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BOTTLE WASH SOAKER AREA ETHANOL EMISSIONS SOURCE TEST REPORT

Note: This is a reference cited in AP 42, *Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources*. AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

Source Location:

Coors Brewing Company
Transload Bottle Wash
Golden, CO

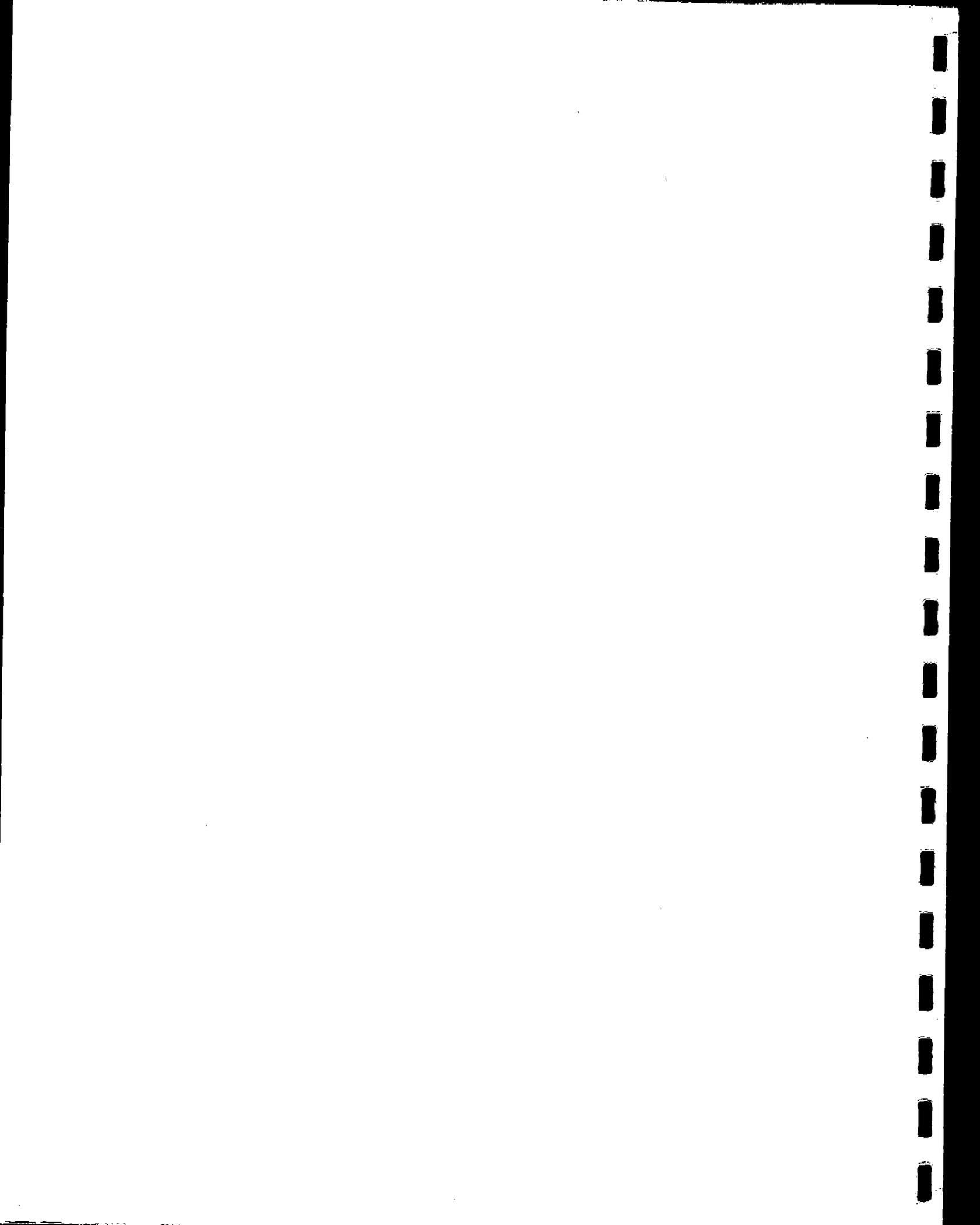
Prepared for:

Coors Brewing Company
Golden, CO

Submitted by:

Acurex Environmental
Southwest Regional Office
4879 East La Palma Avenue, Suite 201
Anaheim, California, 92817

**Acurex
Environmental**
CORPORATION



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SECTION 1 INTRODUCTION

1.1 Background

Acurex Environmental was contracted by Coors Brewing Company (Coors) to measure ethanol emissions from the bottle soaker equipment located in the transload/bottlewash area of their transload bottle wash facility in Golden, Colorado. The objective of this test was to verify ethanol emission levels reported in the Air Pollution Emission Notices (APENs) submitted to the State of Colorado Air Pollution Control Division. To develop process emission factors, process data were collected and exhaust stack emission rates were measured.

1.2 Source Test Report Organization

This document summarizes the source test results obtained from the bottle soaker area test series, including the process emission factors and annual emission rates calculated from the collected data. Also included is a summary of the test matrix and sampling procedures implemented during the test series, and the quality assurance/quality control (QA/QC) procedures employed to ensure accurate, representative data.

Section 2 summarizes and discusses the source test and emission factor calculation results. Section 3 provides a brief description of the soaker area and the sampling locations, and summarizes the test matrix. Section 4 describes the sampling procedures employed, and Section 5 summarizes QA/QC procedures and results. Field sampling and equipment calibration sheets, and laboratory analysis reports are provided in Appendices A and B, respectively. Process data and sample calculations for determining soaker area ethanol emission factors and annual ethanol emission estimates are provided in Appendix C.

SECTION 2
SOURCE TEST RESULTS

2.1 Summary

The results of the bottle soaker area ethanol emission source test series conducted on April 28, 1993 are summarized in Table 2-1, which includes ethanol concentration measurement and emission calculation results.

Table 2-1. Bottle Wash Unit Ethanol Source Test Results

Location	Test/Time	Mass of Ethanol Collected (mg/train)	Sample Volume		Exhaust Flow Rate		Ethanol Emissions	
			(dscf)	(dsl)	(dscfm)	(dslpm)	(lb/hr)	(kg/hr)
Overhead Soaker Area Exhaust	1 1144-1214	3.30	14.60	413.2	17135	484921	0.511	0.232
	2 1243-1313	2.33	11.69	330.8	17063	482897	0.449	0.204
	2 (dup) 1243-1313	2.69	14.36	406.4	17063	482897	0.422 0.435 avg	0.192 0.197 avg
	3 1508-1538	4.36	14.33	405.5	16877	477633	0.678	0.308
Northeast Soaker Area Exhaust	1 1145-1215	0.71	14.04	397.3	4373	123756	0.029	0.0133
	2 1244-1314	0.89	13.83	391.4	4924	139349	0.042	0.0190
	3 1509-1539	1.68	13.67	386.9	4636	131199	0.075	0.0342
	3 (dup) 1509-1539	1.16	12.07	341.6	4636	131199	0.059 0.067 avg	0.0267 0.0305 avg

2.2 Discussion of Results

The ethanol emission source test results reported in Table 2-1 were combined with process data to derive an ethanol emission factor for the bottle soaker unit. The emission factor is

determined by dividing the cumulative quantity of ethanol released from the soaker unit over a specific period of time by the number of bottles processed over the same time frame.

The bottle wash unit ethanol emission measurements were conducted in triplicate to ensure that a representative emission factor was determined. The results of the emission factor calculations are summarized in Table 2-2, which includes process data. The total ethanol emission rates reported in Table 2-2 were developed based on the average of duplicate measurements when applicable. A single ethanol emission rate measurement was also taken on April 29, 1993, one day after the bottle soaker area test series was complete. This sample was collected to assess the representativeness of the soaker area ethanol emission measurements. The result of this measurement is discussed in Section 5.

Table 2-2. Ethanol Emission Factor Calculation for the Bottle Soaker Unit

Test	Total Ethanol Emission Rate (lb/hour)	Bottle Case Throughput (cases/hour)	Soaker Ethanol Emission Factor (lb/case)
1	0.540	2500	0.00022
2	0.477	3125	0.00015
3	0.745	3207	0.00023
Average			0.00020

From the information presented in Table 2-2, a bottle soaker ethanol emission factor is derived by averaging the emission factors reported for each test. The resulting process emission factor (0.00020 lb of ethanol per case of bottles washed) is then applied to the annual bottle throughput rate to determine the annual ethanol emissions from the bottle soaker unit. Coors reports an annual 12,775,000 case throughput rate; therefore, the annual ethanol emissions estimated for the bottle soaker unit is 2,555 pounds (1.28 tons) per year.

SECTION 3

TEST MATRIX AND SAMPLING LOCATION

3.1 Bottle Soaker Area and Sampling Location Description

The bottle soaker unit prepares returned beer bottles for refill. The bottles are conveyed to the entrance of the soaker unit, where beer remaining in the bottles is first dumped into a sump under the floor. The bottles are then transported to the large, partially enclosed, cleaning bath containing caustic solution. From the cleaning bath, the bottles are transferred to a packaging unit, where they are stored in boxes for subsequent transportation and processing.

The bottle soaker unit is located in a non-enclosed portion of the transload/bottlewash area; process emissions are vented through two exhaust ducts identified as the overhead soaker area (OSA) exhaust and the northeast soaker area (NESA) exhaust. The OSA exhaust duct removes process emissions from the caustic cleaning bath via a series of exhaust plenums located above the bath area. The NESA exhaust duct removes process emissions from the soaker unit entrance area.

Ethanol samples were collected simultaneously from each of the two rectangular exhaust ducts. The exhaust flow rate in each duct was determined according to EPA Method 2 by measuring the velocity head at specific duct traverse point locations. The velocity measurement locations for the OSA and NESA exhaust ducts are illustrated in Figure 3-1. The access ports for conducting the velocity measurement conformed with EPA Method 1 requirements.

3.2 Test Matrix

The test matrix, summarized in Table 3-1, identifies the sampling procedures employed, and the number of test and QA samples collected. Several ethanol samples were collected at each location to ensure representative results; these samples were collected simultaneously. An additional confirmatory ethanol sample was collected one day after the soaker area test series was completed to assess daily process variability, if any. Coors recorded the bottle throughput rate during each of the ethanol sampling events. This information was combined with emission measurement data to develop an ethanol emission factor and estimate annual soaker unit ethanol emission rates.

