laboratory and in some cases the maximum or minimum value was selected while in others an intermediate value was used.

The Applicant should explain the basis by which laboratory weight values were selected for subsequent calculations.

Comment 27 - Field Data for Method 5 Sample Recovery

Appendix O, Section 7-8

The Applicant has not provided field data for all of the samples recovered from the Method 5 sampling train. The data which was submitted only includes a net volume of moisture collected in the impingers and a net weight gain of water in silica gel.

If possible, field data sheets which show before and after weights or volumes collected in at least 3 impingers and their contents should be provided. Some indication that the silica gel has not been completely expended is also normally provided.

Comment 28 - Verification of Absence of Cyclonic Flow

Procedures which verify the absence of cyclonic flow are usually performed prior to stack sampling. No evidence has been provided by the Applicant that this has been done. In 40 CFR 60, Appendix A, Method 1, Section 2-4 it is specified that a cyclonic flow check should be conducted if flow disturbances are present which may induce swirling. No information is presented in the report which details the proximity of flow disturbances so there is no way of guaranteeing that cyclonic flow is absent.

The Applicant should supply dimensional drawings for the duct where sampling occurred including upstream and downstream disturbances (see Comment 23). In addition, documentation of any observations made immediately prior to testing which verify the absence of cyclonic flow should be provided.

Appendix A

Recalculation Results and Comparisons

EPA method 5
Data
File la1-1.dat

Source:Los Alamos
Date: 9-4-86
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 1

Stack static pressure .0367647 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.19 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	95.760	0.19	1.20	220	94	91	246	52	255
2	4	98.590	0.19	0.78	220	90	91	248	54	256
3	8	101.010	0.17	0.70	222	89	90	249	61	255
4	12	103.250	0.17	0.70	222	89	90	248	63	256
5	16	105.350	0.19	0.78	214	90	89	249	60	255
6	20	107.640	0.24	0.98	208	89	89	250	58	255
7	24	110.170	0.23	0.94	197	86	87	247	58	256
8	28	112.640	0.20	0.82	182	82	84	250	59	259
9	32	115.020	0.16	0.66	216	81	81	253	64	259
10	36	117.100	0.20	0.82	218	80	81	255	58	259
11	40	119.430	0.17	0.70	219	80	81	254	56	260
12	44	121.640	0.15	0.62	220	80	80	254	56	257
13	48	123.720	0.17	0.70	219	80	79	258	57	260
14	52	125.830	0.12	0.53	200	80	79	259	57	260
15	56	127.740	0.11	0.45	191	79	78	256	58	260
16	60	129.510	0.13	0.53	181	79	78	253	58	261

Final time 64 min
Final meter reading 131.38 cubic feet

Sampling time 64 min
Metered volume 35.62 cubic feet
Average square root of pitot tube readings .4154217
Average orifice reading .744375 inches of water
Average stack temperature 209.3125 F
Average meter temperature 84.25 F
Average oven temperature 251.8125 F
Average impinger temperature 58.0625 F
Average probe temperature 257.6875 F

Gas analysis

	CO2	O2	CO
# 1	8.70%	9.10%	5 PPM
# 2	8.60%	9.20%	
# 3	8.60%	9.20%	
# 4	8.60%	9.20%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.8843 grams tare 3.8832 grams gross
Total filter catch -1.100063E-03 grams

Front half rinse residue .0172 grams
Front half rinse volume 100 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 296 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 12.6 grams gross

Results EPA method 5
file la1-1.res

Los Alamos
9-4-86
CAI
-
run # 1

Velocity in stack	31.630	ft/sec
Stack flow rate	35,182.8	dscf/hr
Stack flow rate	586.38	dscf/min
Stack temperature	209.3	F

Particulate loading, dry catch

uncorrected	0.2119E-01 g/dscm	0.9252E-02 gr/dscf
corrected to 12% CO2	0.2948E-01 g/dscm	0.1287E-01 gr/dscf
corrected to 7% O2	0.2508E-01 g/dscm	0.1095E-01 gr/dscf

Particulate emission rate, 4.651161E-02 lb/hr

Gas composition, dry basis

8.625001 % CO2	9.175 % O2	5 PPM CO	82.1995 % N2

Gas moisture	0.351
Sat. water proportion	1.215
Moisture used in calc.	0.351
Actual molecular weight	25.621
Dry molecular weight	29.747
Isokinetic sampling rate	104.1 %
Isokinetic rate, sat water	104.1 %
Volume sampled	26.833 dscf
Particulates collected	0.0161 grams

EPA method 5
Data
File la1-2.dat

Source:Los Alamos
Date: 9-4-87
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 2

Stack static pressure 4.411765E-02 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.08 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	31.710	0.22	0.90	220	85	88	257	51	270
2	5	34.790	0.23	0.94	221	82	86	257	50	270
3	10	37.920	0.21	0.86	224	81	85	258	50	254
4	15	40.870	0.21	0.86	225	80	84	258	51	259
5	20	43.860	0.19	0.78	216	81	83	261	50	259
6	25	46.710	0.18	0.74	214	80	82	261	50	259
7	30	49.470	0.16	0.66	203	80	81	260	51	259
8	35	52.090	0.16	0.66	187	79	80	259	52	260
9	40	54.790	0.22	0.90	222	77	79	260	52	260
10	45	57.870	0.22	0.90	223	77	78	260	51	260
11	50	60.850	0.17	0.68	226	77	78	261	54	258
12	55	63.510	0.17	0.68	226	77	77	259	53	256
13	60	66.140	0.16	0.66	215	76	76	261	54	260
14	65	68.740	0.16	0.66	214	76	76	262	56	260
15	70	71.330	0.12	0.49	196	76	76	260	56	259
16	75	73.610	0.13	0.53	182	75	75	261	56	260

Final time 80 min
Final meter reading 75.94 cubic feet

Sampling time 80 min
Metered volume 44.23001 cubic feet
Average square root of pitot tube readings .4246853
Average orifice reading .74375 inches of water
Average stack temperature 213.375 F
Average meter temperature 79.46875 F
Average oven temperature 259.6875 F
Average impinger temperature 52.3125 F
Average probe temperature 260.1875 F

Gas analysis

	CO2	O2	CO
# 1	8.60%	9.20%	6 PPM
# 2	8.60%	9.20%	
# 3	8.60%	9.10%	
# 4	8.60%	9.10%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.8261 grams tare 3.8233 grams gross
Total filter catch -2.800226E-03 grams

Front half rinse residue .0149 grams
Front half rinse volume 170 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 395 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 14 grams gross

Results EPA method 5
file la1-2.res

Los Alamos
9-4-87
CAI
-
run # 2

Velocity in stack	32.613	ft/sec
Stack flow rate	35,120.2	dscf/hr
Stack flow rate	585.34	dscf/min
Stack temperature	213.4	F