Table 3-1. Bottle Soaker Area Ethanol Emission Test Matrix

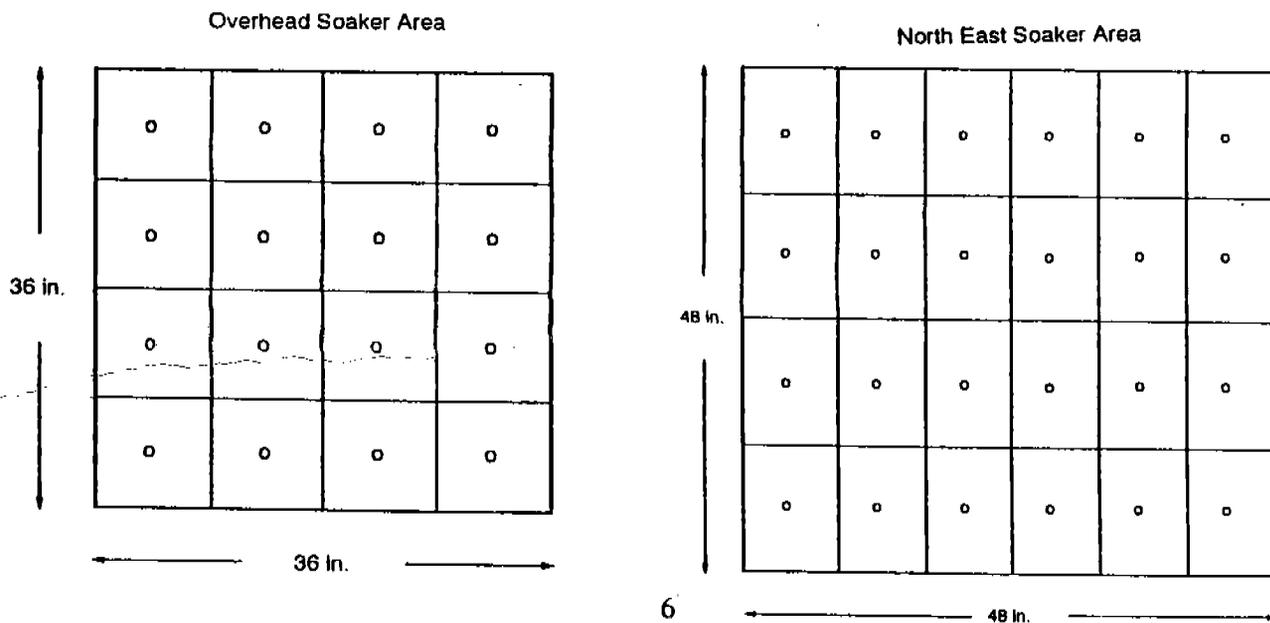
Sampling Location	Measurement Parameter	Sample Method	Analytical Method	Number of Samples	Number of QC Samples
North East Soaker Area Exhaust Duct	Ethanol	BAAQMD ST-32 ^a	BAAQMD Lab 29 ^b	3	1 train blank 1 solution blank 1 duplicate
	Volumetric Flow Rate	EPA 1-4	N/A	3	Pre- and post-test equipment calibration
Overhead Soaker Area Exhaust Duct	Ethanol	BAAQMD ST-32	BAAQMD Lab 29	4	1 train blank 1 solution blank 1 duplicate
	Volumetric Flow Rate	EPA 1-4	N/A	4	Pre- and post-test equipment calibration
Process Data	Bottle Throughput	N/A	N/A	N/A	N/A

^a Bay Area Air Quality Management District Source Test Procedure ST-32: Ethanol, Integrated Sampling

^b Bay Area Air Quality Management District Lab 29 - Determination of Ethanol by Gas Chromatography

N/A - Not Applicable

Figure 3-1. OSA and NESA Exhaust Duct Sampling Locations



SECTION 4

SAMPLING PROCEDURES

4.1 EPA Methods 1, 2, 3, and 4; Volumetric Flow Rate Measurements

Traverse point locations and exhaust gas velocity, molecular weight, and moisture are determined following EPA Methods 1, 2, 3, and 4, respectively. Data collected from EPA Methods 1 through 4 are used to calculate volumetric stack gas flow rate. Method 1 outlines the procedures for selecting the proper traverse points, while Method 2 provides the methodology for performing the actual traverse. The exhaust gas molecular weight is determined per Method 3 using Fyrite (liquid displacement) analysis. Exhaust gas moisture content is measured gravimetrically in general accordance with EPA Method 4 procedures.

Velocity is measured at selected discrete sample points located in a cross sectional plane of the stack according to EPA Method 1 requirements. The cross section is divided into equal areas, to allow the measurement of velocity and temperature profiles.

In Method 2, a calibrated standard type pitot tube and thermocouple are used, in conjunction with an inclined manometer or magnehelic gauge to measure exhaust gas velocity pressure and temperature. From these data, the exhaust gas velocity is calculated using standard equations.

4.2 BAAQMD Method ST-32, Determination of Ethanol Emissions

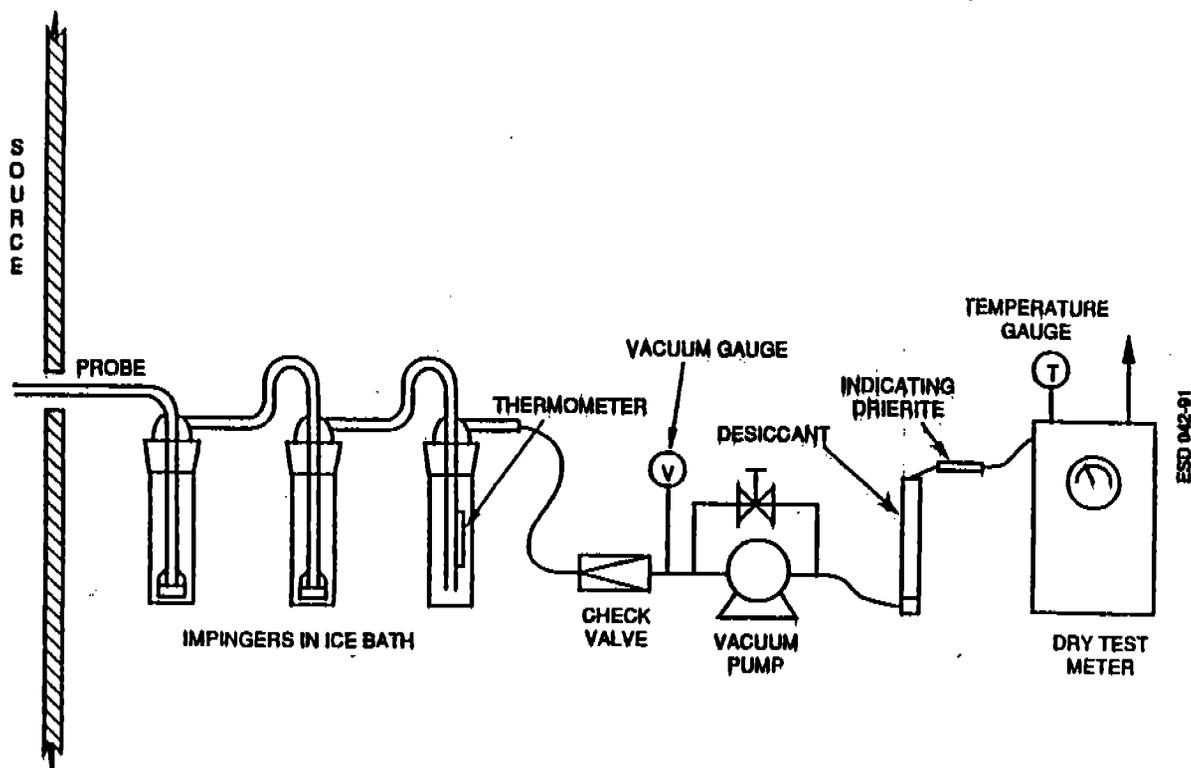
Exhaust gas ethanol concentrations are measured following BAAQMD Method ST-32, an integrated sampling procedure in which a known volume of gas is drawn through an impinger train containing deionized water over a fixed period of time. The water sample is analyzed by gas chromatography/flame ionization detection (GC/FID).

The ethanol sampling train is illustrated in Figure 4-1. The first three impingers each contain 100 ml of deionized water; the last impinger contains silica gel to ensure that the gas is dry before it enters the dry gas meter. A sample volume of approximately 15 ft³ is collected at a maximum rate of 0.5 cfm. The amount of condensate collected is determined by weighing all of the impingers before and after the test. The condensate collected in the impingers is used to calculate the percent moisture of the exhaust gas. For this test series, gaseous ethanol is present

in the exhaust stream, therefore no filter is used in this sampling train and no traverse is necessary. Teflon tubing is used as a probe, and the sample is collected at a single point near the center of the stack.

Solutions contained in the first two impingers were collected and analyzed separately. The contents of the third impinger were collected and analyzed only if the ethanol concentration in the second impinger was greater than 10 percent of the concentration of the first impinger. Ethanol concentrations were determined by GC/FID following BAAQMD Lab 29 procedures.

Figure 4-1. Diagram of BAAQMD ST-32 Ethanol Sampling Train



SECTION 5

QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

For the bottle soaker unit area ethanol emission test series, Acurex Environmental developed and implemented a comprehensive quality assurance/quality control (QA/QC) plan to ensure the collection of accurate, precise, and representative data. This plan stipulated a number of QA/QC audit procedures which were rigorously employed in all field sampling and analysis activities. These procedures include stringent internal QA audits and data validation requirements, rigorous sample chain of custody procedures, and the collection of adequate QA samples.

Key elements of the Acurex Environmental QA/QC auditing procedures that were employed include: field sample recovery and data sheet audits (conducted in the field); mandatory pre- and post-test equipment calibration checks; thorough QA reviews of reduced field data and laboratory analysis reports for completeness; and finally, a QA review of the draft and final source test report. Data validation procedures include calculating relevant data quality indicators such as measurement precision and accuracy, and evaluating these indicators in terms of data quality requirements specified by the applicable method.