Particulate loading, dry catch

uncorrected	0.1277E-01	g/dscm	0.5577E-02	gr/dscf
corrected to 12% CO2	0.1782E-01	g/dscm	0.7782E-02	gr/dscf
corrected to 7% O2	0.1509E-01	g/dscm	0.6589E-02	gr/dscf

Particulate emission rate, .0279864 lb/hr

Gas composition, dry basis

8.600001 % CO2	9.150001 % O2	6.000001 PPM CO	82.2494 % N2

Gas moisture	0.365
Sat. water proportion	1.324
Moisture used in calc.	0.365
Actual molecular weight	25.453
Dry molecular weight	29.742
Isokinetic sampling rate	104.0 %
Isokinetic rate, sat water	104.0 %
Volume sampled	33.456 dscf
Particulates collected	0.0121 grams

EPA method 5
Data
File la1-3.dat

Source:Los Alamos
Date: 9-4-86
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 3

Stack static pressure .0367647 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.08 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	77.500	0.22	0.88	214	65	65	265	60	260
2	5	80.490	0.22	0.88	221	65	65	266	52	260
3	10	83.460	0.20	0.80	225	66	65	268	50	261
4	15	86.340	0.20	0.80	225	66	65	268	53	260
5	20	89.280	0.17	0.68	220	67	66	268	52	261
6	25	91.840	0.16	0.64	214	67	66	262	51	257
7	30	94.420	0.14	0.56	196	67	66	251	51	257
8	35	96.810	0.14	0.56	184	67	66	258	51	257
9	40	99.190	0.19	0.76	221	67	66	258	52	256
10	45	101.970	0.19	0.76	224	67	66	259	51	257
11	50	104.710	0.17	0.68	225	68	66	258	52	257
12	55	107.350	0.17	0.68	226	68	67	259	52	257
13	60	109.990	0.15	0.60	209	68	67	259	52	258
14	65	112.480	0.15	0.60	206	68	67	260	52	259
15	70	114.980	0.12	0.48	198	67	67	259	52	259
16	75	117.220	0.12	0.48	184	67	67	260	52	259

Final time 80 min
Final meter reading 119.47 cubic feet

Sampling time 80 min
Metered volume 41.97 cubic feet
Average square root of pitot tube readings .4098107
Average orifice reading .6775 inches of water
Average stack temperature 212 F
Average meter temperature 66.46875 F
Average oven temperature 261.125 F
Average impinger temperature 52.1875 F
Average probe temperature 258.4375 F

Gas analysis

	CO2	O2	CO
# 1	8.70%	9.10%	12 PPM
# 2	8.60%	9.20%	
# 3	8.60%	9.20%	
# 4	8.60%	9.20%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.8281 grams tare 3.8282 grams gross
Total filter catch 1.001358E-04 grams

Front half rinse residue .0183 grams
Front half rinse volume 170 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 385 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 14 grams gross

Results EPA method 5
file la1-3.res

Los Alamos
9-4-86
CAI
-
run # 3

Velocity in stack	31.447	ft/sec
Stack flow rate	33,880.1	dscf/hr
Stack flow rate	564.67	dscf/min
Stack temperature	212.0	F

Particulate loading, dry catch

uncorrected	0.1998E-01	g/dscm	0.8724E-02	gr/dscf
corrected to 12% CO2	0.2779E-01	g/dscm	0.1214E-01	gr/dscf
corrected to 7% O2	0.2365E-01	g/dscm	0.1033E-01	gr/dscf

Particulate emission rate, 4.223326E-02 lb/hr

Gas composition, dry basis

8.625001 % CO2	9.175 % O2	12 PPM CO	82.1988 % N2

Gas moisture	0.366
Sat. water proportion	1.288
Moisture used in calc.	0.366
Actual molecular weight	25.447
Dry molecular weight	29.747
Isokinetic sampling rate	104.8 %
Isokinetic rate, sat water	104.8 %
Volume sampled	32.523 dscf
Particulates collected	0.0184 grams

EPA method 5
Data
File la2-1.dat

Source:Los Alamos
Date: 9-5-86
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 4

Stack static pressure .0367647 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.05 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	19.710	0.19	0.74	220	65	64	255	46	261
2	5	22.470	0.19	0.74	222	66	64	256	42	260
3	10	25.220	0.17	0.66	225	68	65	257	42	260
4	15	27.810	0.16	0.62	226	70	66	257	42	259
5	20	30.320	0.14	0.55	221	71	67	256	43	258
6	25	32.690	0.14	0.55	218	71	68	256	44	259
7	30	35.090	0.11	0.43	206	72	69	257	46	258
8	35	37.220	0.10	0.39	186	73	70	257	47	258
9	40	39.270	0.19	0.74	221	72	71	256	51	258
10	45	42.040	0.18	0.70	226	75	72	256	46	257
11	50	44.730	0.15	0.59	228	76	73	256	48	257
12	55	47.220	0.14	0.55	228	76	73	256	50	257
13	60	49.640	0.13	0.51	217	76	73	256	51	257
14	65	51.970	0.13	0.51	218	77	74	256	51	257
15	70	54.300	0.10	0.39	203	77	74	256	52	256
16	75	56.400	0.11	0.43	198	78	75	255	53	255

Final time 80 min
Final meter reading 58.55 cubic feet

Sampling time 80 min
Metered volume 38.84 cubic feet
Average square root of pitot tube readings .3794332
Average orifice reading .5687501 inches of water
Average stack temperature 216.4375 F
Average meter temperature 71.28125 F
Average oven temperature 256.125 F
Average impinger temperature 47.125 F
Average probe temperature 257.9375 F

Gas analysis

	CO2	O2	CO
# 1	8.00%	10.40%	5 PPM
# 2	8.00%	10.40%	
# 3	8.00%	10.40%	
# 4	8.00%	10.40%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.8809 grams tare 3.8792 grams gross
Total filter catch -1.699925E-03 grams

Front half rinse residue .0217 grams
Front half rinse volume 140 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 295 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 8.8 grams gross

Results EPA method 5
file la2-1.res

Los Alamos
9-5-86
CAI
-
run # 4

Velocity in stack	28.974	ft/sec
Stack flow rate	33,003.9	dscf/hr
Stack flow rate	550.06	dscf/min
Stack temperature	216.4	F

Particulate loading, dry catch

uncorrected	0.2372E-01 g/dscm	0.1036E-01 gr/dscf
corrected to 12% CO2	0.3558E-01 g/dscm	0.1554E-01 gr/dscf
corrected to 7% O2	0.3132E-01 g/dscm	0.1368E-01 gr/dscf

Particulate emission rate, 4.884395E-02 lb/hr

Gas composition, dry basis

8 % CO2	10.4 % O2	5 PPM CO	81.5995 % N2

Gas moisture	0.324
Sat. water proportion	1.408
Moisture used in calc.	0.324
Actual molecular weight	25.901
Dry molecular weight	29.696
Isokinetic sampling rate	98.5 %
Isokinetic rate, sat water	98.5 %
Volume sampled	29.776 dscf
Particulates collected	0.0200 grams