Representative data were ensured by performing replicate ethanol emission measurements throughout a typical operating day. The relative standard deviation for these replicate measurements is 17 percent. In addition, one side-by-side duplicate ethanol emission measurement was taken at each exhaust duct location to assess sampling method precision (repeatability); the results indicate a method relative percent difference (RPD) of 6 to 24 percent. As a final measure of sample representativeness, a single ethanol sample was collected from the OSA exhaust duct one day after the soaker area ethanol test series was complete. The analytical results indicate a variability of less than 25 percent.

To determine the level of sample contamination (if any) during sample collection, transport, and analysis, Acurex Environmental collected and analyzed field (train) and solution blank samples. No ethanol was measured in any of the blank samples submitted, therefore no sample contamination occurred.

Various QA/QC procedures were also implemented to ensure the accuracy and precision of field measurements such as volumetric flow rate and sample volume. The OSA and NESAs exhaust flow rates were measured in triplicate to assess measurement precision; the relative standard deviations (RSDs) found at these locations were 1.24 and 15.3 percent, respectively. The NESAs RSD is higher due to the low linear flow rate in the duct; the pressure differential reading was very near the instrument sensitivity level. Nonetheless, an RSD range of 1-15 percent indicates that a fairly high degree of measurement precision was achieved. Per EPA equipment maintenance requirements, the dry gas meter in the ethanol sampling train is calibrated regularly against a standard test meter. The equipment calibration sheets are included in Appendix A.

Acurex Environmental coordinated with the analytical laboratory to ensure that adequate analytical QA/QC procedures were implemented. This included the determination of analytical precision, accuracy, and the assessment of potential laboratory contamination. An analytical precision of 2.6 to 17 percent was determined via duplicate analyses of specific samples. Analytical accuracy was established by performing a method spike and recovery study; 91 percent recovery was achieved, indicating that this analytical procedure yields accurate ethanol concentration data. A laboratory storage blank was also analyzed; results indicate that no sample contamination occurred during storage or analysis.

In summary, the data quality indicators derived from the QA/QC activities implemented during this test series reveal that a high level of data quality and reliability was achieved. Method accuracy and precision calculations indicate that the emission factors and annual emission rates derived from the test series results are correct to within 25 percent.

APPENDIX A
FIELD SAMPLING AND EQUIPMENT CALIBRATION DATA SHEETS

This Appendix Includes:

BAAQMD Method 32 Field Sampling Data Sheets
EPA Method 1 through 4 Field Data Sheets
Reduced Field Data Sheets
Post-Test Equipment Calibration Sheets

PARTICULATE TEST FIELD DATA SHEET

*NESA #1
(North East Seaker Area)*

Ebbano!

Plant Coors Barometric Pressure 24.43 Nozzle Size & Number _____

Date 4-28-93 Static Pressure -.03 Molecule Weight _____

Test Location NESA #1 Stack Pressure _____ BWO _____

Run Number ST-32 #1 Probe Number Tetlon

Stack Diameter inches _____ Pitot Coefficient .99

Duct Dimensions in. x in. 48 x 48 Pitot Number _____

Start Time 11:45 Meter Box Number D-820 C

Operator D. Urry Orifice Coefficient .995

IMPINGER VOLUMES	CO ₂	O ₂	CO
580.9			
517.5			
520.2			
SILICA GEL			
648.4			

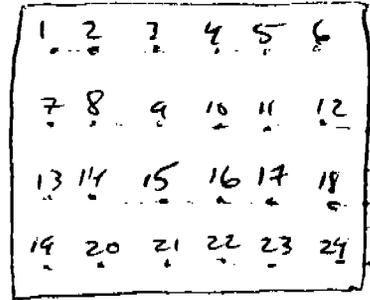
FILTER DATA		
NUMBER	TARE	FINAL WT.

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg.	ORIFICE METER ΔH in. wg.	GAS METER VOLUME FT ³	STACK	PROBE	IMPINGER	TEMPERATURE °F		ORGANIC MODULE	OVEN	GAS METER		PUMP VACUUM in. Hg	GAS METER LEAK CHECK RATE (CFM)
								IN	OUT			IN	OUT		
1	0		.80	190.704			60	81	82			81	82	3.8	PRE. .01/min @ 15"
	5		.85	193.6			60	87	81			87	81	3.8	POST <.005 @ 15"
	10		.85	196.6			60	92	82			92	82	3.8	
	15		.80	199.5			60	96	83			96	83	3.8	
	20		.85	202.6			60	100	85			100	85	3.8	
	25		.85	205.6			60	102	87			102	87	3.8	
	30			208.607											
AVG/TOTAL			TOTAL	17.903											

PRELIMINARY VELOCITY TRAVERSE

Plant Coors Can Mfg.
 Date 4/28/93
 Location NE5A - Flow #1 + #2
 Stack I.D. 48" x 48"
 Barometric Pressure, in. Hg 24.43
 Static Pressure, in. H₂O (-.03) / (-.06)
 Cp 0.99
 Operators D.U. / J.R.

← N



Schematic Of Traverse Point Layout

1115 AM

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δps), in. H ₂ O	STACK TEMPERATURE (T _s), °F
1	.01	82
2	.01	82
3	.01	82
4	.01	82
5	.01	82
6	.01	82
7	.007	82
8	.01	82
9	.01	82
10	.01	82
11	.01	82
12	.003	82
13	.007	82
14	.007	82
15	.007	82
16	.007	82
17	.002	82
18	.002	82
19	.002	82
20	.002	82
21	.002	82
22	.007	82
23	.007	82
24	.002	82
AVERAGE	.0066	82

31500

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δps), in. H ₂ O	STACK TEMPERATURE (T _s), °F
1	.01	79.3
2	.015	79.3
3	.01	79.3
4	.01	79.3
5	.01	79.3
6	.007	79.3
7	.01	79.3
8	.02	79.3
9	.025	79.3
10	.017	79.3
11	.005	79.3
12	.002	79.3
13	.02	79.3
14	.015	79.3
15	.02	79.3
16	.02	79.3
17	.01	79.3
18	.007	79.3
19	.002	79.3
20	.00	79.3
21	.007	79.3
22	.005	79.3
23	.007	79.3
24	.005	79.3
AVERAGE	.01079	79.3



MOISTURE AND VOLUME CALCULATIONS

Plant: COORS
 Date: 4/28/93
 Performed by: RM/JR

Sample Location: OVERHEAD SOAKER EXHAUST
 Test No./Type: ETHONAL/1
 Start/Stop Time: 1144/1214

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.014
Barometric Pressure (in Hg)	P(b)	24.43
# of Sample Points	#	6
Total Sampling Time (min)	(theta) (	30.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	36.00
Width (if rectangular)	W	36.00
Area of Stack (sq ft)	A(s) (	9.00)
Gas Meter Initial Reading (cu ft)		25.48
Gas Meter Final Reading (cu ft)		43.43
Net Gas Sample Volume (cu ft)	V(m) (	17.95)
Vol of Liquid Collected (ml)	VI(c)	10.9
Vol of Liq @ Std. Conds. (scf)	V(w std)(	0.513)

FIELD DATA AVERAGES	
Avg Orifice Meter Reading (in H2O)	dH(avg) = 0.800
Avg Stack Temperature (degF)	T(s avg) = 82.2
Average Meter Temperature (degF)	T(m avg) = 78.4

CALCULATED VALUES	
Meter Volume (std, cu. ft.)	V(m std) = 14.60
Stack Gas Water Vapor Proportion	B(wo) = 0.034

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1.0	5.0	0.80	82.3	77	78
2.0	5.0	0.80	82.5	77	77
3.0	5.0	0.80	82.1	77	77
4.0	5.0	0.80	81.9	79	79
5.0	5.0	0.80	82.2	80	79
6.0	5.0	0.80	82.4	81	80
TOTALS	30.0	4.8000	493.4	471	470

1558 1mp 1 2.9159
 1559 2 0.4
 1560 3 ϕ

 3.3 mg

 D/L = .106
 T/B = ND

MOISTURE AND VOLUME CALCULATIONS

Plant: COORS
 Date: 4/28/93
 Performed by: RM/JR

Sample Location: OVERHEAD SOAKER EXHAUST
 Test No./Type: ETHONAL/2
 Start/Stop Time: 1243/1313

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	0.993
Barometric Pressure (in Hg)	P(b)	24.43
# of Sample Points	#	6
Total Sampling Time (min)	(theta) (	30.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	36.00
Width (if rectangular)	W	36.00
Area of Stack (sq ft)	A(s) (	9.00)
Gas Meter Initial Reading (cu ft)		331.23
Gas Meter Final Reading (cu ft)		346.05
Net Gas Sample Volume (cu ft)	V(m) (	14.83)
Vol of Liquid Collected (ml)	VI(c)	9.8
Vol of Liq @ Std. Conds. (scf)	V(w std)	0.461)

FIELD DATA AVERAGES	
Avg Orifice Meter Reading (in H2O)	dH(avg) = 0.800
Avg Stack Temperature (degF)	T(s avg) = 82.2
Average Meter Temperature (degF)	T(m avg) = 84.0

CALCULATED VALUES	
Meter Volume (std, cu. ft.)	V(m std) = 11.69
Stack Gas Water Vapor Proportion	B(wo) = 0.038

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1.0	5.0	0.80	82.4	82	78
2.0	5.0	0.80	82.2	83	78
3.0	5.0	0.80	82.2	87	78
4.0	5.0	0.80	82.3	90	80
5.0	5.0	0.80	82.2	93	81
6.0	5.0	0.80	82.1	95	83
TOTALS	30.0	4.8000	493.4	530	478

1561 imp 1 1.40 mg
 1562 2 .74
 1563 3 .19

 2.33 mg

D/L = .15
 T/θ = ND

MOISTURE AND VOLUME CALCULATIONS

Plant: COORS
 Date: 4/28/93
 Performed by: RM/JR

Sample Location: OVERHEAD SOAKER EXHAUST
 Test No./Type: ETHONAL/2 DUPLICATE
 Start/Stop Time: 1243/1313