EPA method 5
Data
File la2-2.dat

Source:Los Alamos
Date: 9-5-86
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 5

Stack static pressure 4.411765E-02 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.05 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	58.800	0.19	0.84	233	88	87	261	55	254
2	5	61.770	0.19	0.84	233	89	88	251	50	252
3	10	64.700	0.17	0.75	235	90	89	263	54	253
4	15	67.530	0.17	0.75	234	91	90	265	54	252
5	20	70.330	0.14	0.62	227	92	90	261	57	252
6	25	72.910	0.13	0.57	225	93	90	260	58	252
7	30	75.390	0.11	0.48	212	92	90	260	59	251
8	35	77.640	0.11	0.48	199	92	90	261	60	251
9	40	79.930	0.19	0.84	230	91	90	260	59	251
10	45	82.840	0.18	0.79	233	91	90	264	54	252
11	50	85.750	0.15	0.66	236	93	92	263	58	252
12	55	88.430	0.14	0.62	236	94	93	264	60	253
13	60	91.040	0.13	0.57	232	95	94	263	61	253
14	65	93.560	0.12	0.53	228	98	96	264	63	249
15	70	95.970	0.10	0.44	220	99	97	262	65	249
16	75	98.260	0.10	0.44	210	99	98	263	66	248

Final time 80 min
Final meter reading 100.51 cubic feet

Sampling time 80 min
Metered volume 41.71 cubic feet
Average square root of pitot tube readings .3784679
Average orifice reading .6387499 inches of water
Average stack temperature 226.4375 F
Average meter temperature 92.21875 F
Average oven temperature 261.5625 F
Average impinger temperature 58.3125 F
Average probe temperature 251.5 F

Gas analysis

	CO2	O2	CO
# 1	8.00%	10.40%	6 PPM
# 2	8.00%	10.40%	
# 3	8.00%	10.40%	
# 4	8.00%	10.40%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.7732 grams tare 3.7718 grams gross
Total filter catch -1.399994E-03 grams

Front half rinse residue .0186 grams
Front half rinse volume 147 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 296 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 11 grams gross

Results EPA method 5
file la2-2.res

Los Alamos
9-5-86
CAI
-
run # 5

Velocity in stack	29.076	ft/sec
Stack flow rate	32,884.5	dscf/hr
Stack flow rate	548.07	dscf/min
Stack temperature	226.4	F

Particulate loading, dry catch

uncorrected	0.1974E-01 g/dscm	0.8619E-02 gr/dscf
corrected to 12% CO2	0.2961E-01 g/dscm	0.1293E-01 gr/dscf
corrected to 7% O2	0.2607E-01 g/dscm	0.1138E-01 gr/dscf

Particulate emission rate, 4.050072E-02 lb/hr

Gas composition, dry basis

8 % CO2	10.4 % O2	6.000001 PPM CO	81.59941 % N2

Gas moisture	0.320
Sat. water proportion	1.708
Moisture used in calc.	0.320
Actual molecular weight	25.959
Dry molecular weight	29.696
Isokinetic sampling rate	102.1 %
Isokinetic rate, sat water	102.2 %
Volume sampled	30.771 dscf
Particulates collected	0.0172 grams

EPA method 5
Data
File la2-3.dat

Source:Los Alamos
Date: 9-5-86
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 6

Stack static pressure .0367647 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.05 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	2.720	0.18	0.79	232	99	99	256	68	260
2	5	5.680	0.19	0.84	235	98	99	261	68	260
3	10	8.670	0.18	0.79	236	98	98	255	63	260
4	15	11.550	0.16	0.70	239	99	98	262	64	260
5	20	14.310	0.13	0.57	234	103	100	256	60	259
6	25	16.820	0.12	0.53	232	104	102	258	58	259
7	30	19.270	0.09	0.40	212	105	103	256	56	262
8	35	21.430	0.10	0.44	205	105	104	255	57	260
9	40	23.680	0.17	0.75	235	106	104	254	63	258
10	45	26.470	0.17	0.75	239	105	103	254	56	257
11	50	29.310	0.15	0.66	240	106	105	255	58	259
12	55	31.970	0.14	0.62	239	106	107	260	60	260
13	60	34.590	0.13	0.57	232	107	107	257	61	256
14	65	37.100	0.13	0.57	226	105	104	249	61	258
15	70	39.560	0.12	0.53	216	104	102	261	61	253
16	75	42.020	0.11	0.48	208	103	105	264	62	263

Final time 80 min
Final meter reading 44.32 cubic feet

Sampling time 80 min
Metered volume 41.6 cubic feet
Average square root of pitot tube readings .3745549
Average orifice reading .624375 inches of water
Average stack temperature 228.75 F
Average meter temperature 102.9063 F
Average oven temperature 257.0625 F
Average impinger temperature 61 F
Average probe temperature 259 F

Gas analysis

	CO2	O2	CO
# 1	8.00%	10.40%	7 PPM
# 2	8.00%	10.40%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.8003 grams tare 3.8015 grams gross
Total filter catch 1.200199E-03 grams

Front half rinse residue .0214 grams
Front half rinse volume 140 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 287 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 13.6 grams gross

Results EPA method 5
file la2-3.res

Los Alamos
9-5-86
CAI
-
run # 6

Velocity in stack	28.830	ft/sec
Stack flow rate	32,477.7	dscf/hr
Stack flow rate	541.29	dscf/min
Stack temperature	228.8	F

Particulate loading, dry catch

uncorrected	0.2651E-01 g/dscm	0.1158E-01 gr/dscf
corrected to 12% CO2	0.3976E-01 g/dscm	0.1736E-01 gr/dscf
corrected to 7% O2	0.3501E-01 g/dscm	0.1529E-01 gr/dscf

Particulate emission rate, 5.371953E-02 lb/hr

Gas composition, dry basis

8 % CO2	10.4 % O2	7 PPM CO	81.5993 % N2

Gas moisture	0.320
Sat. water proportion	1.785
Moisture used in calc.	0.320
Actual molecular weight	25.957
Dry molecular weight	29.696
Isokinetic sampling rate	101.2 %
Isokinetic rate, sat water	101.2 %
Volume sampled	30.106 dscf
Particulates collected	0.0226 grams

EPA method 5
Data
File 1a3-1.dat

Source:Los Alamos
Date: 9-6-86
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 7