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.014
Barometric Pressure (in Hg)	P(b)	24.43
# of Sample Points	#	6
Total Sampling Time (min)	(theta) (	30.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	36.00
Width (if rectangular)	W	36.00
Area of Stack (sq ft)	A(s) (	9.00)
Gas Meter Initial Reading (cu ft)		44.37
Gas Meter Final Reading (cu ft)		62.25
Net Gas Sample Volume (cu ft)	V(m) (	17.88)
Vol of Liquid Collected (ml)	VI(c)	11.1
Vol of Liq @ Std. Conds. (scf)	V(w std)(	0.522)

FIELD DATA AVERAGES	
Avg Orifice Meter Reading (in H2O)	dH(avg) = 0.800
Avg Stack Temperature (degF)	T(s avg) = 82.4
Average Meter Temperature (degF)	T(m avg) = 85.1

CALCULATED VALUES	
Meter Volume (std, cu. ft.)	V(m std) = 14.36
Stack Gas Water Vapor Proportion	B(wo) = 0.035

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1.0	5.0	0.80	82.3	84	87
2.0	5.0	0.80	82.5	85	86
3.0	5.0	0.80	82.2	84	85
4.0	5.0	0.80	82.4	84	85
5.0	5.0	0.80	82.5	85	85
6.0	5.0	0.80	82.3	86	85
TOTALS	30.0	4.8000	494.2	508	513

1564 imp1 5-1 mg
 1565 2 .42
 1566 3 .17

 2.69

O/L = .130

T/B = ND

MOISTURE AND VOLUME CALCULATIONS

Plant: COORS
 Date: 4/28/93
 Performed by: RM/JR

Sample Location: OVERHEAD SOAKER EXHAUST
 Test No./Type: ETHONAL/3
 Start/Stop Time: 1508/1538

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	1.014
Barometric Pressure (in Hg)	P(b)	24.43
# of Sample Points	#	6
Total Sampling Time (min)	(theta) (	30.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	36.00
Width (if rectangular)	W	36.00
Area of Stack (sq ft)	A(s) (	9.00)
Gas Meter Initial Reading (cu ft)		63.09
Gas Meter Final Reading (cu ft)		80.91
Net Gas Sample Volume (cu ft)	V(m) (	17.82)
Vol of Liquid Collected (ml)	VI(c)	7.2
Vol of Liq @ Std. Conds. (scf)	V(w std)(	0.339)

FIELD DATA AVERAGES	
Avg Orifice Meter Reading (in H2O)	dH(avg) = 0.800
Avg Stack Temperature (degF)	T(s avg) = 79.4
Average Meter Temperature (degF)	T(m avg) = 84.8

CALCULATED VALUES	
Meter Volume (std, cu. ft.)	V(m std) = 14.33
Stack Gas Water Vapor Proportion	B(wo) = 0.023

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1.0	5.0	0.80	79.4	85	86
2.0	5.0	0.80	79.7	84	84
3.0	5.0	0.80	79.5	84	84
4.0	5.0	0.80	79.3	85	85
5.0	5.0	0.80	79.2	85	85
6.0	5.0	0.80	79.1	85	85
TOTALS	30.0	4.8000	476.2	508	509

1567 imp 3.79 mg
 1568 2 .56
 1569 3 0

 4.36

D/L =
 T/B = ND

MOISTURE AND VOLUME CALCULATIONS

Plant: COORS
 Date: 4/29/93
 Performed by: DU

Sample Location: OVERHEAD SOAKER EXHAUST
 Test No./Type: ETHONAL/4
 Start/Stop Time: 0810/0840

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	0.993
Barometric Pressure (in Hg)	P(b)	24.43
# of Sample Points	#	6
Total Sampling Time (min)	(theta) (	30.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	36.00
Width (if rectangular)	W	36.00
Area of Stack (sq ft)	A(s) (	9.00)
Gas Meter Initial Reading (cu ft)		
Gas Meter Final Reading (cu ft)		
Net Gas Sample Volume (cu ft)	V(m) (	14.35)
Vol of Liquid Collected (ml)	VI(c)	8.4
Vol of Liq @ Std. Conds. (scf)	V(w std)(	0.395)

FIELD DATA AVERAGES	
Avg Orifice Meter Reading (in H2O)	dH(avg) = 0.850
Avg Stack Temperature (degF)	T(s avg) = 80.0
Average Meter Temperature (degF)	T(m avg) = 86.2

CALCULATED VALUES	
Meter Volume (std, cu. ft.)	V(m std) = 11.27
Stack Gas Water Vapor Proportion	B(wo) = 0.034

*POST-TEST LEAK
 CHECK FAILED
 INVALID TEST*

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1.0	5.0	0.85	80.0	82	80
2.0	5.0	0.85	80.0	86	80
3.0	5.0	0.85	80.0	90	82
4.0	5.0	0.85	80.0	92	82
5.0	5.0	0.85	80.0	95	84
6.0	5.0	0.85	80.0	96	85
TOTALS	30.0	5.1000	480.0	541	493

*1586 imp 1 .600 mcy
 1587 2 .840
 1588 3 0

 1.440
 D/L = .160
 T/θ = NO*

MOISTURE AND VOLUME CALCULATIONS

Plant: COORS
 Date: 4/29/93
 Performed by: DU

Sample Location: OVERHEAD SOAKER EXHAUST
 Test No./Type: ETHONAL/5
 Start/Stop Time: 1012/1042

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	0.993
Barometric Pressure (in Hg)	P(b)	24.46
# of Sample Points	#	6
Total Sampling Time (min)	(theta)	(30.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	36.00
Width (if rectangular)	W	36.00
Area of Stack (sq ft)	A(s)	(9.00)
Gas Meter Initial Reading (cu ft)		390.71
Gas Meter Final Reading (cu ft)		406.88
Net Gas Sample Volume (cu ft)	V(m)	(16.17)
Vol of Liquid Collected (ml)	Vl(c)	9.4
Vol of Liq @ Std. Conds. (scf)	V(w std)(	0.442)

FIELD DATA AVERAGES	
Avg Orifice Meter Reading (in H2O)	dH(avg) = 0.883
Avg Stack Temperature (degF)	T(s avg) = 78.4
Average Meter Temperature (degF)	T(m avg) = 83.6

CALCULATED VALUES	
Meter Volume (std, cu. ft.)	V(m std) = 12.78
Stack Gas Water Vapor Proportion	B(wo) = 0.033

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1.0	5.0	0.85	78.4	79	78
2.0	5.0	0.85	78.4	83	78
3.0	5.0	0.90	78.4	87	79
4.0	5.0	0.90	78.4	90	80
5.0	5.0	0.90	78.4	92	81
6.0	5.0	0.90	78.4	93	83
TOTALS	30.0	5.3000	470.4	524	479

1589 mp1 4.9 mg
 1590 2 0
 1591 3 0

 4.9

D/L = .155
 T/B = ND

MOISTURE AND VOLUME CALCULATIONS

Plant: COORS
 Date: 4/28/93
 Performed by: DU

Sample Location: NORTH EAST SOAKER AREA
 Test No./Type: ETHONAL/1
 Start/Stop Time: 1145/1215

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	0.995
Barometric Pressure (in Hg)	P(b)	24.43
# of Sample Points	#	6
Total Sampling Time (min)	(theta) (	30.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	48.00
Width (if rectangular)	W	48.00
Area of Stack (sq ft)	A(s) (	16.00)
Gas Meter Initial Reading (cu ft)		190.70
Gas Meter Final Reading (cu ft)		208.61
Net Gas Sample Volume (cu ft)	V(m) (	17.90)
Vol of Liquid Collected (ml)	VI(c)	4.6
Vol of Liq @ Std. Conds. (scf)	V(w std)(	0.217)

FIELD DATA AVERAGES	
Avg Orifice Meter Reading (in H2O)	dH(avg) = 0.833
Avg Stack Temperature (degF)	T(s avg) = 82.0
Average Meter Temperature (degF)	T(m avg) = 88.2

CALCULATED VALUES	
Meter Volume (std, cu. ft.)	V(m std) = 14.04
Stack Gas Water Vapor Proportion	B(wo) = 0.015

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1.0	5.0	0.80	82.0	81	82
2.0	5.0	0.85	82.0	87	81
3.0	5.0	0.85	82.0	92	82
4.0	5.0	0.80	82.0	96	83
5.0	5.0	0.85	82.0	100	85
6.0	5.0	0.85	82.0	102	87
TOTALS	30.0	5.0000	492.0	558	500

1570 impl .710 mg
 1571 2 0
 1572 3 0

 D/L = .150 .710 mg
 T/B = ND

TRAIN BLANK: 1582 impl 0 mg
 D/L = .150 L 1583 2 0
 1584 3 0
 SOLUBLE BLANK 1585 0
 D/L = .150

MOISTURE AND VOLUME CALCULATIONS

Plant: COORS
 Date: 4/28/93
 Performed by: DU

Sample Location: NORTH EAST SOAKER AREA
 Test No./Type: ETHONAL/2
 Start/Stop Time: 1244/1314

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	0.995
Barometric Pressure (in Hg)	P(b)	24.43
# of Sample Points	#	6
Total Sampling Time (min)	(theta)	(30.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	48.00
Width (if rectangular)	W	48.00
Area of Stack (sq ft)	A(s)	(16.00)
Gas Meter Initial Reading (cu ft)		209.08
Gas Meter Final Reading (cu ft)		227.00
Net Gas Sample Volume (cu ft)	V(m)	(17.92)
Vol of Liquid Collected (ml)	Vl(c)	3.1
Vol of Liq @ Std. Conds. (scf)	V(w std)	(0.146)

FIELD DATA AVERAGES	
Avg Orifice Meter Reading (in H2O)	dH(avg) = 0.850
Avg Stack Temperature (degF)	T(s avg) = 83.0
Average Meter Temperature (degF)	T(m avg) = 97.1

CALCULATED VALUES	
Meter Volume (std, cu. ft.)	V(m std) = 13.83
Stack Gas Water Vapor Proportion	B(wo) = 0.010

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1.0	5.0	0.85	83.0	93	91
2.0	5.0	0.85	83.0	100	91
3.0	5.0	0.85	83.0	103	91
4.0	5.0	0.85	83.0	104	92
5.0	5.0	0.85	83.0	106	93
6.0	5.0	0.85	83.0	107	94
TOTALS	30.0	5.1000	498.0	613	552