Stack static pressure 4.411765E-02 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.15 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	45.480	0.24	1.00	225	72	71	252	41	252
2	5	48.720	0.24	1.00	230	72	72	251	39	253
3	10	51.910	0.23	0.97	233	73	72	253	43	251
4	15	55.060	0.22	0.92	233	74	73	253	51	250
5	20	58.180	0.16	0.67	227	75	73	252	58	251
6	25	60.830	0.17	0.71	225	76	74	252	58	250
7	30	63.560	0.14	0.59	214	78	75	253	57	250
8	35	66.050	0.14	0.59	198	78	76	253	57	250
9	40	68.060	0.23	0.97	230	79	77	252	53	250
10	45	71.190	0.22	0.92	234	80	77	251	50	249
11	50	74.300	0.18	0.76	235	81	78	253	50	250
12	55	77.110	0.18	0.76	235	83	80	256	50	249
13	60	79.940	0.17	0.71	229	85	82	255	53	247
14	65	82.700	0.17	0.71	227	86	84	250	51	248
15	70	85.440	0.14	0.59	220	88	85	252	52	247
16	75	88.010	0.14	0.59	209	90	87	254	54	247

Final time 80 min
Final meter reading 90.55 cubic feet

Sampling time 80 min
Metered volume 45.07001 cubic feet
Average square root of pitot tube readings .428698
Average orifice reading .7787501 inches of water
Average stack temperature 225.25 F
Average meter temperature 78.3125 F
Average oven temperature 252.625 F
Average impinger temperature 51.0625 F
Average probe temperature 249.625 F

Gas analysis

	CO2	O2	CO
# 1	8.00%	10.10%	0 PPM
# 2	8.00%	10.10%	
# 3	8.00%	10.10%	
# 4	8.00%	10.10%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.9441 grams tare 3.9449 grams gross
Total filter catch 8.001328E-04 grams

Front half rinse residue .0258 grams
Front half rinse volume 150 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 381 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 18 grams gross

Results EPA method 5
file la3-1.res

Los Alamos
9-6-86
CAI
-
run # 7

Velocity in stack	33.099	ft/sec
Stack flow rate	35,753.9	dscf/hr
Stack flow rate	595.90	dscf/min
Stack temperature	225.3	F

Particulate loading, dry catch

uncorrected	0.2741E-01 g/dscm	0.1197E-01 gr/dscf
corrected to 12% CO2	0.4111E-01 g/dscm	0.1795E-01 gr/dscf
corrected to 7% O2	0.3520E-01 g/dscm	0.1537E-01 gr/dscf

Particulate emission rate, 6.114443E-02 lb/hr

Gas composition, dry basis

8 % CO2	10.1 % O2	0 PPM CO	81.9 % N2

Gas moisture	0.354
Sat. water proportion	1.663
Moisture used in calc.	0.354
Actual molecular weight	25.548
Dry molecular weight	29.684
Isokinetic sampling rate	104.6 %
Isokinetic rate, sat water	104.6 %
Volume sampled	34.271 dscf
Particulates collected	0.0266 grams

EPA method 5
Data
File la3-2.dat

Source:Los Alamos
Date: 9-6-86
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 8

Stack static pressure 2.941177E-02 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.05 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	90.770	0.24	0.96	224	86	89	249	54	255
2	5	93.940	0.25	1.00	225	88	89	250	52	254
3	10	97.160	0.24	0.96	229	89	90	250	53	252
4	15	100.310	0.24	0.96	228	90	90	257	54	242
5	20	103.460	0.20	0.80	218	88	90	251	57	253
6	25	106.340	0.20	0.80	218	90	91	254	58	253
7	30	109.230	0.16	0.64	204	90	91	248	58	253
8	35	111.830	0.16	0.64	189	89	91	251	58	253
9	40	114.430	0.25	1.00	223	89	91	252	59	254
10	45	117.620	0.25	1.00	225	89	90	252	58	253
11	50	120.870	0.21	0.84	225	88	90	252	58	253
12	55	123.820	0.21	0.84	226	88	90	252	61	255
13	60	126.790	0.21	0.84	217	86	88	251	62	254
14	65	129.760	0.20	0.80	214	86	88	255	64	254
15	70	132.640	0.17	0.68	206	86	88	252	67	254
16	75	135.320	0.17	0.68	252	85	87	252	68	255

Final time 80 min
Final meter reading 137.98 cubic feet

Sampling time 80 min
Metered volume 47.21 cubic feet
Average square root of pitot tube readings .4569206
Average orifice reading .8400001 inches of water
Average stack temperature 220.1875 F
Average meter temperature 88.75 F
Average oven temperature 251.75 F
Average impinger temperature 58.8125 F
Average probe temperature 252.9375 F

Gas analysis

	CO2	O2	CO
# 1	7.60%	10.00%	5 PPM
# 2	7.60%	10.00%	
# 3	7.60%	10.10%	
# 4	7.60%	10.00%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.8299 grams tare 3.832 grams gross
Total filter catch 2.099991E-03 grams

Front half rinse residue .0353 grams
Front half rinse volume 150 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 467 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 18.4 grams gross

Results EPA method 5
file la3-2.res

Los Alamos
9-6-86
CAI
-
run # 8

Velocity in stack	35.594	ft/sec
Stack flow rate	36,129.0	dscf/hr
Stack flow rate	602.15	dscf/min
Stack temperature	220.2	F

Particulate loading, dry catch

uncorrected	0.3765E-01	g/dscm	0.1644E-01	gr/dscf
corrected to 12% CO2	0.5946E-01	g/dscm	0.2596E-01	gr/dscf
corrected to 7% O2	0.4803E-01	g/dscm	0.2098E-01	gr/dscf

Particulate emission rate, 8.489112E-02 lb/hr

Gas composition, dry basis

7.6 % CO2	10.025 % O2	5 PPM CO	82.3745 % N2

Gas moisture	0.394
Sat. water proportion	1.516
Moisture used in calc.	0.394
Actual molecular weight	25.034
Dry molecular weight	29.617
Isokinetic sampling rate	106.0 %
Isokinetic rate, sat water	106.0 %
Volume sampled	35.071 dscf
Particulates collected	0.0374 grams

EPA method 5
Data
File la3-3.dat

Source:Los Alamos
Date: 9-6-86
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 9

Stack static pressure 2.941177E-02 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.05 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	38.200	0.22	1.00	218	73	74	256	55	256
2	5	41.390	0.22	1.00	220	73	74	257	50	256
3	10	44.570	0.21	0.97	221	72	73	257	51	253
4	15	47.690	0.22	1.00	222	73	73	255	57	252
5	20	50.880	0.19	0.87	213	73	72	252	61	253
6	25	53.850	0.19	0.87	211	72	72	256	63	253
7	30	56.800	0.16	0.74	200	72	72	257	61	252
8	35	59.560	0.16	0.74	183	72	72	258	59	252
9	40	62.310	0.26	1.20	218	71	71	255	54	253
10	45	65.700	0.26	1.20	220	72	71	246	51	253
11	50	69.110	0.21	0.97	221	71	71	257	50	253
12	55	72.270	0.21	0.97	221	71	71	255	50	253
13	60	75.400	0.20	0.92	209	70	71	257	50	253
14	65	78.430	0.20	0.92	203	71	70	257	50	252
15	70	81.480	0.15	0.69	191	70	70	256	51	253
16	75	84.140	0.15	0.69	182	70	69	258	52	253

Final time 80 min
Final meter reading 86.8 cubic feet

Sampling time 80 min
Metered volume 48.6 cubic feet
Average square root of pitot tube readings .4464066
Average orifice reading .9218749 inches of water
Average stack temperature 209.5625 F
Average meter temperature 71.625 F
Average oven temperature 255.5625 F
Average impinger temperature 54.0625 F
Average probe temperature 253.125 F

Gas analysis

	CO2	O2	CO
# 1	7.60%	10.20%	5 PPM
# 2	7.60%	10.20%	
# 3	7.60%	10.20%	
# 4	7.60%	10.20%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.962 grams tare 3.9627 grams gross
Total filter catch 6.99997E-04 grams

Front half rinse residue .0435 grams
Front half rinse volume 140 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 280 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 17.9 grams gross

Results EPA method 5
file 1a3-3.res

Los Alamos
9-6-86
CAI
-
run # 9

Velocity in stack	33.568	ft/sec
Stack flow rate	41,538.3	dscf/hr
Stack flow rate	692.31	dscf/min
Stack temperature	209.6	F

Particulate loading, dry catch

uncorrected	0.4187E-01 g/dscm	0.1828E-01 gr/dscf
corrected to 12% CO2	0.6611E-01 g/dscm	0.2887E-01 gr/dscf
corrected to 7% O2	0.5427E-01 g/dscm	0.2370E-01 gr/dscf

Particulate emission rate, .1085228 lb/hr

Gas composition, dry basis

7.6 % CO2	10.2 % O2	5 PPM CO	82.1995 % N2

Gas moisture	0.273
Sat. water proportion	1.229
Moisture used in calc.	0.273
Actual molecular weight	26.447
Dry molecular weight	29.624
Isokinetic sampling rate	98.0 %
Isokinetic rate, sat water	98.0 %
Volume sampled	37.276 dscf
Particulates collected	0.0442 grams

EPA method 5
Data
File 1a4-1.dat

Source:Los Alamos
Date: 9-7-86
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 10

Stack static pressure 2.941177E-02 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.13 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	88.160	0.22	1.00	217	75	77	253	56	252
2	5	91.380	0.21	0.97	220	77	78	247	51	251
3	10	94.520	0.20	0.92	223	78	79	256	48	251
4	15	97.600	0.20	0.92	222	79	79	255	48	251
5	20	100.680	0.15	0.69	223	81	81	256	52	250
6	25	103.400	0.15	0.69	215	82	82	258	53	249
7	30	106.100	0.12	0.55	196	82	83	254	53	250
8	35	108.540	0.14	0.64	185	83	83	253	53	250
9	40	111.170	0.23	1.10	219	83	85	256	53	251
10	45	114.520	0.24	1.10	222	84	85	257	50	250
11	50	117.930	0.19	0.87	222	84	85	256	52	251
12	55	120.960	0.19	0.87	222	84	85	255	53	252
13	60	123.980	0.17	0.78	217	86	86	258	54	249
14	65	126.850	0.17	0.78	211	85	86	255	53	252
15	70	129.740	0.13	0.60	198	85	86	256	54	251
16	75	132.280	0.13	0.60	192	85	86	257	55	250

Final time 80 min
Final meter reading 134.84 cubic feet

Sampling time 80 min
Metered volume 46.67999 cubic feet
Average square root of pitot tube readings .4189932
Average orifice reading .8175 inches of water
Average stack temperature 212.75 F
Average meter temperature 82.46875 F
Average oven temperature 255.125 F
Average impinger temperature 52.375 F
Average probe temperature 250.625 F

Gas analysis

	CO2	O2	CO
# 1	5.80%	12.40%	5 PPM
# 2	5.80%	12.40%	
# 3	6.00%	12.20%	
# 4	6.00%	12.20%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.8131 grams tare 3.8133 grams gross
Total filter catch 1.997948E-04 grams

Front half rinse residue .0124 grams
Front half rinse volume 170 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 242.6 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 11.6 grams gross

Results EPA method 5
file la4-1.res

Los Alamos
9-7-86
CAI
-
run # 10

Velocity in stack	31.475	ft/sec
Stack flow rate	39,949.2	dscf/hr
Stack flow rate	665.82	dscf/min
Stack temperature	212.8	F

Particulate loading, dry catch

uncorrected	0.1264E-01 g/dscm	0.5520E-02 gr/dscf
corrected to 12% CO2	0.2571E-01 g/dscm	0.1123E-01 gr/dscf
corrected to 7% O2	0.2034E-01 g/dscm	0.8883E-02 gr/dscf

Particulate emission rate, 3.150941E-02 lb/hr

Gas composition, dry basis

5.9 % CO2	12.3 % O2	5 PPM CO	81.7995 % N2

Gas moisture	0.254
Sat. water proportion	1.305
Moisture used in calc.	0.254
Actual molecular weight	26.535
Dry molecular weight	29.436
Isokinetic sampling rate	96.2 %
Isokinetic rate, sat water	96.2 %
Volume sampled	35.198 dscf
Particulates collected	0.0126 grams

EPA method 5
Data
File 1a4-2.dat

Source:Los Alamos
Date: 9-7-86
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 11

Stack static pressure 2.941177E-02 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.13 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	35.400	0.24	1.30	222	86	89	262	53	259
2	5	39.020	0.24	1.30	223	87	88	264	46	259
3	10	42.690	0.21	1.10	224	87	88	259	46	258
4	15	46.060	0.21	1.10	224	87	89	259	48	256
5	20	49.430	0.17	0.90	214	86	88	259	48	256
6	25	52.470	0.17	0.90	214	87	88	258	49	254
7	30	55.530	0.15	0.80	194	88	89	258	50	255
8	35	58.430	0.15	0.80	186	89	90	258	51	254
9	40	61.310	0.24	1.30	218	88	89	256	51	255
10	45	64.860	0.25	1.30	222	88	89	260	49	253
11	50	68.500	0.22	1.20	217	84	87	249	50	255
12	55	72.040	0.21	1.10	220	83	86	258	50	254
13	60	75.470	0.19	1.00	212	83	84	258	52	254
14	65	78.680	0.18	0.95	209	81	82	256	51	258
15	70	81.790	0.15	0.78	191	79	81	259	51	255
16	75	84.600	0.15	0.78	182	79	80	260	51	255

Final time 80 min
Final meter reading 87.41001 cubic feet

Sampling time 80 min
Metered volume 52.01 cubic feet
Average square root of pitot tube readings .4404673
Average orifice reading 1.038125 inches of water
Average stack temperature 210.75 F
Average meter temperature 85.90625 F
Average oven temperature 258.3125 F
Average impinger temperature 49.75 F
Average probe temperature 255.625 F

Gas analysis

	CO2	O2	CO
# 1	7.00%	11.30%	5 PPM
# 2	6.70%	11.10%	
# 3	7.00%	11.10%	
# 4	7.00%	11.00%	
# 5	7.20%	11.00%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.8184 grams tare 3.8195 grams gross
Total filter catch 1.100063E-03 grams