1574 imp / .710 mg
 1575 2 .180
 1576 3 ϕ
 .890 mg

$D/L = .150$

$T/B = ND$

MOISTURE AND VOLUME CALCULATIONS

Plant: COORS
 Date: 4/28/93
 Performed by: DU

Sample Location: NORTH EAST SOAKER AREA
 Test No./Type: ETHONAL/3
 Start/Stop Time: 1509/1539

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	0.995
Barometric Pressure (in Hg)	P(b)	24.43
# of Sample Points	#	6
Total Sampling Time (min)	(theta) (	30.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	48.00
Width (if rectangular)	W	48.00
Area of Stack (sq ft)	A(s) (	16.00)
Gas Meter Initial Reading (cu ft)		227.33
Gas Meter Final Reading (cu ft)		244.80
Net Gas Sample Volume (cu ft)	V(m) (	17.47)
Vol of Liquid Collected (ml)	Vl(c)	4.1
Vol of Liq @ Std. Conds. (scf)	V(w std)(	0.193)

FIELD DATA AVERAGES	
Avg Orifice Meter Reading (in H2O)	dH(avg) = 0.800
Avg Stack Temperature (degF)	T(s avg) = 79.3
Average Meter Temperature (degF)	T(m avg) = 89.2

CALCULATED VALUES	
Meter Volume (std, cu. ft.)	V(m std) = 13.67
Stack Gas Water Vapor Proportion	B(wo) = 0.014

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1.0	5.0	0.80	79.3	83	82
2.0	5.0	0.80	79.3	88	82
3.0	5.0	0.80	79.3	93	83
4.0	5.0	0.80	79.3	98	85
5.0	5.0	0.80	79.3	100	86
6.0	5.0	0.80	79.3	102	88
TOTALS	30.0	4.8000	475.8	564	506

1573 imp 1 1.40 mg
 1577 2 .28
 1578 3 ϕ

 1.68 mg

D/L = 150

T/B = ND

MOISTURE AND VOLUME CALCULATIONS

Plant: COORS
 Date: 4/28/93
 Performed by: DU

Sample Location: NORTH EAST SOAKER AREA
 Test No./Type: ETHONAL/3 DUPLICATE
 Start/Stop Time: 1510/1540

PARAMETER	SYMBOL	VALUE (calc.)
Gas Meter Correction Factor	(gamma)	0.993
Barometric Pressure (in Hg)	P(b)	24.43
# of Sample Points	#	6
Total Sampling Time (min)	(theta) (	30.00)
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	48.00
Width (if rectangular)	W	48.00
Area of Stack (sq ft)	A(s) (	16.00)
Gas Meter Initial Reading (cu ft)		347.52
Gas Meter Final Reading (cu ft)		362.92
Net Gas Sample Volume (cu ft)	V(m) (	15.41)
Vol of Liquid Collected (ml)	VL(c)	2.9
Vol of Liq @ Std. Conds. (scf)	V(w std)(	0.137)

FIELD DATA AVERAGES	
Avg Orifice Meter Reading (in H2O)	dH(avg) = 0.825
Avg Stack Temperature (degF)	T(s avg) = 79.3
Average Meter Temperature (degF)	T(m avg) = 87.4

CALCULATED VALUES	
Meter Volume (std, cu. ft.)	V(m std) = 12.07
Stack Gas Water Vapor Proportion	B(wo) = 0.011

Sample Point	dClock Time	Orifice Meter dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out
1.0	5.0	0.80	79.3	83	83
2.0	5.0	0.80	79.3	86	82
3.0	5.0	0.80	79.3	89	83
4.0	5.0	0.85	79.3	93	84
5.0	5.0	0.85	79.3	95	86
6.0	5.0	0.85	79.3	97	88
TOTALS	30.0	4.9500	475.8	543	506

1579 IMP1 .950 mg
 1580 2 = 210
 1581 3 ϕ

 D/L = .160
 T/B = ND
 1.160 mg

FLOWRATE CALCULATIONS

Plant: COORS CAN PLANT
 Date: 4/28/93 RUN #1
 Sample Location: NORTH EAST SOAKER AREA
 Performed by: DU/JR @1115 HOURS

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.9900
Barometric Pressure (in Hg)	P(b)	24.43
Stack Pressure (in H2O)	P(stack)	-0.030
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	
Length (if rectangular)	L	48.00
Width (if rectangular)	W	48.00
Area of Stack (sq ft)	A(s)	(16.00)
O2 Concentration (by CEM)	% O2	20.5
CO2 Concentration (by CEM)	% CO2	0.0
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(79.50)

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg) =	0.007
Avg Stack Temperature (degF)	T(s avg) =	82.0
Avg SQRT(dP)	=	0.078

CALCULATED VALUES

Stack Gas Water Vapor Proportion	B(wo) =	0.013
Mol. Wt., Stack Gas Dry	M(d) =	28.82
Mol. Wt., Stack Gas Wet	M(s) =	28.68
Abs Stack Pressure (in Hg)	P(s) =	24.43
Avg Stack Velocity (ft/sec)	V(s avg) =	5.8
Stack Gas STD Vol Flow (dscfm)	Q(s) =	4373
Actual Stack Gas Vol Flow (acfm)	Q(a) =	5567

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)
1	0.010	82	0.1000
2	0.010	82	0.1000
3	0.010	82	0.1000
4	0.010	82	0.1000
5	0.010	82	0.1000
6	0.010	82	0.1000
7	0.007	82	0.0837
8	0.010	82	0.1000
9	0.010	82	0.1000
10	0.010	82	0.1000
11	0.010	82	0.1000
12	0.003	82	0.0548
13	0.007	82	0.0837
14	0.007	82	0.0837
15	0.007	82	0.0837
16	0.007	82	0.0837
17	0.002	82	0.0447
18	0.002	82	0.0447
19	0.002	82	0.0447
20	0.002	82	0.0447
21	0.002	82	0.0447
22	0.007	82	0.0837
23	0.002	82	0.0447
24	0.002	82	0.0447
TOTALS	0.16	1968.0	1.8698

FLOWRATE CALCULATIONS

Plant: COORS CAN PLANT
 Date : 4/28/93 RUN #2
 Sample Location: NORTH EAST SOAKER AREA
 Performed by: DU/JR @1500 HOURS

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.9900
Barometric Pressure (in Hg)	P(b)	24.43
Stack Pressure (in H2O)	P(stack)	-0.06
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	
Length (if rectangular)	L	48.00
Width (if rectangular)	W	48.00
Area of Stack (sq ft)	A(s)	(16.00)
O2 Concentration (by CEM)	% O2	20.5
CO2 Concentration (by CEM)	% CO2	0.0
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(79.50)

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP (avg) =	0.011
Avg Stack Temperature (degF)	T(s avg) =	79.3
Avg SQRT(dP)	=	0.097

CALCULATED VALUES

Stack Gas Water Vapor Proportion	B(wo) =	0.013
Mol. Wt., Stack Gas Dry	M(d) =	28.82
Mol. Wt., Stack Gas Wet	M(s) =	28.68
Abs Stack Pressure (in Hg)	P(s) =	24.43
Avg Stack Velocity (ft/sec)	V(s avg) =	7.2
Stack Gas STD Vol Flow (dscfm)	Q(s) =	5475
Actual Stack Gas Vol Flow (acfm)	Q(a) =	6936

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)
1	0.010	79.3	0.1000
2	0.015	79.3	0.1225
3	0.010	79.3	0.1000
4	0.010	79.3	0.1000
5	0.010	79.3	0.1000
6	0.007	79.3	0.0837
7	0.010	79.3	0.1000
8	0.020	79.3	0.1414
9	0.025	79.3	0.1581
10	0.017	79.3	0.1304
11	0.005	79.3	0.0707
12	0.002	79.3	0.0447
13	0.020	79.3	0.1414
14	0.015	79.3	0.1225
15	0.020	79.3	0.1414
16	0.020	79.3	0.1414
17	0.010	79.3	0.1000
18	0.007	79.3	0.0837
19	0.002	79.3	0.0447
20	0.000	79.3	0.0000
21	0.007	79.3	0.0837
22	0.005	79.3	0.0707
23	0.007	79.3	0.0837
24	0.005	79.3	0.0707
TOTALS	0.26	1903.2	2.3354

FLOWRATE CALCULATIONS

Plant: COORS CAN PLANT
 Date : 4/28/93 RUN #3
 Sample Location: NORTH EAST SOAKER AREA
 Performed by: DU/JR @1550 HOURS

PARAMETER	SYMBOL	VALUE (calc.)
Pitot Tube Correction Factor	C(p)	0.9900
Barometric Pressure (in Hg)	P(b)	24.43
Stack Pressure (in H2O)	P(stack)	-0.03
# of Sample Points	#	24
Stack (Duct) Dimensions (in):		
Radius (if round)	R	
Length (if rectangular)	L	48.00
Width (if rectangular)	W	48.00
Area of Stack (sq ft)	A(s)	(16.00)
O2 Concentration (by CEM)	% O2	20.5
CO2 Concentration (by CEM)	% CO2	0.0
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(79.50)

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP (avg)	=	0.007
Avg Stack Temperature (degF)	T(s avg)	=	80.6
Avg SQRT(dP)		=	0.068

CALCULATED VALUES

Stack Gas Water Vapor Proportion	B(wo)	=	0.013
Mol. Wt., Stack Gas Dry	M(d)	=	28.82
Mol. Wt., Stack Gas Wet	M(s)	=	28.68
Abs Stack Pressure (in Hg)	P(s)	=	24.43
Avg Stack Velocity (ft/sec)	V(s avg)	=	5.0
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	3797
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	4822

Sample Point	Velocity Head, dP (in H2O)	Stack Temp (degF)	SQRT(dP)
1	0.007	80.6	0.0837
2	0.010	80.6	0.1000
3	0.013	80.6	0.1140
4	0.010	80.6	0.1000
5	0.015	80.6	0.1225
6	0.003	80.6	0.0548
7	0.010	80.6	0.1000
8	0.010	80.6	0.1000
9	0.010	80.6	0.1000
10	0.010	80.6	0.1000
11	0.007	80.6	0.0837
12	0.000	80.6	0.0000
13	0.020	80.6	0.1414
14	0.010	80.6	0.1000
15	0.007	80.6	0.0837
16	0.007	80.6	0.0837
17	0.007	80.6	0.0837
18	0.000	80.6	0.0000
19	0.000	80.6	0.0000
20	0.000	80.6	0.0000
21	0.000	80.6	0.0000
22	0.005	80.6	0.0707
23	0.000	80.6	0.0000
24	0.000	80.6	0.0000
TOTALS	0.16	1934.4	1.6217