Front half rinse residue .0235 grams
Front half rinse volume 160 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 270.9 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 13.8 grams gross

Results EPA method 5
file la4-2.res

Los Alamos
9-7-86
CAI
-
run # 11

Velocity in stack	32.995	ft/sec
Stack flow rate	41,888.9	dscf/hr
Stack flow rate	698.15	dscf/min
Stack temperature	210.8	F

Particulate loading, dry catch

uncorrected	0.2227E-01	g/dscm	0.9727E-02	gr/dscf
corrected to 12% CO2	0.3829E-01	g/dscm	0.1672E-01	gr/dscf
corrected to 7% O2	0.3150E-01	g/dscm	0.1376E-01	gr/dscf

Particulate emission rate, 5.822194E-02 lb/hr

Gas composition, dry basis

6.980001 % CO2	11.1 % O2	5 PPM CO	81.9195 % N2

Gas moisture	0.256
Sat. water proportion	1.254
Moisture used in calc.	0.256
Actual molecular weight	26.604
Dry molecular weight	29.561
Isokinetic sampling rate	101.6 %
Isokinetic rate, sat water	101.6 %
Volume sampled	38.997 dscf
Particulates collected	0.0246 grams

EPA method 5
Data
File 1a4-3.dat

Source:Los Alamos
Date: 9-7-86
Location: CAI
Source code: -

Stack diameter 11.938 inches
16 Traverse points Run number 12

Stack static pressure 2.941177E-02 in of Hg
Pitot tube correction factor .84 Meter correction factor .9

Nozzle diameter .313 inches
Barometric pressure 23.1 in of Hg
Method 1

Traverse Point No	Start Time Min	Meter Rdg Cu ft	Pitot Tube in wa	Orifice Rdg in wa	Stack T F	Meter in T F	Meter Out T F	Oven T F	Impinger T F	Probe T F
1	0	9.340	0.24	1.20	217	73	73	268	59	257
2	5	12.900	0.24	1.20	218	73	73	252	59	257
3	10	16.470	0.21	1.10	221	74	73	254	59	256
4	15	19.810	0.21	1.10	221	73	72	261	58	256
5	20	23.040	0.19	0.99	212	72	72	262	53	257
6	25	26.200	0.19	0.99	210	72	71	265	53	257
7	30	29.420	0.15	0.78	183	69	70	265	53	259
8	35	32.190	0.15	0.78	175	69	68	268	53	257
9	40	35.000	0.24	1.20	209	66	66	266	53	267
10	45	38.470	0.24	1.20	210	66	66	267	53	256
11	50	41.900	0.21	1.10	210	66	65	266	55	257
12	55	45.320	0.21	1.10	207	64	64	258	53	255
13	60	48.670	0.19	0.99	196	63	63	265	52	258
14	65	51.840	0.19	0.99	193	63	63	263	53	257
15	70	54.980	0.15	0.78	178	64	63	262	53	255
16	75	57.820	0.15	0.78	169	64	63	261	53	254

Final time 80 min
Final meter reading 60.65 cubic feet

Sampling time 80 min
Metered volume 51.31 cubic feet
Average square root of pitot tube readings .442836
Average orifice reading 1.0175 inches of water
Average stack temperature 201.8125 F
Average meter temperature 68 F
Average oven temperature 262.6875 F
Average impinger temperature 54.5 F
Average probe temperature 257.1875 F

Gas analysis

	CO2	O2	CO
# 1	8.00%	10.20%	7 PPM
# 2	8.00%	10.20%	

Cyclone catch 0 grams tare 0 grams gross

Filter catch
1 3.8715 grams tare 3.8817 grams gross
Total filter catch 1.020002E-02 grams

Front half rinse residue .0383 grams
Front half rinse volume 175 ml
Rinse solvent blank 0 gr/100 ml

Impinger weight
1 0 grams tare 279 grams gross
2 0 grams tare 0 grams gross
3 0 grams tare 0 grams gross

Silica gell impinger weights
1 0 grams tare 18.4 grams gross

Results EPA method 5
file la4-3.res

Los Alamos
9-7-86
CAI
-
run # 12

Velocity in stack	32.949	ft/sec
Stack flow rate	42,065.2	dscf/hr
Stack flow rate	701.09	dscf/min
Stack temperature	201.8	F

Particulate loading, dry catch

uncorrected	0.4311E-01 g/dscm	0.1883E-01 gr/dscf
corrected to 12% CO2	0.6467E-01 g/dscm	0.2824E-01 gr/dscf
corrected to 7% O2	0.5589E-01 g/dscm	0.2441E-01 gr/dscf

Particulate emission rate, .1131639 lb/hr

Gas composition, dry basis

8 % CO2	10.2 % O2	7 PPM CO	81.7993 % N2

Gas moisture	0.261
Sat. water proportion	1.047
Moisture used in calc.	0.261
Actual molecular weight	26.642
Dry molecular weight	29.688
Isokinetic sampling rate	103.1 %
Isokinetic rate, sat water	103.1 %
Volume sampled	39.723 dscf
Particulates collected	0.0485 grams

VOST
Calculations
File la1-2&3.vst

Source: Los Alamos
Date: 9-4-86
Location: CAI
Run Number: 1

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	2.780	1.000	CCl4	44.8400
			TCE	19.3900

Total CCl4 Feed Rate (g/sec) = 9.423932
Total TCE Feed Rate (g/sec) = 4.075157
Flowrate of Stack Gases (dscf/min) = 586.3795
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V1-2	23.17	199.01	220.72	31.38	16.24
V1-3	23.17	223.01	241.92	30.38	14.19

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V1-2	CCl4	6780.0	6.960E-06	1.156E-04	99.99877373
	TCE	161.0	1.653E-07	2.744E-06	99.99993266
V1-3	CCl4	5110.0	6.003E-06	9.967E-05	99.99894241
	TCE	10.0	1.175E-08	1.950E-07	99.99999521

* Not Corrected To 12% CO2

VOST
Calculations
File la1-6.vst

Source: Los Alamos
Date: 9-4-86
Location: CAI
Run Number: 1

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	2.860	1.000	CCl4	44.8400
			TCE	19.3900

Total CCl4 Feed Rate (g/sec) = 9.695126
Total TCE Feed Rate (g/sec) = 4.192428
Flowrate of Stack Gases (dscf/min) = 585.3366
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V1-6	23.08	294.32	315.68	27.63	16.11

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V1-6	CCl4	5410.0	5.597E-06	9.276E-05	99.99904319
	TCE	140.0	1.448E-07	2.401E-06	99.99994274

* Not Corrected To 12% CO2

VOST
Calculations
File la2-1.vst

Source: Los Alamos
Date: 9-5-86
Location: CAI
Run Number: 2

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	2.890	1.000	CCl4	45.3500
			TCE	19.1200

Total CCl4 Feed Rate (g/sec) = 9.908248
Total TCE Feed Rate (g/sec) = 4.177415
Flowrate of Stack Gases (dscf/min) = 550.0645
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V2-1	23.05	0.00	20.62	20.88	15.89

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V2-1	CCl4	63.0	6.609E-08	1.029E-06	99.99998961
	TCE	10.0	1.049E-08	1.634E-07	99.99999609

* Not Corrected To 12% CO2

VOST
Calculations
File la2-3.vst

Source: Los Alamos
Date: 9-5-86
Location: CAI
Run Number: 2

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	2.860	1.000	TCE	19.1200

Total TCE Feed Rate (g/sec) = 4.13405
Flowrate of Stack Gases (dscf/min) = 548.0745
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V2-3	23.05	43.78	65.60	38.13	15.88

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V2-3	TCE	10.0	1.049E-08	1.629E-07	99.99999606

* Not Corrected To 12% CO2

VOST
Calculations
File la2-4.vst

Source: Los Alamos
Date: 9-5-86
Location: CAI
Run Number: 2

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	2.860	1.000	CCl4	45.3500
			TCE	19.1200

Total CCl4 Feed Rate (g/sec) = 9.805394
Total TCE Feed Rate (g/sec) = 4.13405
Flowrate of Stack Gases (dscf/min) = 548.0745
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V2-4	23.05	66.30	87.47	35.63	15.53

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V2-4	CCl4	1190.0	1.277E-06	1.982E-05	99.99979791
	TCE	164.0	1.760E-07	2.731E-06	99.99993394

* Not Corrected To 12% CO2

VOST
Calculations
File 1a2-5&6.vst

Source: Los Alamos
Date: 9-5-86
Location: CAI
Run Number: 2

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	2.880	1.000	CCl4	45.3500
			TCE	19.1200

Total CCl4 Feed Rate (g/sec) = 9.873964
Total TCE Feed Rate (g/sec) = 4.16296
Flowrate of Stack Gases (dscf/min) = 541.2946
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V2-5	23.05	87.98	109.96	39.63	15.92
V2-6	23.05	110.67	130.59	47.88	14.06

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V2-5	CCl4	4580.0	4.795E-06	7.349E-05	99.99925575
	TCE	115.0	1.204E-07	1.845E-06	99.99995568
V2-6	CCl4	5660.0	6.710E-06	1.029E-04	99.99895835
	TCE	110.0	1.304E-07	1.999E-06	99.99995198

* Not Corrected To 12% CO2

VOST
Calculations
File 1a3-1&2.vst

Source: Los Alamos
Date: 9-6-86
Location: CAI
Run Number: 1

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	2.760	1.000	CCl4	29.8500
			TCE	14.6200

Total CCl4 Feed Rate (g/sec) = 6.228381
Total TCE Feed Rate (g/sec) = 3.050551
Flowrate of Stack Gases (dscf/min) = 595.9
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V3-1	23.15	0.00	20.14	24.88	15.38
V3-2	23.15	20.95	41.82	32.75	15.52

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V3-1	CCl4	2170.0	2.352E-06	3.969E-05	99.99936281
	TCE	231.0	2.504E-07	4.225E-06	99.99986151
V3-2	CCl4	2230.0	2.394E-06	4.040E-05	99.99935139
	TCE	235.0	2.523E-07	4.257E-06	99.99986045

* Not Corrected To 12% CO2

VOST
Calculations
File la3-3&4.vst

Source: Los Alamos
Date: 9-6-86
Location: CAI
Run Number: 2

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	3.110	1.000	CCl4	29.9100
			TCE	14.5600

Total CCl4 Feed Rate (g/sec) = 7.032319
Total TCE Feed Rate (g/sec) = 3.423289
Flowrate of Stack Gases (dscf/min) = 602.15
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V3-3	23.05	45.71	66.42	32.88	15.33
V3-4	23.05	66.83	87.20	32.75	15.09

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V3-3	CCl4	5660.0	6.153E-06	1.049E-04	99.99850823
	TCE	1240.0	1.348E-06	2.298E-05	99.99932863
V3-4	CCl4	4440.0	4.905E-06	8.363E-05	99.99881073
	TCE	543.0	5.999E-07	1.023E-05	99.99970122

* Not Corrected To 12% CO2

VOST
Calculations
File 3-5&6.vst

Source: Los Alamos7
Date: 5-6-86
Location: CAI
Run Number: 3

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	2.960	1.000	CCl4	30.4000
			TCE	14.6800

Total CCl4 Feed Rate (g/sec) = 6.80279
Total TCE Feed Rate (g/sec) = 3.285032
Flowrate of Stack Gases (dscf/min) = 692.31
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V3-5	23.05	87.75	109.74	25.00	16.71
V3-6	23.05	10.42	31.46	24.38	16.02

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V3-5	CCl4	258.0	2.573E-07	5.045E-06	99.99992584
	TCE	6.0	5.984E-09	1.173E-07	99.99999643
V3-6	CCl4	2993.0	3.114E-06	6.104E-05	99.99910279
	TCE	8.0	8.322E-09	1.631E-07	99.99999503

* Not Corrected To 12% CO2

VOST
Calculations
File 1a4-1&2.vst

Source: Los Alamos
Date: 9-7-86
Location: CAI
Run Number: 1

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	3.170	1.000	CCl4	30.1400
			TCE	14.9000

Total CCl4 Feed Rate (g/sec) = 7.223111
Total TCE Feed Rate (g/sec) = 3.570815
Flowrate of Stack Gases (dscf/min) = 665.82
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V4-1	23.13	33.02	53.98	25.25	15.97
V4-2	23.13	54.66	75.42	31.63	15.49

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V4-1	CCl4	5600.0	5.845E-06	1.102E-04	99.99847447
	TCE	52.0	5.427E-08	1.023E-06	99.99997135
V4-2	CCl4	590.0	6.350E-07	1.197E-05	99.99983426
	TCE	10.0	1.076E-08	2.029E-07	99.99999432

* Not Corrected To 12% CO2

VOST
Calculations
File la4-3&4.vst

Source: Los Alamos
Date: 9-7-86
Location: CAI
Run Number: 2

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	3.230	1.000	CCl4	30.2500
			TCE	14.6800

Total CCl4 Feed Rate (g/sec) = 7.386687
Total TCE Feed Rate (g/sec) = 3.58468
Flowrate of Stack Gases (dscf/min) = 698.15
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V4-3	23.13	75.96	96.11	33.75	14.93
V4-4	23.13	96.74	114.45	32.38	13.18

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V4-3	CCl4	2600.0	2.903E-06	5.739E-05	99.99922305
	TCE	36.0	4.020E-08	7.946E-07	99.99997783
V4-4	CCl4	5200.0	6.577E-06	1.300E-04	99.99823993
	TCE	210.0	2.656E-07	5.250E-06	99.99985353