CONSOLE METER POST-CALIBRATION

Client POOR S Project No. 9603.050 Calibrated By [Signature] Date 5-5-93
 Barometric Pressure, P_b 29.98 In. Hg Pre-Test Meter Correction Factor .995 Date Calib. 4-5-93
 Ambient Temperature 74° °F Post-Test Meter Correction Factor .989
 Primary Test Meter No. 445603 Console No. D-820e Percent Difference $\left(\frac{\text{Pre} - \text{Post}}{\text{Pre}} \times 100 = \right)$.6%

Orifice Manometer Setting, (ΔH), in. H ₂ O	Gas Volume		Temperature			Time (θ), min	Vacuum Setting, in. Hg	Y	K ₀	ΔH@	
	Primary Meter (V _p), ft ³	Dry Gas Meter (V _d), ft ³	Primary Meter (t _p), °F	Dry Gas Volume							
				Inlet (t _i), °F	Outlet (t _o), °F						Average (t _d), °F
.8	10.712	11.227	74	101	88	94.5	21.0	8.0	.9888	.714	1.6672
.8	10.22	10.713	74	102	89	95.5	20.0	8.0	.9905	.714	1.663
.8	10.257	10.778	74	102	89	95.5	20.1	8.0	.988	.713	1.668
Average									.989	.714	1.668

	Primary Meter	Total	Dry Gas Meter	Total
Stop	419.692	10.712	364.930	11.227
Start	408.98		353.703	
Stop	429.992		375.643	
Start	419.692	10.22	364.93	10.713
Stop	440.169		386.421	
Start	429.912	10.257	375.643	10.778

Calculations

$$Y = \frac{V_d (P_b) (t_d + 460)}{V_p (P_b) (t_d + 460)}$$

$$K_0 = \frac{V_p}{\theta \sqrt{\frac{\Delta H (t_d + 460)}{P_b (28.96)}}}$$

$$\Delta H@ = \frac{0.0317 \Delta H}{P_b (t_o + 460)} \left[\frac{(t_p + 460) \theta}{V_p} \right]^2$$

CONSOLE METER POST-CALIBRATION

Client COORS Project No. 9603.050 Calibrated By MMQ Date 5-6-93
 Barometric Pressure, P_b 30.01 in. Hg Pre-Test Meter Correction Factor 1.014 Date Calib. 1-5-93
 Ambient Temperature 72. °F Post-Test Meter Correction Factor 1.012
 Primary Test Meter No. 445603 Console No. D-556 Percent Difference $\left(\frac{\text{Pre} - \text{Post}}{\text{Pre}} \times 100 = \right)$.197%

Orifice Manometer Setting, (ΔH), in. H ₂ O	Gas Volume		Temperature		Time (θ), min	Vacuum Setting, in. Hg	Y	K _o	ΔH@	
	Primary Meter (V _p), ft ³	Dry Gas Meter (V _d), ft ³	Primary Meter (t _p), °F	Dry Gas Volume						
				Inlet (t _i), °F						Outlet (t _o), °F
.8	12.391	12.488	72	84	23.5	5.0	1.012	.745	1.572	
.8	11.084	11.215	72	86	21.0	5.0	1.012	.745	1.572	
.8	13.731	13.904	72	86	26.0	5.0	1.012	.745	1.571	
					Average		1.012	.745	1.572	

Stop	Primary Meter	Total	Dry Gas Meter	Total
Start	490.88	12.391	193.045	12.488
Stop	478.489	11.084	180.557	11.215
Start	501.964	24.675	204.260	13.904
Stop	490.88		193.045	
Start	515.695		218.164	
Stop	500.984		204.260	
	501.964	13.731		

Calculations

$$Y = \frac{V_p (P_b) (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6} \right) (t_p + 460)}$$

$$K_o = \frac{V_p}{\theta \sqrt{\frac{\Delta H (t_d + 460)}{P_b (28.96)}}}$$

$$\Delta H@ = \frac{0.0317 \Delta H}{P_b (t_o + 460)} \left[\frac{(t_p + 460) \theta}{V_p} \right]^2$$

CONSOLE METER POST-CALIBRATION

Client COORS Project No. 2603-050 Calibrated By THC Date 5-6-93
 Barometric Pressure, P_b 30.01 In. Hg Pre-Test Meter Correction Factor .993 Date Calib. 2-18-93
 Ambient Temperature 72 °F Post-Test Meter Correction Factor 1.019
 Primary Test Meter No. 445603 Console No. D-838 Percent Difference $\left(\frac{\text{Pre} - \text{Post}}{\text{Pre}} \times 100 = \right)$ -2.6%

Orifice Manometer Setting, (ΔH), in. H ₂ O	Gas Volume		Temperature			Time (θ), min	Vacuum Setting, in. Hg	Y	K ₀	ΔH@
	Primary Meter (V _p), ft ³	Dry Gas Meter (V _d), ft ³	Primary Meter (t _p), °F	Dry Gas Volume						
			Inlet (t _i), °F	Outlet (t _o), °F	Average (t _d), °F					
.8	17.331	17.262	73°	94	84	89	7.0	1.032	.657	2.004
.8	18.534	18.869	73	94	86	90.	7.0	1.0116	.640	2.105
.8	11.644	11.865	72	94	86	90.	7.0	1.013	.642	2.086
							Average	1.019	.646	2.065

	Primary Meter	Total	Dry Gas Meter	Total
Stop	558.535	17.331	450.431	17.862
Start	541.504		433.69	
Stop	577.069	18.534	469.3	18.869
Start	558.535		450.431	
Stop	588.713	11.644	481.65	11.865
Start	577.069		469.3	

Calculations

$$Y = \frac{V_p (P_b) (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6} \right) (t_p + 460)}$$

$$K_0 = \frac{V_p}{\theta \sqrt{\frac{\Delta H (t_d + 460)}{P_b (28.96)}}}$$

$$\Delta H@ = \frac{0.0317 \Delta H}{P_b (t_o + 460)} \left[\frac{(t_p + 460) \theta}{V_p} \right]^2$$



APPENDIX B
BAAQMD LAB 29 SAMPLE ANALYSIS RESULTS

AIR TOXICS LIMITED

BAAQMD METHOD ST-32
GC/FID

Field	Lab	File	Sample	Analyzed	Total Volume	Dilution	Det. Limit	Amount
Sample I.D.	Sample I.D.	Name	Date	For	(mL)	Factor	(uG)	(uG)
1558	9304190-01A	2001F0101	4/28/93	Ethanol	152	1.0	150	2900
1559	9304190-02A	2002F0101	4/28/93	Ethanol	177	1.0	180	440
1560	9304190-03A	2004F0301	4/28/93	Ethanol	174	1.0	170	Not Detected
1561	9304190-04A	2003F0101	4/28/93	Ethanol	148	1.0	150	1400
1562	9304190-05A	2004F0201	4/28/93	Ethanol	151	1.0	150	740
1562 Duplicate	9304190-05B	2004F0202	4/28/93	Ethanol	151	1.0	150	760
1563	9304190-06A	2005F0301	4/28/93	Ethanol	160	1.0	160	190
1564	9304190-07A	2005F0301	4/28/93	Ethanol	152	1.0	150	2100
1565	9304190-08A	2006F0301	4/28/93	Ethanol	154	1.0	150	420
1566	9304190-09A	2006F0401	4/28/93	Ethanol	122	1.0	120	170
1567	9304190-10A	2007F0301	4/28/93	Ethanol	161	1.0	160	3700

Analysis Date: 5/11/93

Container Type: Impinger

COMMENTS: NA=Not Applicable

AIR TOXICS LTD.

BAAQMD METHOD ST-32
GC/FID

Field Sample I.D.	Lab Sample I.D.	File Name	Sample Date	Analyzed For	Total Volume (mL)	Dilution Factor	Det. Limit (ug)	Amount (ug)
1568	9304190-11A	2008F0301	4/28/93	Ethanol	173	1.0	170	660
1569	9304190-12A	2007F0501	4/28/93	Ethanol	154	1.0	150	Not Detected
1585	9304190-13A	2009F0301	4/28/93	Ethanol	222	1.0	220	Not Detected
1582	9304190-14A	2010F0401	4/28/93	Ethanol	148	1.0	150	Not Detected
1582 Duplicate	9304190-14B	2010F0402	4/28/93	Ethanol	148	1.0	150	Not Detected
1583	9304190-15A	2011F0501	4/28/93	Ethanol	141	1.0	140	Not Detected
1584	9304190-16A	2012F0501	4/28/93	Ethanol	156	1.0	160	Not Detected
1579	9304190-17A	2013F0501	4/28/93	Ethanol	156	1.0	160	950
1580	9304190-18A	2014F0501	4/28/93	Ethanol	156	1.0	160	210
1581	9304190-19A	2008F0501	4/28/93	Ethanol	158	1.0	160	Not Detected
1570	9304190-20A	2015F0501	4/28/93	Ethanol	164	1.0	160	710

Analysis Date: 5/11/93
 Container Type: Impinger
 COMMENTS: NA=Not Applicable

AIR TOXICS LTD.