* Not Corrected To 12% CO2

VOST
Calculations
File 1a4-5&6.vst

Source: Los Alamos
Date: 9-7-86
Location: CAI
Run Number: 3

Feed	Flowrate (lb/mn)	Specific Gravity	POHC	Concentration (%)
Feed 1	3.390	1.000	CCl4	30.2500
			TCE	14.7900

Total CCl4 Feed Rate (g/sec) = 7.752591
Total TCE Feed Rate (g/sec) = 3.79044
Flowrate of Stack Gases (dscf/min) = 701.09
VOST Meter Correction Factor = 1.0032

Cartridge Label	Barometric Pressure (in Hg)	Initial Meter Reading (l)	Final Meter Reading (l)	Average Meter Temp. (C)	Corrected Sample Volume (l)
V4-5	23.10	15.12	36.56	23.75	16.40
V4-6	23.10	37.01	57.37	25.38	15.49

Cartridge Label	POHC	Cartridge Content (ng)	Dry Stack Concentration (g/m3)*	Emission Rate (g/sec)	DRE (%)
V4-5	CCl4	6200.0	6.302E-06	1.251E-04	99.99838616
	TCE	162.0	1.647E-07	3.269E-06	99.99991375
V4-6	CCl4	4900.0	5.274E-06	1.047E-04	99.99864954
	TCE	116.0	1.248E-07	2.479E-06	99.99993461

* Not Corrected To 12% CO2

		Feed Data				Emission Data					
MM5 ID	VOST	CCl4	TCE	Cl	Feed Rate	Emission Rate (g/sec)		DRE (%)		HCl Emission	HCl Remova
No.	ID No.	(%)	(%)	(% as HCl)	(lb/min)	CCl4	TCE	CCl4	TCE	Rate (lb/hr)	Eff. (%)
1-1	1-2	32	16	9.8	2.78	1.156E-04	2.744E-06	99.99828	99.99991	0.0016	99.99
	1-3					9.967E-05	1.950E-07	99.99851	99.99999		
1-2	1-6	43	21	13.2	2.86	9.276E-05	2.401E-06	99.99900	99.99994	0.0016	99.99
								-	-		
1-3		40	20	12.3	2.86			-	-	0.0015	99.99
								-	-		
2-1	2-1	30	16	9.2	2.89	1.029E-06	1.634E-07	99.99998	99.99999	0.0014	99.99
								-	-		
2-2	2-3	41	20	12.6	2.86		1.629E-07	-	99.99999	0.063	99.71
	2-4					1.982E-05	2.731E-06	99.99977	99.99993		
2-3	2-5	46	18	14.1	2.88	7.349E-05	1.845E-06	99.99926	99.99995	0.42	98.26
	2-6					1.029E-04	1.999E-06	99.99897	99.99994		
3-1	3-1	30	15	9.2	2.95	3.969E-05	4.225E-06	99.99940	99.99987	0.25	98.45
	3-2					4.040E-05	4.257E-06	99.99939	99.99986		
3-2	3-3	30	15	9.2	2.95	1.049E-04	2.298E-05	99.99843	99.99929	0.11	99.30
	3-4					8.363E-05	1.023E-05	99.99875	99.99968		
3-3	3-5	30	15	9.2	2.95	5.045E-06	1.173E-07	99.99992	99.99999	0.20	98.78
	3-6					6.104E-05	1.631E-07	99.99908	99.99999		
4-1	4-1	30	15	9.3	3.28	1.102E-04	1.023E-06	99.99853	99.99997	0.050	99.72
	4-2					1.197E-05	2.029E-07	99.99984	99.99999		
4-2	4-3	30	15	9.3	3.28	5.739E-05	7.946E-07	99.99923	99.99997	0.28	98.45
	4-4					1.300E-04	5.250E-06	99.99826	99.99985		
4-3	4-5	30	15	9.3	3.28	1.251E-04	3.269E-06	99.99833	99.99991	0.33	98.21
	4-6					1.047E-04	2.479E-06	99.99860	99.99993		

MM5 ID No.	VOST ID No.	CCl4 DRE (%) M&E	CCl4 DRE (%) LANL	CCl4 DRE (%) Percent Difference	TCE DRE (%) M&E	TCE DRE (%) LANL	TCE DRE (%) Percent Difference	HCl Removal Eff. (%) M&E	HCl Removal Eff. (%) LANL	HCl Removal Eff. (%) Percent Difference
1-1	1-2	99.99828	99.99878	0.0005	99.99991	99.99993	1.2E-05	99.99	99.998	0.008
	1-3	99.99851	99.99895	0.0004	99.99999	99.99999	-4.2E-06			
1-2	1-6	99.99900	99.99904	3.8E-05	99.99994	99.99994	-7.1E-06	99.99	99.998	0.005
		-	-	-	-		-			
1-3		-	-	-	-		-	99.99	99.998	0.005
		-	-	-	-		-			
2-1	2-1	99.99998	99.99999	5.7E-06	99.99999	99.99999	-5.3E-06	99.99	99.998	0.007
		-	-	-	-		-			
2-2	2-3	-	-	-	99.99999		-	99.71	99.939	0.2
	2-4	99.99977	99.99979	1.4E-05	99.99993	99.99993	-6.8E-06			
2-3	2-5	99.99926	99.99925	-1.6E-05	99.99995	99.99996	7.1E-06	98.26	99.585	1.3
	2-6	99.99897	99.99896	-1.3E-05	99.99994	99.99996	1.1E-05			
3-1	3-1	99.99940	99.99937	-3.8E-05	99.99987	99.99986	-1.0E-05	98.45	99.623	1.2
	3-2	99.99939	99.99935	-4.8E-05	99.99986	99.99986	-9.5E-06			
3-2	3-3	99.99843	99.99851	0.0001	99.99929	99.99933	3.4E-05	99.30	99.85	0.6
	3-4	99.99875	99.99881	0.0001	99.99968	99.99969	3.6E-06			
3-3	3-5	99.99992	99.99992	-4.8E-06	99.99999	99.99999	-6.4E-06	98.78	99.728	1.0
	3-6	99.99908	99.9991	1.0E-05	99.99999	99.99999	-5.0E-06			
4-1	4-1	99.99853	99.99848	-0.0001	99.99997	99.99997	-2.1E-06	99.72	99.937	0.2
	4-2	99.99984	99.99983	-1.0E-05	99.99999	99.99999	-4.5E-06			
4-2	4-3	99.99923	99.99922	-1.5E-05	99.99997	99.99998	1.7E-06	98.45	99.644	1.2
	4-4	99.99826	99.99824	-2.6E-05	99.99985	99.99985	-6.9E-06			
4-3	4-5	99.99833	99.99839	0.0001	99.99991	99.99991	-9.2E-07	98.21	99.609	1.4
	4-6	99.99860	99.99865	4.6E-05	99.99993	99.99993	-2.4E-06			