BAAQMD METHOD ST-32
GC/FID

Field	Lab	File	Sample	Analyzed	Total Volume	Dilution	Det. Limit	Amount
Sample I.D.	Sample I.D.	Name	Date	For	(mL)	Factor	(uG)	(uG)
1571	9304190-21A	2016F0501	4/28/93	Ethanol	146	1.0	150	Not Detected
1572*	9304190-22A*	Not Analyzed	4/28/93	Ethanol	146	1.0	150	Not Analyzed
1574	9304190-23A	2017F0601	4/28/93	Ethanol	134	1.0	130	710
1574 Duplicate	9304190-23B	2017F0602	4/28/93	Ethanol	134	1.0	130	600
1575	9304190-24A	2018F0701	4/28/93	Ethanol	156	1.0	160	180
1576	9304190-25A	2010F0701	4/28/93	Ethanol	156	1.0	160	Not Detected
1573	9304190-26A	2019F0701	4/28/93	Ethanol	144	1.0	140	1400
1577	9304190-27A	2020F0701	4/28/93	Ethanol	150	1.0	150	280
1578	9304190-28A	2011F0701	4/28/93	Ethanol	152	1.0	150	Not Detected
Lab Blank	9304190-30A	2006F0101	NA	Ethanol	NA	1.0	NA	Not Detected
Spiked Samples								
Method Spike	9304190-29A	2004F0101	NA	Ethanol	NA	1.0	150	91
								% Recovery

Analysis Date: 5/11/93
Container Type: Impinger

COMMENTS: NA=Not Applicable

AIR TOXICS LTD.

BAQMD METHOD ST-32
GC/FID

Field Sample I.D.	Lab Sample I.D.	File Name	Sample Date	Analyzed For	Total Volume (ml)	Dilution Factor	Det. Limit (ug)	Amount (ug)
2502	9305002-01A	2021F0701	4/30/93	Ethanol	173	1.0	170	59000
2503	9305002-02A	2022F0701	4/30/93	Ethanol	154	1.0	150	5200
2504	9305002-03A	2012F0801	4/30/93	Ethanol	166	1.0	170	890
2505	9305002-04A	2023F0701	4/30/93	Ethanol	171	1.0	170	150000
2506	9305002-05A	2024F0701	4/30/93	Ethanol	156	1.0	160	12000
2507	9305002-06A	2013F0901	4/30/93	Ethanol	146	1.0	150	13000
2508	9305002-07A	2023F0701	NP	Ethanol	157	1.0	160	160000
2509	9305002-08A	2026F0801	NP	Ethanol	158	1.0	160	33000
2509 Duplicate	9305002-08B	2026F0802	NP	Ethanol	158	1.0	160	31000
2510	9305002-09A	2014F0901	NP	Ethanol	160	1.0	160	77000
2511	9305002-10A	2027F0901	4/30/93	Ethanol	150	1.0	150	170000

Analysis Date: 5/11/93
Container Type: Impinger

COMMENTS: NA=Not Applicable

AIR TOXICS LTD.

BAAQMD METHOD ST-32
GC/FID

Field	Lab	File	Sample	Analyzed	Total Volume	Dilution	Det. Limit	Amount
Sample I.D.	Sample I.D.	Name	Date	For	(mL)	Factor	(uG)	(uG)
2512	9305002-11A	2028F0901	4/30/93	Ethanol	152	1.0	150	20000
2513	9305002-12A	2015F1001	4/30/93	Ethanol	154	1.0	150	7900
2514	9305002-13A	2029F0901	4/30/93	Ethanol	156	1.0	150	Not Detected
2515	9305002-14A	2030F0901	4/30/93	Ethanol	152	1.0	150	Not Detected
2516*	9305002-15A*	Not Analyzed	4/30/93	Ethanol	138	1.0	140	Not Analyzed
1592	9305002-16A	2031F1001	4/30/93	Ethanol	164	1.0	160	610
1592 Duplicate	9305002-16B	2013F1002	4/30/93	Ethanol	164	1.0	160	640
1593	9305002-17A	2032F1201	4/30/93	Ethanol	144	1.0	140	Not Detected
1594*	9305002-18A*	Not Analyzed	4/30/93	Ethanol	148	1.0	150	Not Analyzed
1589	9305002-19A	2033F1201	4/29/93	Ethanol	158	1.0	160	4900
1590	9305002-20A	2034F1201	4/29/93	Ethanol	138	1.0	140	Not Detected

Analysis Date: 5/11/93

Container Type: Impinger

COMMENTS: NA=Not Applicable

AIR TOXICS LTD.

BAAQMD METHOD ST-32
GC/FTD

Field	Lab	File	Sample	Analyzed	Total Volume	Dilution	Det. Limit	Amount
Sample I.D.	Sample I.D.	Name	Date	For	(ML)	Factor	(UG)	(UG)
1591*	9305002-21A*	Not Analyzed	4/29/93	Ethanol	173	1.0	170	Not Analyzed
1586	9305002-22A	2018F1202	4/29/93	Ethanol	163	1.0	160	600
1587	9305002-23A	2036F1201	4/29/93	Ethanol	160	1.0	160	840
1588	9305002-24A	2019F1301	4/29/93	Ethanol	160	1.0	160	150
Lab Blank	9305002-26A	2003F0202	NA	Ethanol	150	1.0	150	Not Detected
Spiked Samples								
Method Spike	9305002-25A	2002F0202	NA	Ethanol	NA	1.0	150	% Recovery 106

Analysis Date: 5/11/93
 Container Type: Implinger
 COMMENTS: NA=Not Applicable

**ACUREX ENVIRONMENTAL SYSTEMS DIVISION
CHAIN OF CUSTODY**

Release 3
Air Tests

Acurex Proposal Number: _____ Page _____ of _____

SAMPLE ID	DATE	TIME	MATRIX	SAMPLE LOCATION	NO. OF CONTAINERS	ANALYSIS		REMARKS (preservation, special analytical or turnaround requirements, duplicate sample, etc.)
						GC/FID	LAR 24 FLOW	
Company Name: <i>Coors</i> Project Manager: <i>Ayer</i> Project Number: <i>9603.020</i> Project Name: _____ Sampled by: (Printed and Written Signature) _____								
1567	4/28/80		D.I. H ₂ O	Imp #1 OSE	1	X	X	Analyze
1568	9			Imp #2 OSE	1	X	X	Analyze Hold for Analysis - see below
1569				Imp #3 OSE	1	X	X	Analyze
1585				Solution Blank	1	X	X	Analyze
1582				Imp #1 Train Blank	1	X	X	Analyze
1583				Imp #2 Train Blank	1	X	X	Analyze
1584				Imp #3 Train Blank	1	X	X	Analyze
1579				Imp #1 NESA	1	X	X	Analyze
1580				Imp #2 NESA	1	X	X	Analyze
1581				Imp #3 NESA	1	X	X	Analyze Hold for Analysis - see below
Relinquished by: (Signature) _____ Date/Time _____ Received by: (Signature) _____ Date/Time _____						REMARKS: Please analyze impinger #3 it the total mass of Ethanol found in impinger 2 Exceeds 10% of the mass of ethanol found in impinger #1. (Analyze all 3 train blanks)		
Relinquished by: (Signature) _____ Date/Time _____ Received by: (Signature) _____ Date/Time _____						Date/Time: <i>4/30/80 10:00</i>		
Relinquished by: (Signature) _____ Date/Time _____ Received by: (Signature) _____ Date/Time _____						Received for Laboratory by: <i>John A.T.C.</i> Signature: _____ Acurex Environmental Systems Division 555 Clyde Avenue, Bldg. 6 Mountain View, CA 94039 (415) 961-5700		

7 **HERBES** **REINQUISHED**

ACUREX ENVIRONMENTAL SYSTEMS DIVISION

Release 3

Acurex Proposal Number: _____

ALL TOXICS

Page ___ of ___

CHAIN OF CUSTODY

Company Name: **Coors**
Project Manager: **Ayer**

Project Number: **9603.030**

Sampled by: (Printed and Written Signature)

SAMPLE ID DATE TIME MATRIX SAMPLE LOCATION

NO. OF CONTAINERS

ANALYSIS
GC/MS
BAROM LAB 29 EORT
VOLUME

REMARKS
(preservation, special analytical or turnaround requirements, duplicate sample, etc.)

SAMPLE ID	DATE	TIME	MATRIX	SAMPLE LOCATION	NO. OF CONTAINERS	ANALYSIS	REMARKS
1558	4/28/93	AM #1 TEST 1	D.I. H ₂ O	Over head Imp 1 Soaker Exhaust	1	X	ANALYZE
1559				Imp #2 Overhead Soak Ex	1	X	ANALYZE
1560				Imp #3 Overhead Soak Ex	1	X	ANALYZE
1561		AM #2 TEST 2		Imp #1 OSE	1	X	ANALYZE
1562				Imp #2 OSE	1	X	ANALYZE
1563				Imp #3 OSE	1	X	ANALYZE
1564		AM #2 TEST 2		Imp #1 OSE	1	X	ANALYZE
1565				Imp #2 OSE	1	X	ANALYZE
1566				Imp #3 OSE	1	X	ANALYZE

Relinquished by: (Signature) _____ Date/Time _____ Received by: (Signature) _____

Relinquished by: (Signature) _____ Date/Time _____ Received by: (Signature) _____

Relinquished by: (Signature) _____ Date/Time _____ Received by: (Signature) _____

Received for Laboratory by: (Signature) _____ Date/Time _____

Acurex Environmental Systems Division
555 Clyde Avenue, Bldg. 6
Mountain View, CA 94039
(415) 961-5700

REMARKS: PLEASE ANALYZE IMPINGERS OR IF THE TOTAL MASS OF IMPINGERS FOUND IN IMPINGER 2 EXCEEDS 10% OF THE MASS OF IMPINGERS FOUND IN IMPINGER 1 PLEASE RETURN COORTEL

ACUREX ENVIRONMENTAL SYSTEMS DIVISION
CHAIN OF CUSTODY
Air Toxics
RELEASE 3

Acurex Proposal Number: _____

SAMPLE ID	DATE	TIME	MATRIX	SAMPLE LOCATION	NO. OF CONTAINERS	ANALYSIS	REMARKS
1570	APRIL 28	AM 7:51	Dr-I water	N.E. SATEL IMP1 AREA	1	XXXX	ANALYZE
1571				IMP2	1	XXXX	ANALYZE
1572				IMP3	1	XXXX	HOLD FOR ANALYSIS - SEE BELOW
1574		AM 7:52		IMP1	1	XXXX	ANALYZE
1575				IMP2	1	XXXX	ANALYZE
1576				IMP3	1	XXXX	HOLD FOR ANALYSIS - SEE BELOW
1573		AM 7:53		IMP1	1	XXXX	ANALYZE
1577				IMP2	1	XXXX	ANALYZE
1578				IMP3	1	XXXX	HOLD FOR ANALYSIS - SEE BELOW
<p>Relinquished by: (Signature) _____ Date/Time _____ Received by: (Signature) _____ Date/Time _____</p> <p>Relinquished by: (Signature) _____ Date/Time _____ Received by: (Signature) _____ Date/Time _____</p> <p>Relinquished by: (Signature) _____ Date/Time _____ Received by: (Signature) _____ Date/Time _____</p>							
<p>REMARKS: PLEASE ANALYZE IMPINGER 3 IF THE TOTAL MASS OF ETHANOL FOUND IN IMPINGER 2 EXCEEDS 10% OF THE MASS OF ETHANOL FOUND IN IMPINGER 1. PLEASE RETURN COOLER.</p>							

Acurex Environmental Systems Division
 555 Clyde Avenue, Bldg. 6
 Mountain View, CA 94039
 (415) 961-5700

ACUREX ENVIRONMENTAL SYSTEMS DIVISION
CHAIN OF CUSTODY

Company Name: Acurex Project Manager: V. Auer
 Project Number: 2603 Project Name: Ceas

Sampled by: (Printed and Written Signature)
with Rudolf

SAMPLE ID	DATE	TIME	MATRIX	SAMPLE LOCATION	NO: OF CONTAINERS	ANALYSIS	REMARKS
01A 2502	4-30		Imp. #1	BDA (Test #1)	1	X	(preservation, special analytical or turnaround requirements, duplicate sample, etc.) * Analyze Impinger #3 only if concentration in Imp. #2 is greater than 10% of the concentration in Imp. #1
02A 2503	4-30		Imp. #2	BDA (Test #1)	1	X	
03A 2504	4-30		Imp. #3	BDA	1	X	
04A 2505	4-30		Imp. #1	(Test #2)	1	X	
05A 2506	4-30		Imp. #2	"	1	X	
06A 2507	4-30		Imp. #3	"	1	X	
07A 2508			Imp. #1	(Test #3)	1	X	
08A 2509			Imp. #2	"	1	X	
09A 2510			Imp. #3	"	1	X	
10A 2511			Imp. #1	"	1	X	

Relinquished by: (Signature) [Signature] Date/Time: 4-30 15:30
 Received by: (Signature) [Signature] Date/Time: 5/1/93

Relinquished by: (Signature) [Signature] Date/Time: 4-30
 Received by: (Signature) [Signature] Date/Time: 5/1/93

Relinquished by: (Signature) [Signature] Date/Time: 4-30
 Received for Laboratory by: (Signature) [Signature] Date/Time: 5/1/93

REMARKS: BAARD LAB 29
* Also LAB 29
ST-32
Ethan / Sampling with
Please call back: Auer (714) 603-3425
if you have any questions.

Date/Time: 5/1/93 10:30
 Acurex Environmental Systems Division
 555 Clyde Avenue, Bldg. 6
 Mountain View, CA 94039
 (415) 961-5700

**ACUREX ENVIRONMENTAL SYSTEMS DIVISION
CHAIN OF CUSTODY**

Acurex Proposal Number: Release #3

SAMPLE ID	DATE	TIME	MATRIX	SAMPLE LOCATION	NO. OF CONTAINERS	ANALYSIS	REMARKS (preservation, special analytical or turnaround requirements, duplicate sample, etc.)
10A	4-30		Imp # 1	BDA - Test #3	1	X	<p>* Also YAB 29</p> <p>BAGMD YAB 29</p> <p>Analyte Impinger #3 only if concentration in Imp #2 is greater than 10% of the concentration in Imp #1</p>
11A	4-30		Imp # 2	"	1	X	
12A	4-30		Imp # 3	"	1	*?	
13A	4-30		Imp # 1	BDA Train Blank	1	X	
14A	4-30		Imp # 2	"	1	X	
15A	4-30		Imp # 3	"	1	*?	
16A	4-30		Imp # 1	Waste Bar/ Test Room #1	1	X	
17A	4-30		Imp # 2	"	1	X	
18A	4-30		Imp # 3	"	1	*?	
<p>Relinquished by: (Signature) <u>[Signature]</u> Date/Time 4-30 15:30 Received by: (Signature)</p> <p>Relinquished by: (Signature) <u>[Signature]</u> Date/Time Date/Time Received by: (Signature)</p> <p>Relinquished by: (Signature) Date/Time Date/Time Received for Laboratory by: (Signature) <u>[Signature]</u></p>							
<p>REMARKS: BAAC MID ST-32 Ethereal Sampling Method - Please call Jackie Auer (714) 693-3475 if you have any questions</p>						Date/Time	5/1/93 10:30
<p>Acurex Environmental Systems Division 555 Clyde Avenue, Bldg. 6 Mountain View, CA 94039</p>						<p>(415) 961-5700</p>	

Company Name: Acurex Project Manager: V. H. [Signature]

Project Number: 1613 Project Name: Class

Sampled by: (Printed and Written Signature) [Signature]

SAMPLE ID	DATE	TIME	MATRIX	SAMPLE LOCATION	NO. OF CONTAINERS	ANALYSIS		REMARKS (preservation, special analytical or turnaround requirements, duplicate sample, etc.)
						BAAL MID LAB 29	* ALL LAB 29	
1589	4-29		Tap #1	CSE #5	1			* Analyze Tap.
1590	4-29		Tap #2	CSE #5	1			* only if recirculation in Tap #2
1591	4-29		Tap #3	CSE #5	1			* 10% of the recirculation in Tap #1
1586	4-29		Tap #1	CSE #4	1			
1587	4-29		Tap #2	CSE #4	1			
1588	4-29		Tap #3	CSE #4	1			

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	REMARKS:
<u>[Signature]</u>	4-30 15:30						BAAL MID ST-32 External Sampling Method
							Please call us at 415 (714) 973-3975 if you have any questions.

APPENDIX C
PROCESS DATA AND SAMPLE CALCULATIONS

This Appendix Includes:

Bottle Throughput Data Recorded During Soaker Area Exhaust Testing
Calculations for Determining Soaker Area Ethanol Emission Factor
Calculations for Estimating Annual Soaker Area Ethanol Emission Rate

&F

BOTTLE WASH SOAKER
TEST DATA

DATE	HOUR	CASES
04/28/93	6-7a	1950
	7-8a	3050
	8-9a	2800
	9-10a	3100
	10-11a	3100
	11-12a	2000
	12-1p	3000
	1-2p	3250
	2-3p	3200
	3-4p	3207
04/29/93	6-7a	3150
	7-8a	3250
	8-9a	3250
	9-10a	3200
	10-11a	3150
	11-12a	3100
	12-1p	3050
	1-2p	3100
	2-3p	3200
	3-4p	3177

ANNUAL MASS BALANCE = 3500 CASES/HR @10HR/DAY@365DAY/YR.
RESIDUAL LIQUID VOLUME = 3.2+/- 1.8 QT. PER 40 CASES

SOAKER AREA ETHANOL EMISSION MEASUREMENT RESULTS

Site	Test/Time	Mass of Ethanol (mg/train)	Sample Volume (dscf)	Exhaust Flow Rate (dslpm)	Ethanol Concentration (mg/l)	Ethanol Emissions (kg/hr) (lb/hr)	
OSA	1/1144	3.3	14.6	484921	0.0080	0.232	0.511
28 April	2/1243	2.33	11.69	482897 *	0.0070	0.204	0.449 RPD:
	2 (dup)	2.69	14.36	482897 *	0.0066	0.192	0.422 6%
	2 (avg)					0.197	0.435
	3/1508	4.36	14.33	477633 *	0.0108	0.308	0.678
29 April**	4/0810	1.44	11.27	471223	0.0045	0.128	0.281 Invalid test
	5/1012	4.9	12.78	465790	0.0135	0.379	0.833
NESA	1/1145	0.71	14.04	123756	0.0018	0.0133	0.029
28 April	2/1244	0.89	13.83	139349 *	0.0023	0.0190	0.042
	3/1509	1.68	13.67	131199 *	0.0043	0.0342	0.075 RPD:
	3 (dup)	1.16	12.07	131199 *	0.0034	0.0267	0.059 24%
	3 (avg)					0.0305	0.067

* Indicates average of flow rates measured before and after test

SOAKER AREA ETHANOL EMISSION FACTOR CALCULATION

Test/Time	Total Ethanol Emission Rate (lb/hour)	Bottle Case Throughput (case/hour)	Emission Factor (lb/case)
1/1144	0.54	2500 *	0.00022
2/1243	0.48	3125 *	0.00015
3/1509	0.74	3207	0.00023
		Average:	0.00020
		RSD:	17%

* Based on average of hourly throughput

THE HOURLY EMISSION RATE IS CALCULATED AS FOLLOWS

(USING TEST 1 USE DATA FOR THE EXAMPLE)

$$\left(\frac{3.3 \text{ mg ETHANOL}}{\text{TRAIN}} \right) \left(\frac{1 \text{ TRAIN}}{14.6 \text{ dscf SAMPLE VOLUME}} \right) \left(\frac{484921 \text{ dslpm}}{\text{MIN}} \right) \left(\frac{1 \text{ lb}^3}{28.3 \text{ L}} \right) \left(\frac{60 \text{ MIN}}{\text{HR}} \right) \left(\frac{1 \text{ kg}}{10^6 \text{ MG}} \right) = 0.232 \frac{\text{kg}}{\text{hr}}$$

$$= 0.511 \frac{\text{lb}}{\text{hr}}$$

THE EMISSION FACTOR IS DERIVED FROM THE AVG. HOURLY EMISSION RATE VALUE, & THE THROUGHPUT DATA:

$$\left(\frac{0.54 \text{ lb-ETHANOL}_{\text{AVG}}}{\text{hr}} \right) \left(\frac{1 \text{ hr}}{2500 \text{ CASES}} \right) = 0.00022 \text{ lb/CASE}$$

(2.2 lb/kg)

CONFIRMATORY DATA OBTAINED ON 29 APRIL FOR OSA
INDICATES THE FOLLOWING EMISSION FACTORS (OSA ONLY)

Total Ethanol Emission Rate (lb/hour)	Bottle Case Throughput (#/test)	Emission Factor (lb/case)
0.51	2500 *	0.00020
0.44	3125 *	0.00014
0.68	3207	0.00021
0.83	3150	0.00026
	AVG:	0.00020
	RSD:	19%

